

ಜೆಎಸ್‌ಎಸ್ ಮಹಾವಿದ್ಯಾಲಯ



ಜೆಎಸ್‌ಎಸ್ ಕಲಾ, ವಾಣಿಜ್ಯ ಮತ್ತು ವಿಜ್ಞಾನ ಕಾಲೇಜು

(ಸ್ವಾಯತ್ತ)

ಬಿ.ಎನ್. ರಸ್ತೆ, ಮೈಸೂರು - ೫೭೦ ೦೨೫

ಕನ್ನಡ ಸ್ನಾತಕೋತ್ತರ ವಿಭಾಗ

ಪಠ್ಯ - ಪಾಠಕ್ರಮ - ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಚಾತುರ್ಮಾಸ ಯೋಜನೆ (ಸಿಬಿಸಿಎಸ್-ಸಿಎಜಿಪಿ)

೨೦೨೨-೨೩

**ಮೊದಲನೆಯ ವರ್ಷ ಎಂ.ಎ. ಕನ್ನಡ**  
**೨೦೨೨ -೨೦೨೩ ರಿಂದ ಆರಂಭವಾಗುವ ಶೈಕ್ಷಣಿಕ ವರ್ಷಕ್ಕೆ**  
**ಮೊದಲನೆಯ ಚತುರ್ಮಾಸ (ಆಗಸ್ಟ್ - ಡಿಸೆಂಬರ್ ೨೦೨೨)**  
**ಪಠ್ಯ-ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ**

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿದ್ಯಾನುಸ	ಕ್ರೆಡಿಟ್ ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರೀಕ್ಷಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರೀಕ್ಷಾ ಅಂಕಗಳು	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪವಿದ್ಯಾನುಸ	ಒಟ್ಟು ಬೋಧನಾ ಗಂಟೆಗಳು				
<b>ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard Core)</b>									
೧	ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ - ಪಂಪರಾಮಾಯಣ ಸಂಗ್ರಹ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೨	ಪ್ರಾಚೀನ ಮತ್ತು ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೩	ಕನ್ನಡ ಭಂದಸ್ಥಾನ ಅಧ್ಯಯನ : ಪಠ್ಯ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೪	ವಿಮರ್ಶೆಯ ಅಧ್ಯಯನ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
<b>ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Soft Core)</b>									
೫	ವಿದ್ಯಾರ್ಥಿ ಈ ಕೆಳಗಿನ ಯಾವುದಾದರೂ ಒಂದು ವಿಷಯವನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು ಮುಂದಿನ ಮೂರು ಚತುರ್ಮಾಸಗಳಲ್ಲಿಯೂ ಅದೇ ವಿಷಯವನ್ನು ಮುಂದುವರಿಸತಕ್ಕದ್ದು								
೫.೧	ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಭಾಷಾ ವಿಜ್ಞಾನದ ಮೂಲತತ್ವ ಗಳು	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಜಾನಪದ ಸಾಹಿತ್ಯದ ತಾತ್ವಿಕ ಅಧ್ಯಯನ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಕರ್ಣಾಟಕ ಸಾಂಸ್ಕೃತಿಕ ಚರಿತ್ರೆ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦

**ಮೊದಲನೆಯ ವರ್ಷ ಎಂ.ಎ. ಕನ್ನಡ**  
**ಎರಡನೆಯ ಚತುರ್ಮಾಸ ( ಜನವರಿ - ಮೇ ೨೦೨೩ )**  
**ಪಠ್ಯ-ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ**

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿನ್ಯಾಸ	ಕ್ರೆಡಿಟ್ ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರೀಕ್ಷಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರೀಕ್ಷಾ ಅಂಕಗಳು	ಅಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪನ್ಯಾಸ	ಟ್ಯುಟೋರಿಯಲ್				
<b>ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard Core)</b>									
೧	ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ವಚನ ಸಾಹಿತ್ಯ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೨	ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ: ಕಾವ್ಯ : ಹರಿಶ್ಚಂದ್ರ ಕಾವ್ಯ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೩	ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೪	ಕನ್ನಡ ವಿಮರ್ಶೆ : ಆಯ್ದ ಲೇಖನಗಳು	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
<b>ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Soft core)</b>									
೫	ಕೆಳಗಿನ ಪತ್ರಿಕೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಯು ಹಿಂದೆ ಆಯ್ದು ಮಾಡಿಕೊಂಡ ಪತ್ರಿಕೆಯನ್ನೇ ಈ ಚತುರ್ಮಾಸದಲ್ಲಿಯೂ ಅಧ್ಯಯನ ಮಾಡಬೇಕು.								
೫.೧	ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಕನ್ನಡ ವ್ಯಾಕರಣಗಳ ತೌಲನಿಕ ಸಮೀಕ್ಷೆ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಜನಪದ ಸಂಸ್ಕೃತಿಯ ತಾತ್ವಿಕ ಅಧ್ಯಯನ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ (೧೩ನೆಯ ಶತಮಾನ)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
<b>ವಿಶೇಷ ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Special Soft Core)</b>									
ವಿದ್ಯಾರ್ಥಿಗಳು ಈ ಚತುರ್ಮಾಸದಲ್ಲಿ ಯಾವುದಾದರೂ ಒಂದು ವಿಶೇಷ ಉಪ ಪ್ರಧಾನ ವಿಷಯವನ್ನು ಆಯ್ದು ಮಾಡಿ ಅಧ್ಯಯನ ಮಾಡಬೇಕು									
೬.೧	ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಚಿಂತನೆ (ಆಯ್ದ ಲೇಖನಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೬.೨	ಮಹಿಳೆ : ಸಮಾಜ-ಸಾಹಿತ್ಯ (ಆಯ್ದ ಲೇಖನಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦

ಕನ್ನಡ ಎಂ.ಎ ಎರಡನೆಯ ವರ್ಷ  
ಮೂರನೆಯ ಚತುರ್ಮಾಸ (ಆಗಸ್ಟ್ - ಡಿಸೆಂಬರ್ ೨೦೨೨)  
ಪಠ್ಯ-ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿನ್ಯಾಸ	ಕ್ರೆಡಿಟ್ ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರಿಷ್ಕಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರಿಷ್ಕಾ ಅಂಕಗಳು	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪನ್ಯಾಸ	ಟ್ಯುಟೋರಿಯಲ್				
<b>ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard core)</b>									
೧	ತೌಲನಿಕ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಮಹಾಕಾವ್ಯ ಮತ್ತು ನಾಟಕ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೨	ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೩	ಭಾರತೀಯ ಕಾವ್ಯಮೀಮಾಂಸೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೪	ಸಂಶೋಧನ ವಿಧಾನ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೫	<b>ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Soft core)</b> ಕೆಳಗಿನ ಪತ್ರಿಕೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಯು ಹಿಂದೆ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡ ಪತ್ರಿಕೆಯನ್ನೇ ಈ ಚತುರ್ಮಾಸದಲ್ಲಿಯೂ ಅಧ್ಯಯನ ಮಾಡಬೇಕು.								
೫.೧	ಭಾಷಾ ವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಉಪಭಾಷಾ ವಿಜ್ಞಾನ (ಕನ್ನಡ)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಶಾಸನಶಾಸ್ತ್ರ ಆಯ್ಕೆ ಪಠ್ಯಗಳೊಡನೆ	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೬	<b>ಮುಕ್ತ ಐಚ್ಛಿಕ (Open Elective)</b>								
೬.೧	ಕನ್ನಡ ಭಾಷೆ ಸಾಹಿತ್ಯ (ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ, ಆಧುನಿಕ)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦

ಕನ್ನಡ ಎಂ.ಎ ಎರಡನೆಯ ವರ್ಷ  
ನಾಲ್ಕನೆಯ ಚತುರ್ಮಾಸ (ಜನವರಿ-ಮೇ ೨೦೨೪)  
ಪಠ್ಯ-ಪಾಠಕ್ರಮ ಮತ್ತು ಪರೀಕ್ಷಾ ಯೋಜನೆ

ಪತ್ರಿಕೆ ಸಂಖ್ಯೆ	ಪತ್ರಿಕೆಗಳ ಶೀರ್ಷಿಕೆ	ಕ್ರೆಡಿಟ್ ವಿನ್ಯಾಸ	ಕ್ರೆಡಿಟ್ ಗಳ ಸಂಖ್ಯೆ	ಬೋಧನಾ ಗಂಟೆಗಳು (ವಾರಕ್ಕೆ)		ಪರೀಕ್ಷಾ ಅವಧಿ (ಗಂಟೆಗಳಲ್ಲಿ)	ಪರೀಕ್ಷಾ ಅಂಕಗಳು	ಅಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	ಒಟ್ಟು ಅಂಕಗಳು
				ಉಪನ್ಯಾಸ	ಟ್ಯೂಟೋರಿಯಲ್				
<b>ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard core)</b>									
೧	ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಕಾವ್ಯ ಮತ್ತು ಕಾದಂಬರಿ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೨	ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೩	ಸಮೂಹ ಮಾಧ್ಯಮ	೨:೧	೩	೨	೨	೩	೭೦	೩೦	೧೦೦
೪	ಅವಧಿಕ ಕಾರ್ಯ	೧:೨	೩	೧	೪	೩	೭೦	೩೦	೧೦೦
<b>ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Soft core)</b>									
ಕೆಳಗಿನ ಪತ್ರಿಕೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಯು ಹಿಂದೆ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡ ಪತ್ರಿಕೆಯನ್ನೇ ಈ ಚತುರ್ಮಾಸದಲ್ಲಿಯೂ ಅಧ್ಯಯನ ಮಾಡಬೇಕು.									
೫.೧	ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಕನ್ನಡ ಭಾಷಾಸ್ವರೂಪ : ಆಯ್ದ ಪಠ್ಯಗಳು	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೨	ಜಾನಪದ ಅಧ್ಯಯನ : ಕನ್ನಡ ಜನಪದ ಸಾಹಿತ್ಯ (ಆಯ್ದ ಪಠ್ಯಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦
೫.೩	ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ (ಆಯ್ದ ಪಠ್ಯಗಳು)	೩:೧	೪	೩	೨	೩	೭೦	೩೦	೧೦೦

ಪ್ರಧಾನ ವಿಷಯ : ೫೨ ಕ್ರೆಡಿಟ್

ಉಪಪ್ರಧಾನ ವಿಷಯ : ೧೬ ಕ್ರೆಡಿಟ್

ವಿಶೇಷ ಉಪಪ್ರಧಾನ ವಿಷಯ : ೦೪ ಕ್ರೆಡಿಟ್

ಮುಕ್ತ ಐಚ್ಛಿಕ : ೦೪ ಕ್ರೆಡಿಟ್

ಒಟ್ಟು ಟ್ಯೂಟೋರಿಯಲ್ ಮತ್ತು ಪ್ರಾಯೋಗಿಕ ತರಗತಿಗಳು : ೭೬ ಕ್ರೆಡಿಟ್

ಆಯಾ ಪತ್ರಿಕೆಗಳಿಗೆ ಅನುಸಾರವಾಗಿ ಈ ಕೆಳಗಿನ ಪ್ರಾಯೋಗಿಕ ಅಭ್ಯಾಸಗಳನ್ನು ಪತ್ರಿಕೆಗಳು ಒಳಗೊಂಡಿರುತ್ತವೆ.

೧. ಪದ್ಯ ಓದುವ ಕ್ರಮ, ಅರ್ಥೈಸುವ ಕ್ರಮ, ವಿಶ್ಲೇಷಣೆ ಮತ್ತು ವಿಮರ್ಶೆ,
೨. ಭಾವನಾಸ್ಮಾರಸ್ಯ, ಸಂಭಾಷಣಾ ಕೌಶಲ, ಸನ್ನಿವೇಶಗಳ ಪರಿಚಯ
೩. ವಸ್ತು, ಪಾತ್ರ, ಭಾಷೆ ಬಳಕೆ, ರಚನೆ, ತಂತ್ರಗಾರಿಕೆ

**ಮೊದಲನೆಯ ವರ್ಷ ಎಂ.ಎ ಕನ್ನಡ  
ಮೊದಲನೆಯ ಚತುರ್ಮಾಸ (ಆಗಸ್ಟ್-ಡಿಸೆಂಬರ್ ೨೦೨೨)  
ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard Core)**

**KNA \_\_\_\_\_ : ಪತ್ರಿಕೆ: ೧ ಪ್ರಾಚೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ (೩:೧=೪ ಕ್ರೆಡಿಟ್)**

ನಾಗಚಂದ್ರ : ಹಿನ್ನೆಲೆ, ಇತಿವೃತ್ತ, ಕೃತಿಗಳು

ಪಠ್ಯ: ಪಂಪರಾಮಾಯಣ ಸಂಗ್ರಹ - ತಿರುವಳ್ಳೂರ್ ಶ್ರೀನಿವಾಸರಾಘವಾಚಾರ್, ಡಿ.ಎಲ್. ನರಸಿಂಹಚಾರ್, ಪ್ರಸಾರಾಂಗ,  
ಮೈಸೂರು ವಿ.ವಿ., ಮೈಸೂರು

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ನಾಗಚಂದ್ರ	: ವಿಜಯಾದಿಭೈ
೨. ಮಲ್ಲಿನಾಥ ಪುರಾಣ	: ಸಿ.ಪಿ. ಕೃಷ್ಣ ಕುಮಾರ್
೩. ನಾಗಚಂದ್ರ	: ಸಿ.ಪಿ. ಕೃಷ್ಣ ಕುಮಾರ್
೪. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ	: ರಂ.ಶ್ರೀ. ಮುಗಳಿ
೫. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂ: ೧,೨,೩	: ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈವಿವಿ, ಮೈಸೂರು
೬. ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ	: ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾಲಯ

**KNA \_\_\_\_\_ : ಪತ್ರಿಕೆ: ೨ ಪ್ರಾಚೀನ ಮತ್ತು ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ**

(೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧. ಭೌಗೋಳಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ಹಿನ್ನೆಲೆ

- ಅಷ್ಟಾದಶ ವರ್ಣನೆಗಳು, ಭೌಗೋಳಿಕ ಪರಿಸರ
- ಸಾಹಿತ್ಯ ರೂಪಗಳು, ತಂತ್ರಗಳು

೨. ಧಾರ್ಮಿಕ ಹಿನ್ನೆಲೆ

- ಬೌದ್ಧಧರ್ಮ, ಜೈನ ಧರ್ಮ
- ಶೈವಧರ್ಮ, ವೈಷ್ಣವ ಧರ್ಮ

೩. ರಾಜಕೀಯ ಹಿನ್ನೆಲೆ

- ಬಾದಾಮಿ ಚಾಲುಕ್ಯರು, ರಾಷ್ಟ್ರಕೂಟರು, ಗಂಗರು, ಹೊಯ್ಸಳರು, ವಿಜಯನಗರದ ಅರಸರ ಕಾಲದ ರಾಜಕೀಯ ಪರಿಸರ
- ಪ್ರಭುತ್ವ ಮತ್ತು ಸಾಹಿತ್ಯ ಸಂಬಂಧ
- ಸಮಾಜ ಜನಮುಖಿ ಸಾಹಿತ್ಯ

೪. ಇತರ ಭಾಷೆಗಳ ಪ್ರಭಾವ ಪ್ರೇರಣೆ

- ಸಂಸ್ಕೃತ, ಪ್ರಾಕೃತ
- ತಮಿಳು, ತೆಲುಗು

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

೧. ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು ೧, ೨ ಮತ್ತು ೩  
 ೨. ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟಗಳು, ಬೆಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ  
 ೩. ಕನ್ನಡ ನಾಡಿನ ಧರ್ಮಗಳು : ಶಿ.ಬಿ. ನಂದೀಮಠ  
 ೪. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ : ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ  
 ೫. ಕನ್ನಡ ಶಾಸನಗಳ ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ : ಎಂ.ಚಿದಾನಂದಮೂರ್ತಿ  
 ೬. ಜೈನಧರ್ಮ : ಮಿರ್ಜಿ ಅಣ್ಣರಾಯ  
 ೭. ಭಾರತೀಯ ಸಂಸ್ಕೃತಿ : (ಸಂ) ಅ.ನ.ಕೃಷ್ಣರಾಯ  
 ೮. ಕರ್ನಾಟಕ ಪರಂಪರೆ : ಭಾಗ ೧ ಮತ್ತು ೨, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ  
 ೯. ಚಂಪೂ ಸಾಹಿತ್ಯ : ಪಿ.ವಿ. ನಾರಾಯಣ  
 ೧೦. ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪುನರ್ ಮೌಲ್ಯೀಕರಣ ಮಾಲೆಯ ಸಂಪುಟಗಳು  
 ೧೧. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚಾರಿತ್ರಿಕ ಬೆಳವಣಿಗೆ (ಮಧ್ಯಕಾಲೀನ) : ಸಿ.ವೀರಣ್ಣ

**KNA \_\_\_ : ಪತ್ರಿಕೆ: ೩ ಕನ್ನಡ ಭಂದಸ್ಸಿನ ಅಧ್ಯಯನ : ಪಠ್ಯ ( ೩:೧=೪ ಕ್ರೆಡಿಟ್)**

- ೧-೩. ಪಠ್ಯ: ನಾಗವರ್ಮನ ಭಂದೋಂಬುಧಿ, ಸಂ: ಡಾ. ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರಿ  
 ೪. ಹೊಸಗನ್ನಡ ಭಂದಸ್ಸು ಪಠ್ಯ:  
 ೧. ಕನ್ನಡದಲ್ಲಿ ಹೊಸಮಟ್ಟುಗಳಿಗಿರುವ ಅವಶ್ಯಕತೆ : ತೀನಂಶ್ರೀ  
 ೨. ಶ್ರೀರಾಮಾಯಣದರ್ಶನಂ ಭಂದಸ್ಸು : ಡಾ. ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರಿ  
 ೩. ಭಂದೋವಿಶ್ಲೇಷಣೆ : ಕೆ.ಜಿ. ನಾರಾಯಣಪ್ರಸಾದ  
 (ಶ್ರೀ ಶಿವಕುಮಾರಚರಿತಂ ವಿಮರ್ಶೆ: ಪಿ. ಬಸವಣ್ಣನವರಿಗೆ ಬರೆದ ಪತ್ರ)

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು**

೧. ಕನ್ನಡ ಭಂದಸ್ಸಂಪುಟ : (ಸಂ) ಎಲ್. ಬಸವರಾಜು  
 ೨. ಕನ್ನಡ ಕೈಪಿಡಿ, ಸಂಪುಟ ೧ ಭಾಗ ೨ : ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ  
 ೩. ಜಯದಾಮನ್ : (ಸಂ) ಎಚ್.ಡಿ. ವೇಲಣಕರ್  
 ೪. ಕನ್ನಡ ಭಂದೋವಿಕಾಸ : ಡಿ.ಎಸ್. ಕರ್ಕಿ  
 ೫. ಸಮಾಲೋಕನ : ತೀನಂಶ್ರೀ  
 ೬. ಕನ್ನಡ ಭಂದಃಸ್ವರೂಪ : ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರಿ  
 ೭. ಪೀಠಿಕೆಗಳು, ಲೇಖನಗಳು : ಡಿ.ಎಲ್. ನರಸಿಂಹಾಚಾರ್  
 ೮. ಕನ್ನಡ ಭಂದೋವಿಕಾರ : ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರಿ  
 ೯. ಭಂದೋಗತಿ : ಸೇಡಿಯಾಪು ಕೃಷ್ಣಭಟ್ಟ  
 ೧೦. ಕನ್ನಡ ಭಂದಸ್ಸು : ಸೇಡಿಯಾಪು ಕೃಷ್ಣಭಟ್ಟ  
 ೧೧. ಹೊಸಗನ್ನಡ ಕವಿತೆಯ ಭಂದಸ್ಸು : ಕೆ.ಜಿ. ನಾರಾಯಣಪ್ರಸಾದ್  
 ೧೨. ಭಾರತೀಯ ಭಂದಶಾಸ್ತ್ರ : ಪ್ರ.ಗೋ. ಕುಲಕರ್ಣಿ  
 ೧೩. ಭಂದೋತರಂಗ : ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ  
 ೧೪. ಹೊಸಗನ್ನಡ ಕವಿತೆಯ ಮೇಲೆ ಇಂಗ್ಲಿಷ್ ಕಾವ್ಯದ ಪ್ರಭಾವ : ಎಸ್.ಅನಂತನಾರಾಯಣ  
 ೧೫. The Commonness in the Meters of the Dravidian Languages : S.Subrahmanyam

**KNA \_\_\_\_\_ : ಪತ್ರಿಕೆ: ೪ ವಿಮರ್ಶೆಯ ಅಧ್ಯಯನ (೨:೧=೩ ಕ್ರೆಡಿಟ್)**

೧. (ಅ) ಪ್ರಾಯೋಗಿಕ ವಿಮರ್ಶೆ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ  
 (ಆ) ಜಾನಪದ ಕಾವ್ಯಗಳು, ವಚನ, ಆಧುನಿಕ ಕಾವ್ಯಗಳು (ನವೋದಯ, ನವ್ಯ, ದಲಿತ, ಬಂಡಾಯ)
೨. ಮನೋವೈಜ್ಞಾನಿಕ ವಿಮರ್ಶೆ, ಚಾರಿತ್ರಿಕ ವಿಮರ್ಶೆ, ಮಾರ್ಕ್ಸ್ ವಾದಿ ವಿಮರ್ಶೆ, ಸ್ತ್ರೀವಾದಿ ವಿಮರ್ಶೆ
೩. ರೂಪನಿಷ್ಠ ವಿಮರ್ಶೆ, ರಾಚನಿಕ ವಿಮರ್ಶೆ, ನಿರಚನವಾದಿ ವಿಮರ್ಶೆ,
೪. ವಸಾಹತು- ವಸಾಹತೋತ್ತರ ವಿಮರ್ಶೆ

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

- |  |  |
|--|--|
| ೧. ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ                    | : ವಿ.ಎಂ. ಇನಾಂದಾರ್  |
| ೨. ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆಯ ತತ್ವಗಳು                  | : ಎಚ್.ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ (ಸಂ.ಶೈಲಜ ಎಚ್.ಟಿ)                 |
| ೩. ಇಂಗ್ಲಿಷ್ ಭಾಷೆಯಲ್ಲಿ ಆಧುನಿಕ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ | : ಎಲ್.ಎಸ್. ಶೇಷಗಿರಿರಾವ್                                   |
| ೪ ಪ್ರಮಾಣ                                     | : ಗಿರಿಧಿ ಗೋವಿಂದರಾಜು                                      |
| ೫. ಕಾವ್ಯಾರ್ಥ ಚಿಂತನೆ                          | : ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ                                    |
| ೬. ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ                           | : ಸಿ.ಎನ್. ರಾಮಚಂದ್ರನ್                                     |
| ೭. ವಿಮರ್ಶೆಯ ಪರಿಭಾಷೆ                          | : ಓ.ಎಲ್. ನಾಗಭೂಷಣಸ್ವಾಮಿ                                   |
| ೮. ವಿಮರ್ಶೆಯ ತತ್ವಗಳು ವಿಧಾನಗಳು                 | : (ಸಂ) ವಿ.ಕೃ ಗೋಕಾಕ್ & ಕುಲಕರ್ಣಿ                           |
| ೯. ಪ್ರಾಯೋಗಿಕ ವಿಮರ್ಶೆ                         | : (ಸಂ)ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ<br>ಎನ್.ಎಸ್. ಲಕ್ಷ್ಮೀನಾರಾಯಣ ಭಟ್ಟ |
| ೧೦. ಓದುಗರು ಮತ್ತು ಓದುವಿಕೆ                     | : ಸಿ.ಎನ್. ರಾಮಚಂದ್ರನ್                                     |
| ೧೧. ವಸಾಹತೋತ್ತರ ಚಿಂತನೆ                        | : ಸಿ.ಎನ್. ರಾಮಚಂದ್ರನ್                                     |
| ೧೨. ಸ್ತ್ರೀವಾದ                                | : ಸುಮಿತ್ರಾಬಾಯಿ ಬಿ.ಎನ್                                    |
| ೧೩. Literary Criticism – A Short History     | : W.K. Wimsatt & Cleanth Brooks                          |
| ೧೪. Contemporary Criticism                   | : (Ed)Sethuraman V S                                     |



ಉಪಪ್ರಧಾನ ವಿಷಯಗಳು (Soft Core)

**KNA 210: ಪತ್ರಿಕೆ: ೫.೧ ಭಾಷಾ ವಿಜ್ಞಾನ ಅಧ್ಯಯನ :  
ಭಾಷಾ ವಿಜ್ಞಾನದ ಮೂಲತತ್ವಗಳು (೩:೧=೪ ಕ್ರೆಡಿಟ್)**

೧. ಭಾಷೆ: ವ್ಯಾಖ್ಯಾನಗಳು-ಲಕ್ಷಣಗಳು, ಸ್ವರೂಪ ;  
ಭಾಷಾ ವಿಜ್ಞಾನದ ಸ್ವರೂಪ-ವ್ಯಾಪ್ತಿ-ಪ್ರಯೋಜನಗಳು,  
ಭಾಷೆಯ ಉಗಮ ಸಿದ್ಧಾಂತಗಳು;  
ಭಾಷೆಗಳ ವರ್ಗೀಕರಣದ ಕ್ರಮಗಳು, ಭಾರತೀಯ ಭಾಷೆಗಳ ವರ್ಗೀಕರಣ
೨. ಧ್ವನಿ-ಉಪಧ್ವನಿ :ವ್ಯಾಖ್ಯೆ, ಸ್ವರೂಪ ;  
ಧ್ವನಿವಿಜ್ಞಾನದ ಶಾಖೆಗಳು, ಧ್ವನಿಮಾ : ವ್ಯಾಖ್ಯೆ, ಸ್ವರೂಪ- ಧ್ವನಿಮಾ ನಿರ್ಣಯದ ತತ್ವಗಳು
೩. ಆಕೃತಿಮಾ : ವ್ಯಾಖ್ಯೆ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ.  
ಆಕೃತಿಮಾ ನಿರ್ಣಯ, ನೈದಾ ತತ್ವಗಳು  
ಆಕೃತಿಮಾದ ಬಗೆಗಳು
೪. ವಾಕ್ಯ ಮತ್ತು ಅರ್ಥ ವಿಜ್ಞಾನ  
ಭಾಷಿಕ ಬದಲಾವಣೆ ;  
ಭಾಷಿಕ ಸ್ವೀಕರಣ, ಭಾಷೆ ಮತ್ತು ಬರಹ

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

೧.ವರ್ಣನಾತ್ಮಕ ವ್ಯಾಕರಣ	: ಎಚ್.ಎಸ್. ಬಿಳಿಗಿರಿ
೨. ಭಾಷಾವಿಜ್ಞಾನದ ಮೂಲತತ್ವಗಳು	: ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ
೩.ಭಾಷೆ ಮತ್ತು ಭಾಷಾವಿಜ್ಞಾನ	: ಕೆ.ಕೆಂಪೇಗೌಡ
೪.ಸಾಮಾನ್ಯ ಭಾಷಾವಿಜ್ಞಾನ	: ಕೆ.ಕೆಂಪೇಗೌಡ
೫.ಆಧುನಿಕ ವರ್ಣನಾತ್ಮಕ ಭಾಷಾವಿಜ್ಞಾನ	: ರಾಜೇಶ್ವರಿ ಮಹೇಶ್ವರಯ್ಯ
೬.ಭಾಷೆ	: (ಸಂ) ಕೆ.ವಿ. ನಾರಾಯಣ
೭. Language	: Leonard Bloomfield
೮. Language	: Edward Sapir
೯. A Course in Modern Linguistics	: C.F. Hackett
೧೦. Modern Linguistics	: S Potter
೧೧. Introduction to theoretical Linguistics	: J. Lyons
೧೨. Historical Linguistics An Introduction	: W.P. Lehmann

## KNA 210 : ಪತ್ರಿಕೆ ೫.೧

### ಜಾನಪದ ಅಧ್ಯಯನ: ಜಾನಪದ ಸಾಹಿತ್ಯದ ತಾತ್ವಿಕ ಅಧ್ಯಯನ

೧. ಜನಪದ – ಜಾನಪದ : ವ್ಯಾಖ್ಯಾನ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ, ವರ್ಗೀಕರಣ ; ಆದಿವಾಸಿ (ಬುಡಕಟ್ಟು) ಮತ್ತು ನಗರ ಜಾನಪದ, ಜಾನಪದ ಮತ್ತು ಇತರ ವಿಜ್ಞಾನಗಳು, ಜಾನಪದ ಮತ್ತು ದೇಶೀವಾದ; ಜನಪದ ಸಾಹಿತ್ಯದ ವರ್ಗೀಕರಣ, ಶಿಷ್ಟ ಮತ್ತು ಜನಪದ ಸಾಹಿತ್ಯ
೨. ಜನಪದ ಗೀತೆ, ಕಥನ ಕಾವ್ಯ, ಲಾವಣಿ, ಜನಪದ ಮಹಾಕಾವ್ಯ, ಜನಪದ ಕಥೆಗಳು – ಇವುಗಳ ಸ್ವರೂಪ, ಲಕ್ಷಣ, ಹಿನ್ನೆಲೆ, ಪ್ರಕಾರ
೩. ಜನಪದ ಗಾದೆ – ಜನಪದ ಒಗಟು, ಒಡಪು, ದಂತಕತೆ, ಐತಿಹ್ಯ, ಪವಾಡ, ಪುರಾಣ ಇವುಗಳ ಸ್ವರೂಪ, ಲಕ್ಷಣ, ಹಿನ್ನೆಲೆ, ಪ್ರಕಾರ
೪. ಜನಪದ ಕ್ಷೇತ್ರಕಾರ್ಯ : ಸ್ವರೂಪ – ಕ್ಷೇತ್ರಜ್ಞರ ವ್ಯಕ್ತಿತ್ವ ಮತ್ತು ಗುಣಗಳು – ಕ್ಷೇತ್ರಕಾರ್ಯದ ಪೂರ್ವಸಿದ್ಧತೆಗಳು- ಕ್ಷೇತ್ರಕಾರ್ಯದ ಪರಿಕರಗಳು

#### ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

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|--|--------------------------------------|
| ೧. ಜಾನಪದ ತತ್ವಗಳು                       | : (ಸಂ)ಅರವಿಂದ ಮಾಲಗತ್ತಿ                |
| ೨. ಜಾನಪದ ಅಧ್ಯಯನ                        | : ದೇಜಗೌ                              |
| ೩. ಜನಪದ ಪುರಾಣಗಳು                       | : ರಾಗೌ                               |
| ೪. ಜಾನಪದ                               | : ಜಿ.ಶಂ.ಪರಮಶಿವಯ್ಯ                    |
| ೫. ಜಾನಪದ ಸ್ವರೂಪ                        | : ಹಾ.ಮಾ. ನಾಯಕ                        |
| ೬. ಭಾರತೀಯ ಜಾನಪದ ಸಮೀಕ್ಷೆ                | : ದುರ್ಗಾಭಾಗವತ್ ಅನು: ಕೆ. ಮರುಳಸಿದ್ದಪ್ಪ |
| ೭ ಭಾರತೀಯ ಪರಂಪರೆ ಹಾಗೂ ಸಾಹಿತ್ಯದಲ್ಲಿ ಒಗಟು | : ದುರ್ಗಾಭಾಗವತ್ ಅನು: ಬಿ.ಎ.ವಿವೇಕ ರೈ    |
| ೮. ನಮ್ಮ ಗಾದೆಗಳು                        | : ರಾಗೌ                               |
| ೯. ಜನಪದ ಕಥಾಮಾರ್ಗಗಳು                    | : ಹಿ.ಶಿ. ರಾಮಚಂದ್ರಗೌಡ                 |
| ೧೦. ಜನಪದ ಆಟಗಳು                         | : ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ      |
| ೧೧. ಜಾನಪದ ಅಧ್ಯಯನ –ಸಂಕ್ಷಿಪ್ತ ಇತಿಹಾಸ     | : ನಂ. ತಪಸ್ವೀಕುಮಾರ್                   |
| ೧೨. ಜಾನಪದ ಕೆಲವು ಮುಖಗಳು                 | : ಜಿ.ಶಂ. ಪರಮಶಿವಯ್ಯ                   |
| ೧೩. ಜನಪದ ಸಾಹಿತ್ಯ ರೂಪಗಳು                | : ರಾಗೌ                               |
| ೧೪. ಜಾನಪದ ಪ್ರವೇಶ                       | : ಚಂದ್ರ ಕಾಳೇನಹಳ್ಳಿ                   |
| ೧೫. ಜಾನಪದ ಸಮಾವೇಶ                       | :(ಸಂ) ಜಿ.ಶಂ. ಪರಮಶಿವಯ್ಯ               |
| ೧೬. ಜಾನಪದ ವಾಹಿನಿ                       | : ದೇ. ಜವರೇಗೌಡ                        |
| ೧೭. ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಜನಪದ ಪ್ರಕಾರಗಳು     | : ಜಿ.ಶಂ. ಪರಮಶಿವಯ್ಯ                   |
| ೧೮. ಜಾನಪದ ಸಮೀಕ್ಷೆ                      | : ಅಂಬಳಿಕೆ ಹಿರಿಯಣ್ಣ                   |
| ೧೯. ಕರ್ನಾಟಕ ಜಾನಪದ                      | : (ಸಂ)ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ             |
| ೨೦. ಜಾನಪದ ಮೂಲಭೂತ ತತ್ವಗಳು               | : ದೇವೇಂದ್ರಕುಮಾರ ಹಕಾರಿ                |
| ೨೧. ಕನ್ನಡ ಜಾನಪದ: ಕೆಲವು ಮುಖಗಳು          | : ಟಿ.ಎಸ್. ಸತ್ಯನಾಥ                    |
| ೨೨. ಜಾನಪದ: ವೈಜ್ಞಾನಿಕ ಕ್ಷೇತ್ರಕಾರ್ಯ      | : ಸಿ.ಸಿ.ಎ.ಪೈ                         |

೨೩. ದ್ರಾವಿಡ ಜಾನಪದ	: (ಸಂ)ಎಚ್.ಜೆ. ಲಕ್ಷ್ಮಪ್ಪ ಗೌಡ
೨೪. ಮಲೆನಾಡು ಜಾನಪದ	: (ಸಂ)ಎಚ್.ಜೆ. ಲಕ್ಷ್ಮಪ್ಪ ಗೌಡ
೨೫. ಜಾನಪದ ಸಾಹಿತ್ಯ ದರ್ಶನ ಸಂಪುಟಗಳು	: ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
೨೬. ಜಾನಪದದ ವಿವಿಧ ಮುಖಗಳು	: (ಸಂ) ಪ್ರೊ. ಶ್ರೀಕಂಠಕೂಡಿಗಿ
೨೭. ಸೈದ್ಧಾಂತಿಕ ಜಾನಪದ	: ಅಂಬಳಿಕೆ ಹಿರಿಯಣ್ಣ
೨೭. Folklore and Folk life	: Ed. Richard M Dorson
೨೮. The study of Folklore	: Ed: Alan Dundes
೨೯. Folklore Genres	: Dass Ben Amos
೩೦. The Folktale	: Stith Thompson
೩೧. Current Trends in Folklore	: Jawaharlal Handoo
೩೨. Story Performance and Event	: Richard Bauman

### KNA 210: ಪತ್ರಿಕೆ ೫.೩ ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ: ಕರ್ನಾಟಕ ಸಾಂಸ್ಕೃತಿಕ ಚರಿತ್ರೆ

೧. ಸಂಸ್ಕೃತಿ ಎಂದರೇನು? ಕರ್ನಾಟಕ ಸಾಂಸ್ಕೃತಿಕ ಚರಿತ್ರೆಯ ಅಧ್ಯಯನದ ಮೂಲ ಸಾಮಗ್ರಿಗಳು; ಕರ್ನಾಟಕದ ಪ್ರಾಚೀನತೆ – ದೊರೆಯುವ ಆಕರಗಳು ಮತ್ತು ಅವುಗಳ ಸ್ವರೂಪ

೨. ಕದಂಬರು : ಮಯೂರವರ್ಮ, ಕಾಕುತ್ಸವರ್ಮ ; ಗಂಗರು: ದುವಿನೀತ, ಶ್ರೀಪುರುಷ ಬಾದಾಮಿಯ ಚಾಲುಕ್ಯರು: ಇಮ್ಮಡಿ ಪುಲಿಕೇಶಿ, ಇಮ್ಮಡಿ ವಿಕ್ರಮಾದಿತ್ಯ

೩. ರಾಷ್ಟ್ರಕೂಟರು : ಮುಮ್ಮಡಿ ಗೋವಿಂದ, ಅಮೋಘವರ್ಷ ನೃಪತುಂಗ, ಮುಮ್ಮಡಿ ಕೃಷ್ಣ ಕಲ್ಯಾಣದ ಚಾಲುಕ್ಯರು : ಇಮ್ಮಡಿ ತೈಲಪ, ಇಮ್ಮಡಿ ಜಯಸಿಂಹ, ಆರನೆಯ ವಿಕ್ರಮಾದಿತ್ಯ ಹೊಯ್ಸಳರು : ವಿಷ್ಣುವರ್ಧನ, ಇಮ್ಮಡಿ ಬಲ್ಲಾಳ

೪. ವಿಜಯನಗರ: ಇಮ್ಮಡಿ ದೇವರಾಯ, ಕೃಷ್ಣದೇವರಾಯ; ಮೈಸೂರು ಒಡೆಯರು, ಚಿಕ್ಕದೇವರಾಯ, ಮುಮ್ಮಡಿ ಕೃಷ್ಣರಾಜ

೨, ೩ ಮತ್ತು ೪ನೇ ಘಟಕಗಳಲ್ಲಿ ಆಯಾ ರಾಜರ ಕಾಲದ ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಸ್ಥಿತಿಗತಿಗಳನ್ನು ಅಭ್ಯಾಸ ಮಾಡತಕ್ಕದ್ದು, ರಾಜಕೀಯ ಎಂದರೆ ಚಾರಿತ್ರಿಕ ವಿವರಗಳು ; ಧಾರ್ಮಿಕ ಎಂದರೆ ಭೌದ್ಧ, ಜೈನ, ವೈದಿಕ, ವೀರಶೈವ ಧರ್ಮಗಳ ವಿವರಗಳು; ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ, ಶಿಕ್ಷಣ, ಆಡಳಿತ, ಜನಜೀವನ, ಆತ್ಮಬಲಿದಾನ ಪದ್ಧತಿಗಳು; ದೇವಸ್ಥಾನಗಳ ವಾಸ್ತುಶಿಲ್ಪ

#### ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ೧,೨,೩,೪,೫,	: ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು
೨. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ	: ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೩. ಕನ್ನಡ ಶಾಸನಗಳ ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ	: ಎಂ.ಚಿದಾನಂದಮೂರ್ತಿ
೪. ಮಾರ್ಗ ೧,೨,೩	: ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ
೫. ಕರ್ನಾಟಕದ ಅರಸು ಮನೆತನಗಳು	: ಎನ್. ಲಕ್ಷ್ಮೀನಾರಾಯಣರಾವ್ ಮತ್ತು ಆರ್.ಎಸ್., ಪಂಚಮುಖಿ
೬. ಕರ್ನಾಟಕ ಇತಿಹಾಸ	: ಎಂ.ವಿ. ಕೃಷ್ಣರಾವ್ ಮತ್ತು ಕೇಶವಭಟ್ಟ

೭. ಕರ್ನಾಟಕ ಪರಂಪರೆ ೧,೨	: ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ
೮. ಕರ್ನಾಟಕ ಚರಿತ್ರೆ	: ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ
೯. ವಿಷಯ ವಿಶ್ಲೇಷಣೆ : ಕರ್ನಾಟಕ	: ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ
೧೦. Karnataka Darshana	: R.R. Diwakar
೧೧. The Heritage of Karnataka	: R.S. Mugali
೧೨. A History of south India	: K.A. Nilakntha Shastry
೧೩. Early History of Deccan I & II	: Yazdani
೧೪. Administration and Social Life Under Vijaynagar	: T.V. Mahalingam

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ಮೊದಲನೆಯ ವರ್ಷ ಎಂ.ಎ. ಕನ್ನಡ  
ಎರಡನೆಯ ಚತುರ್ಮಾಸ (ಜನವರಿ-ಮೇ ೨೦೨೩)  
ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard core)

**KNB 010 : ಪತ್ರಿಕೆ : ೧ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ: ವಚನ ಸಾಹಿತ್ಯ**

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

ಹಿನ್ನೆಲೆ, ಅಂದಿನ ಸಾಮಾಜಿಕ ಸಾಂಸ್ಕೃತಿಕ ಜೀವನ, ವಚನಾಂದೋಲನದ ಸ್ವರೂಪ,  
ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಂಬಿಗರ ಚೌಡಯ್ಯ-ಈ ನಾಲ್ಕು ಮಂದಿ ವಚನಕಾರರ  
ಹಿನ್ನೆಲೆ ಮತ್ತು ಇತಿವೃತ್ತ.

೧. ಜೇಡರ ದಾಸಿಮಯ್ಯನ ವಚನಗಳು - (ಆಯ್ದು ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೨೧೧, ೨೨೨, ೨೪೨, ೨೪೪, ೨೬೪, ೨೬೫, ೨೬೮, ೨೬೯, ೨೮೫, ೨೯೩, ೨೯೯, ೮೦೧, ೮೦೮, ೮೧೦,  
೮೧೮, ೮೩೧, ೮೩೮, ೮೪೧, ೮೫೩, ೮೬೨, ೮೬೬, ೮೭೮, ೮೮೦, ೮೮೪, ೮೯೩

೨. ಬಸವಣ್ಣನ ವಚನಗಳು (ಆಯ್ದು ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೨೬, ೨೯, ೩೪, ೫೯, ೬೨, ೮೩, ೯೨, ೯೩, ೯೬, ೧೧೫, ೧೨೯, ೧೩೦, ೧೫೫, ೧೬೧, ೧೮೩, ೨೦೮, ೨೧೨,  
೨೨೩, ೨೩೫, ೨೪೧, ೨೯೧, ೪೩೬, ೪೩೮, ೪೪೭, ೫೫೭,

೩. ಅಕ್ಕಮಹಾದೇವಿಯ ವಚನಗಳು (ಆಯ್ದು ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೨೮, ೩೩, ೫೨, ೯೫, ೧೨೫, ೧೪೩, ೧೬೩, ೧೯೬, ೨೬೮, ೨೯೦, ೩೦೩, ೩೦೭, ೩೨೧, ೩೩೦, ೩೪೦, ೩೬೪,  
೩೬೫, ೩೯೮, ೪೧೧, ೪೧೨, ೪೧೩, ೪೧೯, ೪೨೬, ೪೨೯, ೪೩೨

೪. ಅಂಬಿಗರ ಚೌಡಯ್ಯನ ವಚನಗಳು (ಆಯ್ದು ಇಪ್ಪತ್ತೈದು ವಚನಗಳು)

೬, ೭, ೯, ೧೭, ೨೫, ೨೭, ೩೫, ೫೩ ೫೪, ೭೯, ೮೮, ೧೦೬, ೧೧೦, ೧೩೯, ೧೫೭, ೧೫೮, ೧೬೯, ೧೮೭, ೧೮೯,  
೨೪೨, ೨೪೩, ೨೪೪, ೨೪೫, ೨೪೭, ೨೫೨

ಪಠ್ಯ ಮೂಲ :

೧. ಸಂಕೀರ್ಣ ವಚನ ಸಂಪುಟ ೨ : (ಸಂ) ಎಸ್. ವಿದ್ಯಾಶಂಕರ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು
೨. ಬಸವಣ್ಣನವರ ವಚನ ಸಂಪುಟ: (ಸಂ) ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು
೩. ಶಿವಶರಣೆಯರ ವಚನ ಸಂಪುಟ: (ಸಂ) ವೀರಣ್ಣ ರಾಜೂರ, ಕನ್ನಡ ಪುಸ್ತಕ ಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು
೪. ಸಂಕೀರ್ಣ ವಚನ ಸಂಪುಟ ೧: (ಸಂ) ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

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|------------------------------|---------------------------|
| ೧. ವಚನಧರ್ಮಸಾರ                | : ಎಂ.ಆರ್. ಶ್ರೀನಿವಾಸಮೂರ್ತಿ |
| ೨. ವಚನಶಾಸ್ತ್ರ ರಹಸ್ಯ          | : ರಂ.ರಾ. ದಿವಾಕರ           |
| ೩. ಬಸವಣ್ಣನವರ ಷಟ್ಸ್ಥಲದ ವಚನಗಳು | : ಎಲ್.ಬಸವರಾಜು             |

೪.ಬಸವಣ್ಣನವರ ವಚನಾಮೃತ ಭಾಗ ೧ ಮತ್ತು ೨	: ಎಲ್. ಬಸವರಾಜು
೫.ಬಸವಣ್ಣನವರ ವಚನಗಳು	: ಫ.ಗು.ಹಳಕಟ್ಟೆ
೬.ಭಕ್ತಿ ಭಂಡಾರಿ ಬಸವಣ್ಣನವರು	: ಎಂ.ಆರ್.ಶ್ರೀನಿವಾಸಮೂರ್ತಿ
೭.ಶರಣರ ಅನುಭಾವ ಸಾಹಿತ್ಯ	: ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೮.ಬಸವೇಶ್ವರ ವಚನ ದೀಪಿಕೆ	: ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೯.ಅಕ್ಕನ ವಚನ ಚಿಂತನ	: ಅನ್ನದಾನೀಶ್ವರ ಸ್ವಾಮಿಗಳು
೧೦. Sri Basaveswara and His contemporaries	: A R Jayaram
೧೧. The thoughts of Basava	: N K Sanakalmath
೧೨. Hand book of Veerashavism	: S C Nadimath
೧೩. Speaking of Siva	: A.K. Ramanujan

## KNB \_\_\_\_ : ಪತ್ರಿಕೆ: ೨ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಕಾವ್ಯ

(೨:೧=೩ ಕ್ರೆಡಿಟ್)

ರಾಘವಾಂಕ : ಹಿನ್ನೆಲೆ, ಇತಿವೃತ್ತ, ಕೃತಿಗಳು

ಹರಿಶ್ಚಂದ್ರಕಾವ್ಯ ಸಂಗ್ರಹ : ಸಂ: ಎ. ಆರ್. ಕೃಷ್ಣಶಾಸ್ತ್ರೀ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ರಾಘವಾಂಕ	: ಆರ್.ಸಿ. ಹಿರೇಮಠ
೨. ರಾಘವಾಂಕ : ಒಂದು ಅಧ್ಯಯನ	: ಸೂರ್ಯನಾರಾಯಣ
೩. ಹರಿಶ್ಚಂದ್ರ ಓದು ವಿಮರ್ಶೆ	: ಜಿ.ಎಚ್. ನಾಯಕ
೪. ಹರಿಶ್ಚಂದ್ರ ಚಾರಿತ್ರ್ಯ-ಸಾಂಸ್ಕೃತಿಕ ಮುಖಾಮುಖಿ	: ಸಂ: ಅಮರೇಶ ನುಗಡೋಣಿ
೫. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು	: ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈವಿವಿ
೬. ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ	: ಬೆಂಗಳೂರು ವಿವಿ.

## KNB 030: ಪತ್ರಿಕೆ: ೩ ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ (೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧. ದ್ರಾವಿಡ ಪದದ ನಿಷ್ಪತ್ತಿ - ದ್ರಾವಿಡ ಭಾಷೆಗಳ ಸಂಖ್ಯೆ, ಸ್ವರೂಪ ಮತ್ತು ವರ್ಗೀಕರಣ
೨. ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನದ ಇತಿಹಾಸ-ಸ್ವರವ್ಯತ್ಯಯ ವಿಚಾರ-ದ್ರಾವಿಡ ಧ್ವನಿಮಾಗಳ ಚರಿತ್ರೆ -ಕ್, ಚ್, ಟ್, ಪ್, ಳ್, ಳ್
೩. ಆಕೃತಿಮಾ ಅಧ್ಯಯನ : ಸರ್ವನಾಮ, ಲಿಂಗ, ವಚನ, ವಿಭಕ್ತಿ, ಸಂಖ್ಯಾವಾಚಕಗಳ ಸ್ಥೂಲಪರಿಚಯ, ಚರಿತ್ರೆ, ಕ್ರಿಯಾಪದ ಮತ್ತು ಕರ್ಮಣಿ ಪ್ರಯೋಗ
೪. ಭಾಷಾವಿಜ್ಞಾನದ ದೃಷ್ಟಿಯಿಂದ ಮುಖ್ಯವೆನಿಸಿದ ಕೆಲವು ಪದಗಳ ಇತಿಹಾಸ

ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧ ಭಾಷಾವಿಜ್ಞಾನದ ಮೂಲತತ್ವಗಳು	: ಎಂ.ಚಿದಾನಂದಮೂರ್ತಿ
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೧ ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ	: ಹಂಪ ನಾಗರಾಜಯ್ಯ
೨ ದ್ರಾವಿಡ ಸಂಖ್ಯಾವಾಚಕಗಳು	: ಹಂಪ ನಾಗರಾಜಯ್ಯ
೪ ದ್ರಾವಿಡ ಭಾಷಾವ್ಯಾಸಂಗ	: ಸಂಗಮೇಶ ಸವದತ್ತಿಮಠ
೫ ದ್ರಾವಿಡ ಭಾಷೆಗಳು	: ಸಂಗಮೇಶ ಸವದತ್ತಿಮಠ
೬ ಕನ್ನಡ ಭಾಷಾವ್ಯಾಸಂಗ	: ಸಂಗಮೇಶ ಸವದತ್ತಿಮಠ
೭ ಆಲೋಕ	: ಎಚ್.ಎಸ್. ಬಿಳಿಗಿರಿ
೮ ಕನ್ನಡ ಭಾಷೆಯ ರೂಪರೇಷೆಗಳು	: ವಿಲಿಯಂ ಮಾಡ್ಡಾ
೯ ಕನ್ನಡ ಭಾಷೆಯ ಸಂಕ್ಷಿಪ್ತ ಚರಿತ್ರೆ	: ಡಿ.ಎನ್. ಶಂಕರಭಟ್ಟ
೧೦ ಕನ್ನಡ ಭಾಷೆಯ ಚರಿತ್ರೆ	: ಪ್ರ.ಗೋ. ಕುಲಕರ್ಣಿ
೧೧ ಕನ್ನಡ ಭಾಷೆಯ ಸ್ವರೂಪ	: ಕೆ.ಎಂ.ಕೃಷ್ಣರಾವ್
೧೨ ಐತಿಹಾಸಿಕ ಭಾಷಾವಿಜ್ಞಾನ	: ಜೆ.ಎಸ್.ಕುಳ್ಳಿ
೧೩ ವರ್ಣನಾತ್ಮಕ ಭಾಷಾವಿಜ್ಞಾನ	: ಜೆ.ಎಸ್.ಕುಳ್ಳಿ
೧೪ ದ್ರಾವಿಡ ಭಾಷೆಗಳ ತೌಲನಿಕ ಅಧ್ಯಯನ	: ಟಿ.ಮಣಿಯನ್
೧೫ ತಮಿಳು ಭಾಷಾಚರಿತ್ರೆ	: ಟಿ.ಮಣಿಯನ್
೧೬ ತೌಲನಿಕ ದ್ರಾವಿಡ ಭಾಷಾವಿಜ್ಞಾನ ಪರಿಚಯ	: ಕೆ.ಕೆಂಪೇಗೌಡ
೧೭ ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡ ಭಾಷಾ ಚರಿತ್ರೆ	: .ಎಂ.ಎಚ್.ಕೃಷ್ಣಯ್ಯ
೧೮ A Comparative Grammar of the Dravidian Languages	: R. Caldwell
೧೯ History of Kannada Language	: R Narasimahacharaya
೨೦ Collected Papers on Dravidian Linguistics	: T. Burrow
೨೧ Dravidian Comparative Phonology – A sketch	: M.B. Emeneau
೨೨ Dravidian Nouns	: S.V. Shanmugam
೨೩ Dravidian Verb Morphology	: P.S. Subramanyam

**KNB 040: ಪತ್ರಿಕೆ : ೪ ಕನ್ನಡ ವಿಮರ್ಶೆ - ಪಠ್ಯ : ಆಯ್ದ ಲೇಖನಗಳು (೩:೧=೪ ಕ್ರೆಡಿಟ್)**

ಆಧುನಿಕ ಕನ್ನಡ ವಿಮರ್ಶೆಯ ಸ್ವರೂಪ, ಬೆಳವಣಿಗೆ, ವಿವಿಧ ಪಂಥಗಳು-ಧೋರಣೆಗಳು

೧ ಸಾಹಿತ್ಯದಲ್ಲಿ ಅನಾದರ	: ಟಿ.ಎಸ್. ವೆಂಕಣ್ಣಯ್ಯ
೨ ಪ್ರತಿಮಾ ಮತ್ತು ಪ್ರತಿಕ್ರಮ	: ಕುವೆಂಪು
೩ ನಾದಲೀಲೆ ಮುನ್ನುಡಿ	: ಮಾಸ್ತಿ ವೆಂಕಟೇಶ ಅಯ್ಯಂಗಾರ್
೪ ಪ್ರಗತಿಶೀಲ ಸಾಹಿತ್ಯ ಗೊತ್ತು ಗುರಿಗಳು	: ನಿರಂಜನ
೫ ಕಾದಂಬರಿ ಮತ್ತು ಹೊಸ ನೈತಿಕ ಪ್ರಜ್ಞೆ	: ಯು. ಆರ್. ಅನಂತಮೂರ್ತಿ
೬ ಮತ್ತೆ ಮತ್ತೆ ಪಂಪ	: ಜಿ. ಎಚ್. ನಾಯಕ
೭ ಬಂಡಾಯ ಸಾಹಿತ್ಯಮೀಮಾಂಸೆ	: ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ
೮ ದಲಿತ ಸಾಹಿತ್ಯ : ಕೆಲವು ತಾತ್ವಿಕ ಚಿಂತನೆಗಳು	: ದೇವಯ್ಯ ಹರವೆ
೯ ಹೊನ್ನಮ್ಮನ ಕಿವಿಮಾತಿಗೆ ಒಂದು ಪ್ರತಿಕ್ರಿಯೆ	: ವಿಜಯಾ ದಬ್ಬೆ
೧೦ ನಾನು ಗಾಂಧಿಚಿತ್ರ ನೋಡಿದೆ ಅಥವಾ ಆಕಾಶಕ್ಕೆ ಎರಡು ಗೇಣುಕಮ್ಮಿ: ದೇವನೂರ ಮಹಾದೇವ	

ಪರಾಮರ್ಶನ ಸಾಹಿತ್ಯ

೧ ಗಿರಡ್ಡಿ ಗೋವಿಂದರಾಜ : ಪ್ರಮಾಣ, ಕವಿವಿ ಹಂಪಿ, ೨೦೦೩

- ೨ ಬಿ.ದಾಮೋದರರಾವ್ : ಆಯಾಮಗಳು, ಪರಿಸರ ಸಾಹಿತ್ಯ ಪ್ರ. ಶಿವಮೊಗ್ಗ, ೧೯೯೨  
 ೩ ರಹಮತ್ ತರೀಕೆರೆ (ಸಂ) : ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮೀಮಾಂಸೆ, ಕವಿವಿ, ಹಂಪಿ, ೨೦೦೧  
 ೪ ರಹಮತ್ ತರೀಕೆರೆ (ಸಂ) : ಮಾತು ತಲೆ ಎತ್ತುವ ಬಗೆ, ಕವಿವಿ, ಹಂಪಿ, ೨೦೦೫  
 ೫ ಲಕ್ಷ್ಮಣ ಕೊಡಸೆ (ಸಂ) : ಕನ್ನಡ ವಿಮರ್ಶಾ ವಿವೇಕ, ಸುಮುಖ ಪ್ರ. ಬೆಂ, ೨೦೦೮  
 ೬ ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ : ಯುಗಧರ್ಮ ಮತ್ತು ಸಾಹಿತ್ಯ ದರ್ಶನ  
 ೭. ಪ್ರಾಚೀನ ಸಾಹಿತ್ಯ : ಟಿ.ಎಸ್. ವೆಂಕಣಯ್ಯ  
 ೮. ನಾದಲೀಲೆ (೧೯೩೮) : ಅಂಬಿಕಾತನಯದತ್ತ  
 ೯. ತಪೋನಂದನ (೧೯೫೦) : ಕುವೆಂಪು  
 ೧೦. ಸಮಕ್ಷಮ (೧೯೮೦) : ಯು. ಆರ್. ಅನಂತಮೂರ್ತಿ  
 ೧೧. ಎದೆಗೆ ಬಿದ್ದ ಅಕ್ಷರ : ದೇವನೂರ ಮಹಾದೇವ  
 ೧೨. ಮಹಿಳೆ ಸಾಹಿತ್ಯ ಸಮಾಜ: ವಿಜಯಾ ದಬ್ಬೆ

## ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Soft Core)

### KNB 210: ಪತ್ರಿಕೆ: ೫.೧

### ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ: ಕನ್ನಡ ವ್ಯಾಕರಣಗಳ ತೌಲನಿಕ ಸಮೀಕ್ಷೆ

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

ಈ ಕೆಳಗಿನ ಪಠ್ಯ ವಿವರಗಳನ್ನು ಮಾತ್ರ ಪ್ರಧಾನವಾಗಿ ಶಬ್ದಮಣಿದರ್ಪಣದ ತತ್ಸಂಬಂಧಿತ ಸೂತ್ರಗಳನ್ನು ಅಧರಿಸಿ ಅಭ್ಯಾಸ ಮಾಡಬೇಕು. ಇತರ ವ್ಯಾಕರಣಗಳ ಸೂತ್ರಗಳನ್ನು ಅನುಷಂಗಿಕವಾಗಿ ಪ್ರಸ್ತಾಪಿಸಬೇಕು.

೧. ಹಳಗನ್ನಡ ವ್ಯಾಕರಣಗಳು : ಕರ್ತೃ, ಕಾಲ, ಸ್ವರೂಪ, ಸ್ಥಾನ, ವೈಶಿಷ್ಟ್ಯ  
 ಕನ್ನಡ ವರ್ಣಸಮಾಪ್ತಿಯ- ಮಹಾಪ್ರಾಣಗಳು - ಁಁ-ಕುಳ-ಕ್ಷಳ ವಿಚಾರ, ಶಿಥಿಲದ್ವಿತ್ವ
೨. ಸ್ವರಸಂಧಿ - ವ್ಯಂಜನಸಂಧಿ:  
 ಲಿಂಗ: ಲಕ್ಷಣ, ಸ್ವರೂಪ;  
 ವಚನ : ಲಕ್ಷಣ, ಸ್ವರೂಪ,  
 ಪ್ರತ್ಯಯಗಳು; ವಿಭಕ್ತಿ : ಲಕ್ಷಣ, ಸ್ವರೂಪ, ಪ್ರತ್ಯಯಗಳು.
೩. ಸಮಾಸ : ಲಕ್ಷಣ, ಸ್ವರೂಪ-ತತ್ಪುರುಷ, ಕರ್ಮಧಾರೆಯ, ದ್ವಿಗು,  
 ಅಂಶಿ, ಬಹುವ್ರೀಹಿ, ಧ್ವಂಧ್ಯ, ಗಮಕ ಮತ್ತು ಕ್ರಿಯಾ ಸಮಾಸ
೪. ಆಖ್ಯಾತ ಪ್ರತ್ಯಯ, ಪುರುಷತ್ರಯ, ಕಾಲತ್ರಯ - ತದ್ವಿತ - ಸಮಸಂಸ್ಕೃತ - ಅಪಭ್ರಂಶ, ತತ್ಸಮ

### ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

- ೧ ಪೀಠಿಕೆಗಳು, ಲೇಖನಗಳು : ಡಿ.ಎಲ್. ನರಸಿಂಹಾಚಾರ್  
 ೨ ಆಲೋಕ : ಎಚ್.ಎಸ್. ಬಿಳಿಗಿರಿ  
 ೩ ಪ್ರಾಚೀನ ಕನ್ನಡ ವ್ಯಾಕರಣಗಳು : ಎಂ.ವಿ. ಸೀತಾರಾಮಯ್ಯ  
 ೪ ವ್ಯಾಕರಣಗಳು : ವಿ. ಸೀತಾರಾಮಯ್ಯ



೫ ಕನ್ನಡ ವ್ಯಾಕರಣ ಪರಂಪರೆಯ ಮೇಲೆ ಸಂಸ್ಕೃತದ ಪ್ರಭಾವ	: ಪಿ. ಶ್ರೀಕೃಷ್ಣಭಟ್
೬ ಕನ್ನಡ ಭಾಷಾವಲೋಕನ	: ಕೆ. ಕುಶಾಲವ್ವಗೌಡ
೭ ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ವ್ಯಾಕರಣಗಳ ಅಧ್ಯಯನ	: ಕೆ. ಕುಶಾಲವ್ವಗೌಡ
೮ ಶಬ್ದಮಣಿದರ್ಪಣದಲ್ಲಿ ಗ್ರಾಂಥಿಕ ವ್ಯಾವಹಾರಿಕ ಶೈಲಿಗಳು	: ವಿ. ಶಿವಾನಂದ
೯ ಶಬ್ದಮಣಿದರ್ಪಣಂ	: (ಸಂ) ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರೀ
೧೦ ಕರ್ನಾಟಕ ಶಬ್ದಾನುಶಾಸನ ವಿವೇಚನೆ	: ಉಷ್ಣಂಗಳ ರಾಮಭಟ್ಟ
೧೧ ಕನ್ನಡ ವ್ಯಾಕರಣಗಳ ತೌಲನಿಕ ವಿಶ್ಲೇಷಣೆ	: ದೊಡ್ಡಸ್ವಾಮಿ
೧೨ ಶೋಧನಲೋಕ	: ಎನ್.ಎಸ್. ತಾರಾನಾಥ
೧೩ ಕನ್ನಡ ವಾಗ್ಮೂರ್ತಿಗಳು	: ಡಿ.ಎನ್. ಶಂಕರಭಟ್ಟ
೧೪ ಭಾಷೆಯ ಸುತ್ತಮುತ್ತ	: ಕೆ.ವಿ. ನಾರಾಯಣ
೧೫ ಕನ್ನಡ ಭಾಷಾ ಕೈಪಿಡಿ	: ಸವದತ್ತಿಮಠ
೧೬ ಭಾಷೆ	: ಸಂ : ಕೆ.ವಿ.ನಾರಾಯಣ
೧೭ ಕನ್ನಡ ಕೈಪಿಡಿ, ಭಾಗ-೧	: ಬಿಎಂಶ್ರೀ

### KNB 210 : ಪತ್ರಿಕೆ: ೫.೨

#### ಜಾನಪದ ಅಧ್ಯಯನ: ಜನಪದ ಸಂಸ್ಕೃತಿಯ ತಾತ್ವಿಕ ಅಧ್ಯಯನ

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಸಂಸ್ಕೃತಿ ಎಂದರೇನು? ಸ್ವರೂಪ, ಕಾರ್ಯಗಳು, ನಾಗರಿಕತೆ ಮತ್ತು ಸಂಸ್ಕೃತಿ, ಜನಪದ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಸಂಸ್ಕೃತೀಕರಣ, ಜನಪದ ಧರ್ಮ
೨. ಜಾನಪದರ ಆರಾಧನೆಯ ಪರಿಕಲ್ಪನೆ, ಸ್ವರೂಪ, ಮಹತ್ವ, ಜನಪದ ದೇವತೆಗಳು, ಭೂತಾರಾಧನೆ, ಜಾತ್ರೆ ಮತ್ತು ಹಬ್ಬಗಳು, ನಂಬಿಕೆ, ಸಂಪ್ರದಾಯ, ಆಚರಣೆ, ಮಂತ್ರ-ಮಾಟ
೩. (ಅ) ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು : ಹಿನ್ನೆಲೆ, ಸ್ವರೂಪ, ಮಹತ್ವದ ಪ್ರಕಾರಗಳು : ವೇಷಗಾರರು, ನೀಲಗಾರರು, ತೊಗಲುಗೊಂಬೆ, ಚೌಡಿಕೆಯವರು, ಡೊಳ್ಳುಕುಣಿತ, ಕಂಸಾಳೆ
- (ಆ) ಕರ್ನಾಟಕ ಜನಪದ ರಂಗಭೂಮಿ - ಹಿನ್ನೆಲೆ, ಸ್ವರೂಪ, ಮಹತ್ವ, ಯಕ್ಷಗಾನ, ಬಯಲಾಟ, ದೊಡ್ಡಾಟ, ಸಣ್ಣಾಟ
೪. ಭೌತಿಕ ಜಾನಪದ, ಜನಪದ ಆಯುಗಾರರು-ಕೈಕಸುಬುದಾರರು, ಜನಪದ ಆಟಗಳು, ಜನಪದ ವೈದ್ಯ, ಆಕಾಶ ಜಾನಪದ

#### ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:

೧. ಕರ್ನಾಟಕ ಜಾನಪದ : ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ
೨. ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು : ಗೊ.ರು. ಚನ್ನಬಸವ್ವ
೩. ಕರ್ನಾಟಕ ಕಲೆಗಳು ೩ನೆಯ ಸಂಪುಟ ಕರಕುಶಲ ಕಲೆಗಳು : ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು
೪. ಸುವರ್ಣ ಜಾನಪದ ಭಾಗ - ೧, ೨ : ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ
೫. ನಮ್ಮ ಸುತ್ತಿನ ನಂಬಿಕೆಗಳು : ಡಿ.ಕೆ. ರಾಜೇಂದ್ರ
೬. ಕರ್ನಾಟಕದ ಜಾತ್ರೆಗಳು : ಸಿ.ಎನ್. ಶಿವಕುಮಾರಸ್ವಾಮಿ
೭. ಜಾನಪದ ಸಾಹಿತ್ಯ ದರ್ಶನ ಸಂಪುಟಗಳು : ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ ಧಾರವಾಡ

**KNB 210: ಪತ್ರಿಕೆ: ೫.೩**

**ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ: ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ (೧೩ ನೆಯ ಶತಮಾನ)**

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

**ಪ್ರವೃತ್ತಿಗಳು ಮತ್ತು ಕವಿಗಳು**

೧. ಪ್ರವೃತ್ತಿಗಳು : ಸ್ವತಂತ್ರ ಮನೋಧರ್ಮ, ಭಕ್ತಿ, ಮತನಿಷ್ಠೆ, ಧಾರ್ಮಿಕ ಶಾಸ್ತ್ರ ಒಲವು, ಪ್ರಸಾರಾಕಾಂಕ್ಷೆ, ಲೌಕಿಕಶಾಸ್ತ್ರ ಒಲವು, ಉಪಯುಕ್ತತೆ
೨. ಪ್ರಕಾರ : ಚಂಪೂ, ಷಟ್ಪದಿ, ರಗಳೆ ಇತ್ಯಾದಿ ನೆಲೆಯಲ್ಲಿ: ಜನ್ಮ, ಕವಿಕಾಮ, ದೇವಕವಿ, ಹರಿಹರ, ಕೆರೆಯ ಪದ್ಮರಸ, ತ್ರಿಭುವನತಾತ, ಎರಡನೇ ಗುಣವರ್ಮ, ರಾಘವಾಂಕ
೩. ಕವಿಗಳು : ಆಂಡಯ್ಯ, ಮಲ್ಲಿಕಾರ್ಜುನ, ಮಹಾಬಲ, ಕೇಶಿರಾಜ, ಪುಲಿಗೆರೆಯ ಸೋಮ, ರಟ್ಟಕವಿ, ಚೌಂಡರಸ, ಪಾಲ್ಕುರಿಕೆ ಸೋಮನಾಥ
೪. ಹೆಚ್ಚು ಮಾಹಿತಿ ದೊರಕದ ಕವಿಗಳು : ಕೇಶಿಯಣ್ಣ, ಮುನಿಚಂದ್ರ, ನಯವರ್ಮ, ಅಮೃತನಂದಿ

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

- |  |  |
|--|--|
| ೧. ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ ೪, ಭಾಗ ೨ | : ಮೈ.ವಿ.ವಿ.                              |
| ೨. ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟಗಳು ಸಂಪುಟ ೪              | : ಬೆಂಗಳೂರು ವಿ.ವಿ                         |
| ೩. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ                                     | : ರಂ.ಶ್ರೀ.ಮುಗಳಿ                          |
| ೪. ಚಂಪೂ ಕವಿಗಳು (ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂ.೨)            | : ಬೆಂಗಳೂರು ವಿ.ವಿ                         |
| ೫. ಷಟ್ಪದಿ ಸಾಹಿತ್ಯ (ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂ. ೫)        | : ಬೆಂಗಳೂರು ವಿ.ವಿ                         |
| ೬. ಶಾಸ್ತ್ರ ಸಾಹಿತ್ಯ (ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂ.೩)        | : ಬೆಂಗಳೂರು ವಿ.ವಿ                         |
| ೭. ವೀರಶೈವ ಧರ್ಮದರ್ಶನ ಭಾಗ ೨ ಮತ್ತು ೩                            | : ಜೆಎಸ್‌ಎಸ್ ಗ್ರಂಥಮಾಲೆ                    |
| ೮. ಪೀಠಿಕೆಗಳು, ಲೇಖನಗಳು  | : ಡಿ.ಎಲ್. ನರಸಿಂಹಾಚಾರ್                    |
| ೯. ಹರಿಹರದೇವ  | : ಕರ್ನಾಟಕ ಸಂಘ, ರಾಜಾರಾಮ ಕಾಲೇಜು, ಕೊಲ್ಲಾಪುರ |
| ೧೦. ಋಷಿಕವಿ ರಾಘವಾಂಕ   | : ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ                 |
| ೧೧. ಸಾಹಿತ್ಯಾಲೋಕ  | : ಎಂ.ಆರ್.ಶ್ರೀನಿವಾಸಮೂರ್ತಿ                 |
| ೧೨. ಲಿಂಗಾಯತ ಅಧ್ಯಯನಗಳು  | : ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ                      |

**ವಿಶೇಷ ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Special Soft core)**

**KNB 220: ಪತ್ರಿಕೆ : ೬.೧. ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಚಿಂತನೆ (ಆಯ್ದು ಲೇಖನಗಳು) (೩:೧=೪ ಕ್ರೆಡಿಟ್)**

೧. ಸಂಸ್ಕೃತಿ ಎಂದರೇನು? - ದೇವುಡು ನರಸಿಂಹಶಾಸ್ತ್ರಿ
೨. ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಗರಿಕತೆ - ಡಾ. ಎನ್. ಶ್ರೀಕಂಠಶಾಸ್ತ್ರಿ

೩. ಸಂಸ್ಕೃತಿ ಮತ್ತು ಸಾಹಿತ್ಯ - ಎ.ಎನ್. ಮೂರ್ತಿರಾವ್  
 ೪. ಕರ್ಣಾಟಕ ಸಂಸ್ಕೃತಿ - ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ  
 ೫. ವಿಚಾರ ಕ್ರಾಂತಿಗೆ ಆಹ್ವಾನ - ಕುವೆಂಪು  
 ೬. ಕನ್ನಡ ಮಾತು ತಲೆಯೆತ್ತುವ ಬಗೆ - ಬಿ.ಎಂ.ಶ್ರೀ  
 ೭. ಹೊಸ ದಿಗಂತದೊಡನೆ ಮತ್ತು ಮಣ್ಣಿನ ವಾಸನೆ, ಸಮಕಾಲೀನ ಪ್ರಜ್ಞೆ, ಇತ್ಯಾದಿ - ಪೂಚಂತೇ  
 ೮. ಜನಪದರು ಮತ್ತು ಇತಿಹಾಸ - ಕೃಷ್ಣಮೂರ್ತಿ ಹನೂರು  
 ೯. ಆಧುನಿಕ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಾಮಾನ್ಯ ಮನುಷ್ಯ - ಡಿ.ಆರ್. ನಾಗರಾಜ್  
 ೧೦ ಧರ್ಮ ಮತ್ತು ಮಹಿಳೆ - ಸಾ.ರಾ. ಅಬೂಬಕರ್

**ಪಠ್ಯ ಮೂಲ:**

೧. ಸಂಸ್ಕೃತಿ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಕನ್ನಡ ಭವನ, ಜೆ.ಸಿ. ರಸ್ತೆ, ಬೆಂಗಳೂರು, ೨೦೦೭  
 ೨. ಭಾರತೀಯ ಸಂಸ್ಕೃತಿ, ಡಾ. ಎಸ್. ಶ್ರೀಕಂಠಶಾಸ್ತ್ರಿ, ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು. ವಿ.ವಿ., ಮೈಸೂರು, ೧೯೬೯  
 ೩. ಗದ್ಯ ವಿಹಾರ-೨, ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು. ವಿ.ವಿ., ಮೈಸೂರು, ೧೯೮೩  
 ೪. ಕರ್ಣಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ - ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ, ೨೦೧೧, ಡಿ.ವಿ.ಕೆ. ಮೂರ್ತಿ ಪ್ರಕಾಶನ, ಮೈಸೂರು  
 ೫. ಕುವೆಂಪು ಸಮಗ್ರ ಗದ್ಯ, ಸಂಪುಟ-೨, ೨೦೧೩, ರಾಷ್ಟ್ರಕವಿ ಕುವೆಂಪು ಪ್ರತಿಷ್ಠಾನ, ಕುಪ್ಪಳಿ, ಶಿವಮೊಗ್ಗ  
 ೬. ಮಾತು ತಲೆಯೆತ್ತುವ ಬಗೆ (ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮೀಮಾಂಸೆ) - ಸಂ: ರಹಮತ್ ತರೀಕೆರೆ; ಕವಿವಿ, ಹಂಪಿ, ೨೦೧೧,  
 ೭. ವಿಮರ್ಶೆಯ ವಿಮರ್ಶೆ -ಕೆ.ಪಿ. ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ, ಪುಸ್ತಕ ಪ್ರಕಾಶನ, ಮೈಸೂರು-೨೦೦೯  
 ೮. ಹೊನ್ನಾರು, ಪ್ರೊ ಎಚ್.ಜೆ. ಲಕ್ಷ್ಮಪ್ಪಗೌಡರ ಅಭಿನಂದನ ಗ್ರಂಥ, ೨೦೦೪, ತೆಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ,  
 ಮೈಸೂರು  
 ೯. ಅಮೃತ ಮತ್ತು ಗರುಡ, ಡಿ.ಆರ್. ನಾಗರಾಜ್, ೨೦೦೯, ಅಕ್ಷರ ಪ್ರಕಾಶನ, ಹೆಗ್ಗೋಡು, ಸಾಗರ, ಕರ್ನಾಟಕ  
 ೧೦. ಮಹಿಳೆ ಮತ್ತು ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಸಂ: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ, ೧೯೭೯, ಪ್ರಸಾರಾಂಗ, ಬೆಂಗಳೂರು ವಿವಿ, ಬೆಂಗಳೂರು

**ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು:**

೧. ಕರ್ಣಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ : ಎಚ್.ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ  
 ೨. ಶಕ್ತಿ ಶಾರದೆಯ ಮೇಳ : ಡಿ.ಆರ್. ನಾಗರಾಜ್  
 ೩. ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ : ರಹಮತ್ ತರೀಕೆರೆ  
 ೪. ಶ್ರೀ ಸಾಹಿತ್ಯ : ಬಿ.ಎಂ.ಶ್ರೀ  
 ೫. ಸಂಸ್ಕೃತಿ : ಡಿ.ವಿ.ಜಿ  
 ೬. ಜೀವನ ಸೌಂದರ್ಯ ಮತ್ತು ಸಾಹಿತ್ಯ : ಡಿ.ವಿ.ಜಿ  
 ೭. ಸಂಸ್ಕೃತಿ ಕಥನ : ಡಿ.ಆರ್. ನಾಗರಾಜ್  
 ೮. ಭಾರತೀಯ ಸಂಸ್ಕೃತಿ : (ಸಂ) ಅ.ನ.ಕೃಷ್ಣರಾಯ

**KNB 220 : ಪತ್ರಿಕೆ ೨.೨ ಮಹಿಳೆ : ಸಮಾಜ - ಸಾಹಿತ್ಯ (ಆಯ್ದು ಲೇಖನಗಳು)**

೧. ಮಹಿಳಾವಾದ ಮತ್ತು ಮಹಿಳಾ ಸಾಹಿತ್ಯ - ವಿಜಯಾದಿತ್ಯ  
 ೨. ಹೆಣ್ಣು ಮತ್ತು ಭಾಷೆ : ಅಭಿವ್ಯಕ್ತಿ - ಎಚ್.ಎಸ್.ರಾಘವೇಂದ್ರರಾವ್  
 ೩. ಭಾರತೀಯ ಸ್ತ್ರೀವಾದ (ಪೀಠಿಕಾ ಭಾಗ-ಮೊದಲಭಾಗ) - ಮನು ಚಕ್ರವರ್ತಿ

೪. ಕಪ್ಪು ಸ್ತ್ರೀವಾದಿ ವಿಮರ್ಶೆ	-	ವಿಜಯಾದಬ್ಬೆ
೫. ಪಾಠ್ಯಗಳಲ್ಲಿ ಸ್ತ್ರೀತ್ವದ ಪ್ರತಿನಿಧೀಕರಣ	-	ಗಾಯತ್ರಿ ನಾವಡ
೬. ಜನ್ಮನ ಕಾವ್ಯಗಳು : ಹೆಣ್ಣನ್ನು ಪಳಗಿಸುವ ವ್ಯವಸ್ಥೆಯ ಕನ್ನಡಿ	-	ಸಬಿಹಾ ಭೂಮಿಗೌಡ
೭. ಚಕ್ರಾಧಿಪತ್ಯ, ರಾಷ್ಟ್ರ ಮತ್ತು ಸಾಹಿತ್ಯಕ ಪಠ್ಯ	-	ಸೂಸಿ ಥಾರು ಮತ್ತು ಕೆ. ಲಲಿತ ಅನು: ಎಚ್.ಎಸ್.ರಾಘವೇಂದ್ರರಾವ್

೮. ಮುಸ್ಲಿಂ ಮಹಿಳಾ ಸಂವೇದನೆ ಮತ್ತು ಪ್ರತಿಭಟನಾ ನೆಲೆಗಳು	-	ಕೆ. ಷರೀಫಾ
೯. ದಲಿತ ಸಾಹಿತ್ಯದಲ್ಲಿ ಮಹಿಳೆ	-	ಧರಣಿದೇವಿ ಮಾಲಗತ್ತಿ
೧೦.ವಾಸ್ತವತೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಲೇಖಕಿ	-	ಅನುಪಮಾ ನಿರಂಜನ

**ಪಠ್ಯ ಮೂಲ:**

೧. ನಾರಿ: ದಾರಿ-ದಿಗಂತ-ವಿಜಯಾದಬ್ಬೆ ೧೯೯೭, ರಚನಾ ಪ್ರಕಾಶನ, ಮೈಸೂರು
೨. ಭಾರತೀಯ ಸ್ತ್ರೀವಾದ - ಅಕ್ಷರ ಪ್ರಕಾಶನ, ೧೯೯೩, ಹೆಗ್ಗೋಡು, ಸಾಗರ
೩. ಹೆಣ್ಣು ಮತ್ತು ಭಾಷೆ- ಸಂ: ಎಚ್.ಎಸ್. ಶ್ರೀಮತಿ, ಶಿವಾನಂದ ಎಸ್. ವಿರಕ್ತಮಠ, ೨೦೦೭, ಕನ್ನಡ ವಿವಿ, ಹಂಪಿ
೪. ಸ್ತ್ರೀವಾದಿ ಪ್ರವೇಶಿಕೆ- ಸಂ: ಬಿ.ಎನ್. ಸುಮಿತ್ರಾಬಾಯಿ, ಎನ್.ಗಾಯತ್ರಿ, ೧೯೯೫, ಕರ್ನಾಟಕ ಲೇಖಕಿಯರ ಸಂಘ, ಬೆಂ.
೫. ವಿರಚನೆ- ಗಾಯತ್ರಿ ನಾವಡ, ೧೯೯೭, ಎನ್.ಆರ್.ಎ.ಎಂ.ಎಚ್. ಪ್ರಕಾಶನ, ಕೋಟೇಶ್ವರ, ದಕ್ಷಿಣ ಕನ್ನಡ
೬. ಬಗೆ - ಸಬಿಹಾ ಭೂಮಿಗೌಡ, ೨೦೦೧, ಲೋಹಿಯಾ ಪ್ರಕಾಶನ, ಬಳ್ಳಾರಿ
೭. ಸ್ತ್ರೀವಾದಿ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ- (ಸಂ) ತೇಜಸ್ವಿನಿ ನಿರಂಜನ, ೧೯೯೪, ಕನ್ನಡ ಸಂಘ, ಕ್ಯಾನ್ಪ್ ಕಾಲೇಜ್,ಬೆಂಗಳೂರು
೮. ಮುಸ್ಲಿಂ ಮಹಿಳಾ ಸಂವೇದನೆ-ಕೆ.ಷರೀಫಾ, ೨೦೧೧, ಅಂಕಿತ ಪುಸ್ತಕ, ಬೆಂಗಳೂರು
೯. ಸ್ತ್ರೀವಾದ ಮತ್ತು ಭಾರತೀಯತೆ- ಧರಣಿದೇವಿ ಮಾಲಗತ್ತಿ, ೧೯೯೮, ಚೇತನ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು
೧೦. ಸಾಹಿತ್ಯ ಮತ್ತು ಪ್ರಗತಿ- ಅನುಪಮಾ ನಿರಂಜನ, ೨೦೦೮, ಡಿ.ವಿ.ಕೆ. ಮೂರ್ತಿ, ಮೈಸೂರು

**ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು**

೧. ಮಹಿಳಾ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ	: (ಸಂ) ಎಚ್.ಎಸ್. ಶ್ರೀಮತಿ
೨. ಹೆಣ್ಣು ಮತ್ತು ಭಾಷೆ	: (ಸಂ) ಎಚ್ ಎಸ್. ಶ್ರೀಮತಿ, ಶಿವಾನಂದ ಎಸ್. ವಿರಕ್ತಮಠ
೩. ಸ್ತ್ರೀವಾದಿ ಪ್ರವೇಶಿಕೆ	: (ಸಂ) ಬಿ.ಎನ್. ಸುಮಿತ್ರಾಬಾಯಿ, ಎನ್. ಗಾಯತ್ರಿ
೪. ವಿರಚನೆ	: ಗಾಯತ್ರಿ ನಾವಡ
೫. ವಿಜಯಾನ್ವೇಷಣೆ	: (ಸಂ) ಎಸ್.ಡಿ. ಶಶಿಕಲಾ

ಎರಡನೆಯ ವರ್ಷ ಕನ್ನಡ ಎಂ.ಎ

ಮೂರನೆಯ ಚತುರ್ಮಾಸ (ಆಗಸ್ಟ್-ಡಿಸೆಂಬರ್ ೨೦೨೩)

**ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard Core)**

**KNC 050: ಪತ್ರಿಕೆ: ೧**

**ತೌಲನಿಕ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಮಹಾಕಾವ್ಯ ಮತ್ತು ನಾಟಕ (೨:೧=೩ ಕ್ರೆಡಿಟ್)**

೧. ತೌಲನಿಕ ಸಾಹಿತ್ಯದ ಸೂತ್ರ ಸ್ವರೂಪ - ರಾಷ್ಟ್ರೀಯ ಸಾಹಿತ್ಯ, ಜಾಗತಿಕ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಾಮಾನ್ಯ ಸಾಹಿತ್ಯ - ತೌಲನಿಕ ಸಾಹಿತ್ಯದ ಪಂಥಗಳು, ಸ್ವೀಕಾರ ಮತ್ತು ಪ್ರಭಾವ
೨. ತುಫಲರ್- ಕಾರ್ನಾಡ್, ಕ್ಯಾಲಿಗುಲ- ಆಲ್ಬರ್ಟ್ ಕಾಮು (ಅನು-ಡಿ.ಎ. ಶಂಕರ್)
೩. ಹ್ಯಾಮ್ಲೆಟ್- ಕೆ.ಎಸ್. ಭಗವಾನ್, ರಕ್ತಾಕ್ಷಿ- ಕುವೆಂಪು
೪. ವ್ಯಾಸಭಾರತ - ವಿರಾಟ ಪರ್ವ  
ಕುಮಾರವ್ಯಾಸ ಭಾರತ - ವಿರಾಟ ಪರ್ವ

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

- |   |                                 |
|---|---------------------------------|
| ೧. ಪಾಶ್ಚಾತ್ಯ ಮಹಾಕಾವ್ಯಗಳು  | : ಶ್ರೀಕಂಠಕೂಡಿಗಿ (ಸಂ) ಪ್ರ,ಮೈವಿವಿ |
| ೨. ಮಹಾಕಾವ್ಯ ಸ್ವರೂಪ  | : ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ           |
| ೩. ಮಹಾಕಾವ್ಯ ಲಕ್ಷಣ   | : ಟಿ.ವಿ. ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರಿ       |
| ೪. Comparative Literary studies   | : S.S. Pawar                    |
| ೫. Comparative Literary and Literary Theory   | : Ulrich Weisstein              |
| ೬. Comparative Literature Method & perspective  | : (Ed) Newton P Stalknecht      |
| ೭. Method and perspective Discriminations<br>(First two Essays on Comparative Literature) | : Horst Frenz                   |

**KNC 020: ಪತ್ರಿಕೆ: ೨ ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಹಿನ್ನೆಲೆ** (೨:೧=೩ ಕ್ರೆಡಿಟ್)

೧. ನವೋದಯ ಸಾಹಿತ್ಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ರೊಮ್ಯಾಂಟಿಸಿಸಂ, ರಾಷ್ಟ್ರೀಯತೆ, ಸುಧಾರಣಾವಾದ, ದೇಶೀಯತೆ, ನಾಡು-ನುಡಿ
೨. ಪ್ರಗತಿಶೀಲ ಸಾಹಿತ್ಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ಮಾರ್ಕ್ಸ್ ವಾದ, ವಾಸ್ತವವಾದ
೩. ನವ್ಯ ಸಾಹಿತ್ಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ಅಸ್ತಿತ್ವವಾದ, ಅಸಂಗತವಾದ
೪. ದಲಿತ ಬಂಡಾಯ : ಪ್ರಭಾವ, ಪ್ರೇರಣೆ, ಮಾರ್ಕ್ಸ್ ವಾದ, ಅಂಬೇಡ್ಕರ್ ವಾದ, ಲೋಹಿಯಾವಾದ, ಸ್ತ್ರೀವಾದ

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು :**

೧. ಹೊಸಗನ್ನಡದ ಅರುಣೋದಯ	: ಶ್ರೀನಿವಾಸ ಹಾವನೂರ
೨. ಹೊಸಗನ್ನಡದ ಕವಿತೆಯ ಮೇಲೆ ಇಂಗ್ಲಿಷ್ ಕಾವ್ಯದ ಪ್ರಭಾವ	: ಎಸ್. ಅನಂತನಾರಾಯಣ
೩ ಯುಗಧರ್ಮ ಹಾಗೂ ಸಾಹಿತ್ಯ ದರ್ಶನ	: ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ
೪ ಪ್ರಗತಿಶೀಲ ಸಾಹಿತ್ಯ	: ಅನಕೃ (ಸಂ)
೫ ಭಾರತೀಯ ಪತ್ರಿಕೋದ್ಯಮ	: ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ
೬ ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ	: ಎಲ್. ಎಸ್. ಶೇಷಗಿರಿರಾವ್
೭ ೨೦ನೆಯ ಶತಮಾನದ ಕನ್ನಡ ಸಾಹಿತ್ಯ :	: ಡಾ. ಬಸವರಾಜ ಸಾದರ
೮ ಕರ್ನಾಟಕ ಸಂಗಾತಿ	: ಕನ್ನಡ ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ ಪ್ರಕಟಣೆ
೯ Impact of Marxism on Indian life and Literature	: H.M. Nayak (Ed)
೧೦ Heritage of Karnataka	: R.S. Mugali

**KNC 030 : ಪತ್ರಿಕೆ: ೩ ಭಾರತೀಯ ಕಾವ್ಯಮೀಮಾಂಸೆ (೨:೧=೩ ಕ್ರೆಡಿಟ್)**

೧. ಸಂಸ್ಕೃತ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಕವಿ-ಕಾವ್ಯ-ಸಹೃದಯ, ಕವಿತೆಯ ಆಕರ-ಪ್ರತಿಭೆ, ಪರಿಕರ-ವ್ಯುತ್ಪತ್ತಿ, ಪ್ರಮುಖ ಸಿದ್ಧಾಂತಗಳು : ಅಲಂಕಾರ, ರೀತಿ, ಗುಣ, ರಸ-ಧ್ವನಿ, ಔಚಿತ್ಯ, ವಕ್ರೋಕ್ತಿ

೨. ಕನ್ನಡ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಕವಿರಾಜಮಾರ್ಗ ಮತ್ತು ಇತರ ಪ್ರಾಚೀನ ಲಕ್ಷಣ ಗ್ರಂಥಗಳು, ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯಮೀಮಾಂಸೆಯ ವಿವಿಧ ಚಿಂತನೆಗಳು: ನವೋದಯ, ನವ್ಯ, ಪ್ರಗತಿಶೀಲ, ದಲಿತ ಬಂಡಾಯ, ಸ್ತ್ರೀವಾದ

೩. ಕನ್ನಡ ಕವಿಗಳ ಕಾವ್ಯ ಕಲ್ಪನೆ-ಪ್ರಾಚೀನ, ಆಧುನಿಕ

೪. ತಮಿಳು ಕಾವ್ಯಮೀಮಾಂಸೆ ಮತ್ತು ಕನ್ನಡ ಜಾನಪದ ಕಾವ್ಯಮೀಮಾಂಸೆ

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

೧ ಭಾರತೀಯ ಕಾವ್ಯಮೀಮಾಂಸೆ	: ತೀನಂಶ್ರೀ
೨ ತೌಲನಿಕ ಕಾವ್ಯಮೀಮಾಂಸೆ	: ಎಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೩ ಕಾವ್ಯಾರ್ಥ ಚಿಂತನೆ	: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೪ ಕನ್ನಡ ಕವಿಗಳ ಕಾವ್ಯಕಲ್ಪನೆ	: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೫ ಕನ್ನಡದಲ್ಲಿ ಸರಸ್ವತೀ ತತ್ವ	: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೬ ಕಾವ್ಯಾರ್ಥ ಪದಕೋಶ	: ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ
೭ ವಿಮರ್ಶೆಯ ಪರಿಭಾಷೆ	: ಓ.ಎಲ್. ನಾಗಾಭೂಷಣಸ್ವಾಮಿ
೮ ಕನ್ನಡ ಧ್ವನಿಯೋಕ ಲೋಚನಸಾರ	: ಕೆ.ಕೃಷ್ಣಮೂರ್ತಿ
೯ ಔಚಿತ್ಯ ವಿಚಾರ ಚರ್ಚೆ	: ಕೆ.ಕೃಷ್ಣಮೂರ್ತಿ
೧೦ ತಮಿಳು ಕಾವ್ಯ ಮೀಮಾಂಸೆ	: ಡಾ.ಕಾರ್ಲೋಸ್

**KNC \_\_\_\_ : ಪತ್ರಿಕೆ : ೪ : ಸಂಶೋಧನ ವಿಧಾನ (೨:೧=೩ ಕ್ರೆಡಿಟ್)**

೧. ಸಂಶೋಧನೆ, ಅರ್ಥವ್ಯಾಪ್ತಿ, ಸ್ವರೂಪ, ಕನ್ನಡ ಸಂಶೋಧನೆಯ ಇತಿಹಾಸ, ಸಂಶೋಧನಾ ವಿಧಾನಗಳು, ಸಂಶೋಧನಾ ಪ್ರಕಾರಗಳು, ಸಂಶೋಧಕರ ಅರ್ಹತೆ ಹಾಗೂ ಮನೋಧರ್ಮ.

೨. ವಿಷಯ ಆಯ್ಕೆ: ಸಂಶೋಧನಾ ಪ್ರಸ್ತಾವ (Proposal), ಪೂರ್ವ ಸಂಶೋಧನಾ ಸಾಹಿತ್ಯ ಪರಾಮರ್ಶೆ, ಕ್ಷೇತ್ರಕಾರ್ಯದ ಸ್ವರೂಪ ಹಾಗೂ ವಿಧಾನ, ಧನಸಹಾಯ ಸಂಸ್ಥೆಗಳು.

೩. ಸಂಶೋಧನ ಲೇಖನ (Research Paper), ನಿಬಂಧ (Dissertation), ಮಹಾಪ್ರಬಂಧ (Thesis)- ಇವುಗಳ ಸ್ವರೂಪ ಮತ್ತು ವ್ಯತ್ಯಾಸ, ಸಂಶೋಧನ ಸಾರಲೇಖ (Synopsis); ಸಂಶೋಧನೆಯ ಭಾಷೆ ಮತ್ತು ಶೈಲಿ, ಉದ್ಧರಣೆ, ಅಡಿಟಿಪ್ಪಣಿ, ಅನುಬಂಧ, ಗ್ರಂಥಸೂಚಿ, ಸಂಕ್ಷೇಪಸೂಚಿ.

೪. ಕನ್ನಡ ಸಂಶೋಧನೆಯ ಇತಿಹಾಸ ಮತ್ತು ಬೆಳವಣಿಗೆ, ಸಂಶೋಧನಾ ಲೇಖನಗಳು ಮತ್ತು ಮಹಾಪ್ರಬಂಧಗಳ ಸ್ವರೂಪದ ಪರಾಮರ್ಶೆ. (ನಾಡು ನುಡಿ ಶೋಧ, ಛಂದಶೋಧ, ಚಾರಿತ್ರಿಕ ಶೋಧ, ಸಂಸ್ಕೃತಿ ಶೋಧ, ಜಾನಪದ ಶೋಧ, ಸಾಹಿತ್ಯ ಶೋಧ, ಮಹಿಳಾ ಶೋಧ, ದಲಿತ ಶೋಧ, ಭಾಷಾ ಶೋಧ ಕುರಿತ ಸಂಶೋಧನಾ ಮಹಾಪ್ರಬಂಧಗಳನ್ನು ಪರಾಮರ್ಶೆ ಮಾಡುವುದು)

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

೧ ಸಂಶೋಧನೆ	: ಎಂ.ಚಿದಾನಂದಮೂರ್ತಿ
೨ ಕನ್ನಡ ಸಂಶೋಧನ ಶಾಸ್ತ್ರ	: ಎಂ.ಎಂ.ಕಲಬುರ್ಗಿ
೩ ಸಂಶೋಧನ ಸ್ವರೂಪ	: ಬಿ.ವಿ.ಶಿರೂರ
೪ ಸಂಶೋಧನ ಪ್ರಜ್ಞೆ	:(ಸಂ) ಹೇರಂಜಿ ಕೃಷ್ಣಭಟ್ಟ
೫ ಸಂಶೋಧನೆ ತಾತ್ವಿಕ ವಿಚಾರ	: ರಹಮತ್ ತರೀಕೆರೆ
೬ ಅಧ್ಯಯನದ ವಿಧಿವಿಧಾನಗಳು	: ಕೆ.ರವೀಂದ್ರನಾಥ
೭ ಮಹಾಮಾರ್ಗ	: ಎಂ.ಎಂ.ಕಲಬುರ್ಗಿ

**ಉಪ ಪ್ರಧಾನ ವಿಷಯಗಳು (Soft Core)**

**KNC 210: ಪತ್ರಿಕೆ: ೫.೧ ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಉಪಭಾಷಾವಿಜ್ಞಾನ (ಕನ್ನಡ)  
(೩:೧=೪ ಕ್ರೆಡಿಟ್)**

೧. ಉಪಭಾಷಾ ವಿಜ್ಞಾನ : ಸ್ವರೂಪ ಮತ್ತು ವ್ಯಾಪ್ತಿ, ಭಾಷಾಭೂಗೋಳ, ಉಪಭಾಷಾಭೂಗೋಳ ಮತ್ತು ಭಾಷಾ ಭೂಪಟ- ಈ ಶಬ್ದಗಳ ಅರ್ಥ ಮತ್ತು ವ್ಯಾಪ್ತಿ: ಕನ್ನಡದ ಸಾಮಾಜಿಕ ಉಪಭಾಷೆಗಳು ಮತ್ತು ಪ್ರಾದೇಶಿಕ ಉಪಭಾಷೆಗಳು

೨. ಉಪಭಾಷಾ ವಿಜ್ಞಾನದ ಸಂಕ್ಷಿಪ್ತ ಇತಿಹಾಸ : ಭಾರತ, ಫ್ರಾನ್ಸ್, ಅಮೆರಿಕಾ, ಇಂಗ್ಲೆಂಡ್ ಮತ್ತು ಜರ್ಮನಿ ದೇಶಗಳಲ್ಲಿ ಉಪಭಾಷಾ ಅಧ್ಯಯನಗಳು, 'ಲಿಂಗ್ವಿಸ್ಟಿಕ್ ಸರ್ವೆ ಆಫ್ ಇಂಡಿಯಾ'ದ ಮಹತ್ವ; ಕರ್ನಾಟಕದಲ್ಲಿ ನಡೆದಿರುವ ಉಪಭಾಷಾ ಅಧ್ಯಯನಗಳು

೩. ಅ) ಭಾಷೆ, ಉಪಭಾಷೆ, ವ್ಯಕ್ತಿಭಾಷೆ, ಪ್ರಮಾಣ ಭಾಷೆ, ಭಾಷಾಗುಂಪು, ಪರಸ್ಪರ ಅರಿವು, ಸಾಮಾನ್ಯ ತಿರುಳು

ಆ) ಉಪಭಾಷಾವಿಜ್ಞಾನದ ವಿಧಾನಗಳು : ಏಕಕಾಲಿಕ, ದ್ವಿಕಾಲಿಕ

೪. ಭಾಷಾವಿಜ್ಞಾನದಲ್ಲಿ ಕ್ಷೇತ್ರಕಾರ್ಯದ ಸ್ವರೂಪ ಮತ್ತು ಪ್ರಯೋಜನ, ವಕ್ರ, ಪ್ರತಿವಕ್ರ-ಅರ್ಹತೆ ಕಾರ್ಯನಿರ್ವಹಣೆ, ದತ್ತಸಂಗ್ರಹ, ಸ್ವರೂಪ, ಉದ್ದೇಶ, ಪರಿಶೀಲನ ರೀತಿ ಮತ್ತು ಸಂಗ್ರಹದ ವಿವಿಧ ಹಂತಗಳು, ಸಂಗ್ರಹ ಕಾರ್ಯದಲ್ಲಿ ಪ್ರಶ್ನಾವಳಿಗಳು ಮತ್ತು ಇತರ ಉಪಕರಣಗಳು

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು**

೧. ಉಪಭಾಷೆ	: ಕೃಷ್ಣ ಪರಮೇಶ್ವರ ಭಟ್ಟ
೨. ಉಪಭಾಷಾ ಅಧ್ಯಯನ	: ಶಾಲಿನಿ ರಘುನಾಥ
೩. ಭಾಷಾಕ್ಷೇತ್ರಕಾರ್ಯ	: ಎಸ್.ಎಸ್.ಅಂಗಡಿ
೪. ಕ್ಷೇತ್ರಕಾರ್ಯದ ಹಾದಿಯಲ್ಲಿ	: ಕ್ಯಾತನಹಳ್ಳಿ ರಾಮಾಣ್ಣ
೫. ಹಾದಿಯೊಳಗಣ ಜ್ಯೋತಿ	: ಹನೂರು ಕೃಷ್ಣಮೂರ್ತಿ
೬. ಸಾಮಾಜಿಕ ಉಪಭಾಷೆ	: ಮಹಾದೇವಯ್ಯ
೭. ಸುವರ್ಣ ಸಂಚಯ	: (ಸಂ) ದೇ ಜವರೇಗೌಡ
೮. ಕರ್ನಾಟಕ ಭಾರತಿ	: (ಸಂ) ಸುಂಕಾಪುರ ಎಂ.ಎಸ್
೯. ಕನ್ನಡ ಉಪಭಾಷೆಗಳ ಅಧ್ಯಯನ	: ಕೆ ಕೆಂಪೇಗೌಡ
೧೦. Field Linguistics	: William J Samarien
೧೧. The Structure of Karnataka	: R.C. Hiremath
೧೨. An Outline of Colloquial Kannada	: William Bright
೧೩. Kannada –Literary and colloquial	: H.M. Nayak
೧೪. Field Study	: Sen Gupta
೧೫. World Geography of the Eastern United States	: H Kurath
೧೬. Handbook of the Linguistic Geography of New England	: H Kurath
೧೭. Reading in American Dialectology	: Allen and Underwood
೧೮. The Study of dialect	: K.M. Petyt
೧೯. A course in Modern Linguistics	: Charles F Hockett

**KNC 210 : ಪತ್ರಿಕೆ: ೫.೨ ಜಾನಪದ ಅಧ್ಯಯನ: ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು**

**(೩:೧=೪ ಕ್ರೆಡಿಟ್)**

೧. ತಾತ್ವಿಕತೆ : ಜನಪದ ಕಲೆಗಳ ಉಗಮ, ಸ್ವರೂಪ, ವ್ಯಾಪ್ತಿ, ಬುಡಕಟ್ಟು ಕಲೆಗಳು, ಗ್ರಾಮಾಂತರ ಜನಪದ ಕಲೆಗಳು, ಶಿಷ್ಟಕಲಾ ಪ್ರಕಾರಗಳು, ಜನಪದಕಲೆ, ಕಲಾವಿದರು ಮತ್ತು ಆಧುನಿಕತೆಯ ಮುಖಾಮುಖಿ
೨. ಪ್ರದರ್ಶನಾತ್ಮಕ ಕಲೆಗಳು : ವಾದ್ಯಪ್ರಧಾನ : ವೀರಗಾನೆ, ಕರಪಾಲ, ತಮಟೆವಾದನ, ನೀಲಗಾರರು, ಮುಖವೀಣೆ
೩. ಆರಾಧನಾ ಪ್ರಧಾನ ಕಲೆಗಳು : ಮೊಹರಂ, ಆಟಕಳಂಜ, ವೀರಭದ್ರನ ಕುಣಿತ, ಗೊರವರ ಕುಣಿತ, ಗೊಂದಲಿಗರು, ಹಾಲಕ್ಕಿ ಕುಣಿತ, ಆಸಾದಿ ಹಾಡುಗಳು, ಭೂತಾರಾಧನೆ
೪. ರಂಗಭೂಮಿ : ಹಗರಣ, ಜಾಲಾಟ, ಬಹುರೂಪಿ, ಕೇಳಿಕೆ, ತಾಳಮದ್ದಳೆ, ಸೂತ್ರದಬೊಂಬೆಯಾಟ, ತೊಗಲುಬೊಂಬೆಯಾಟ, ಕೋಲಾಟ, ಮೂಡಲಪಾಯ, ಪದುವಲಪಾಯ ಯಕ್ಷಗಾನ (ತೆಂಕುತಿಟ್ಟು, ಬಡಗುತಿಟ್ಟು)



**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

೧. ಉತ್ತರ ಕರ್ನಾಟಕದ ಜನಪದ ರಂಗಭೂಮಿ	: ಚಂದ್ರಶೇಖರ ಕಂಬಾರ
೨. ದಕ್ಷಿಣ ಕರ್ನಾಟಕದ ಜನಪದ ರಂಗಭೂಮಿ	: ಡಿ.ಕೆ. ರಾಜೇಂದ್ರ
೩. ಕರಪಾಲ ಮೇಳ	: ಡಿ.ಕೆ. ರಾಜೇಂದ್ರ
೪. ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳ ಕೋಶ	: (ಸಂ) ಹಿ.ಬಿ. ಬೋರಲಿಂಗಯ್ಯ
೫. ಕರ್ನಾಟಕ ಜನಪದ ಕಲೆಗಳು	: ಗೊ.ರು. ಚನ್ನಬಸವ್ವ
೬. ಹೊನ್ನಬಿತ್ತೇವು ಹೊಲಕಲ್ಲ	: ಗೊ.ರು. ಚನ್ನಬಸವ್ವ
೭. ಕನ್ನಡ ಜಾನಪದ ವಿಶ್ವಕೋಶ	: (ಸಂ) ಚಂದ್ರಶೇಖರ ಕಂಬಾರ
೮. ಭೂತಾರಾಧನೆ	: ಕೆ.ಬಿನ್ನಪ್ಪಗೌಡ
೯. ಮೌಖಿಕ ಕಥನ	: ಜಿ.ಆರ್. ತಿಪ್ಪೇಸ್ವಾಮಿ
೧೦. ಜಾನಪದ ಪರಿಭಾವನೆ	: ಜಿ.ಆರ್. ತಿಪ್ಪೇಸ್ವಾಮಿ
೧೧. ದಕ್ಷಿಣ ಕರ್ನಾಟಕ ಜನಪದ ಕಾವ್ಯಪ್ರಕಾರಗಳು	: ಜಿ.ಶಂ.ಪರಮಶಿವಯ್ಯ
೧೨. ಯಕ್ಷಗಾನ	: ಕೆ.ಶಿವರಾಮಕಾರಂತ
೧೩. ಕನ್ನಡ ಜಾನಪದ ಕಲಾ ಪ್ರವೇಶ	: ಚಕ್ಕರೆ ಶಿವಶಂಕರ
೧೪. The Encyclopedia of folk culture of Karnataka	: Krishna Murthy Hanur

**KNC 210: ಪತ್ರಿಕೆ: ೫.೩ ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ : ಶಾಸನಶಾಸ್ತ್ರ (ಆಯ್ದ ಪಠ್ಯಗಳೊಡನೆ)**

(೩:೧=೪ ಕ್ರೆಡಿಟ್)

- ೧ ಶಾಸನ ಎಂದರೇನು? ಕರ್ನಾಟಕದಲ್ಲಿ ಶಾಸನ ಅಧ್ಯಯನದ ಇತಿಹಾಸ-ಶಾಸನಗಳ ಪ್ರಾಮುಖ್ಯ, ಶಾಸನಗಳ ವರ್ಗೀಕರಣ
- ೨ ಶಾಸನಕವಿ, ಲಿಪಿಕಾರ, ರೂವಾಲಿ-ಶಾಸನಗಳ ವಿಷಯಾನುಪೂರ್ವಿ - ದಾನಶಾಸನ, ಕೂಟಶಾಸನ-ವೀರಗಲ್ಲು, ಮಾಸ್ತಿಗಲ್ಲು, ನಿಷದಿಗಲ್ಲು
- ೩ ಹಲ್ಮಿಡಿ ಶಾಸನ - ಬಾದಾಮಿಯ ಕವ್ವೆ ಅರಭಟ್ಟನ ಶಾಸನ - ಕುರ್ಯಾಲದ ಜಿನವಲ್ಲಭನ ಶಾಸನ ಶಾಸನ
- ೪ ಲಕ್ಷ್ಮಂಡಿಯ ಅತ್ತಿಮಬ್ಬೆ ಶಾಸನ - ಬಳ್ಳಿಗಾವಿಯ ಕೋಡಿಮಠದ ಶಾಸನ- ಶ್ರವಣಬೆಳಗೊಳದ ಬುಕ್ಕರಾಯನ ಶಾಸನ

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು :**

೧ ಶಾಸನ ವ್ಯಾಸಂಗ ೧,೨	: ಎಂ.ಎಂ. ಕಲಬುರ್ಗಿ
೨ ಕನ್ನಡ ಶಾಸನಗಳ ಸಾಂಸ್ಕೃತಿಕ ಅಧ್ಯಯನ	: ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ
೩ ಕರ್ನಾಟಕ ಶಾಸನ ಸಮೀಕ್ಷೆ	: ಕೆ.ವಿ. ರಮೇಶ
೪ ಕನ್ನಡ ಲಿಪಿಯ ಉಗಮ ಮತ್ತು ವಿಕಾಸ	: ಎ.ವಿ. ನರಸಿಂಹಮೂರ್ತಿ
೫ ಕನ್ನಡ ಶಾಸನ ಸಂಗ್ರಹ	: ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು
೬ ಶಾಸನಶಾಸ್ತ್ರ ಪ್ರವೇಶ	: ಸಿಪಿಕೆ
೭ ಭಾರತೀಯ ಶಾಸನಶಾಸ್ತ್ರ ಪರಿಚಯ	: (ಅನು) ಸಿಪಿಕೆ
೮ ಶಾಸನ ಪದ್ಯಮಂಜರಿ (ಪ್ರಸ್ತಾವನೆ)	: (ಸಂ) ಎಂ. ಚಿದಾನಂದಮೂರ್ತಿ

೯ Indian Epigraphy	: D.C. Sircar
೧೦ Indian Epigraphy and South Indian Scripts	: C. Shivaramamurthy
೧೧ Indian Paleography	: Ahmed Hussain Dani
೧೨ The Alphabet	: David Diringer

## ಮುಕ್ತ ಐಚ್ಛಿಕ (Open Elective)

**KNC 530: ಪತ್ರಿಕೆ: ೩.೧ ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ಸಾಹಿತ್ಯ (ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ, ಆಧುನಿಕ)**

( ೩:೧=೪ ಕ್ರೆಡಿಟ್ )

೧. ಪ್ರಾಚೀನ ಸಾಹಿತ್ಯ :

(ಅ) ಕವಿರಾಜಮಾರ್ಗ - ನಾಡು ನುಡಿಯ ವರ್ಣನೆ: ಪ್ರಥಮ ಪರಿಚ್ಛೇದದಲ್ಲಿ ಪದ್ಯ ಸಂಖ್ಯೆ: ೩೬, ೩೭, ೩೮, ೩೯, ೪೦.

ಮೂರನೆಯ ಪರಿಚ್ಛೇದದಲ್ಲಿ: ೧೭೪, ೧೭೬, ೧೭೭, ೧೭೯ನೇ ಪದ್ಯ, (ಸಂ): ಎಂ.ವಿ.ಸೀತಾರಾಮಯ್ಯ

(ಆ) ಪಂಪಭಾರತ: ಭೀಷ್ಮರ ಪಟ್ಟಾಭಿಷೇಕ ಪ್ರಸಂಗ - ವಿಕ್ರಮಾರ್ಜುನ ವಿಜಯ: (ಸಂ) ಟಿ.ವಿ.

ವೆಂಕಟಾಚಲಶಾಸ್ತ್ರೀ: ದಶಮಾಶ್ವಾಸಂ ಭಾಗದಲ್ಲಿ ಪದ್ಯ ಸಂಖ್ಯೆ ೧೫ ರಿಂದ ೨೫ರವರೆಗೆ

(ಇ) ಗದಾಯುದ್ಧ: ದುರ್ಯೋಧನನ ವಿಲಾಪಂ ಭಾಗ. ರನ್ನ ಗದಾಯುದ್ಧ ಸಂಗ್ರಹಂ, ಸಂ: ತೀನಂಶ್ರೀ

೨. ಮಧ್ಯಕಾಲೀನ ಸಾಹಿತ್ಯ -೧ :

(ಅ) ಬಸವಣ್ಣನವರ ವಚನ ಸಂಪುಟ (ಸಂ) ಎಂ.ಎಂ.ಕಲಬುರ್ಗಿ

ವಚನಗಳ ಸಂಖ್ಯೆ: ೧೦೫, ೧೫೮, ೧೯೪, ೨೩೫, ೨೪೧, ೩೪೫, ೪೪೭, ೬೩೮, ೮೨೧, ೫೮೦

(ಆ) ಅಕ್ಕಮಹಾದೇವಿ:ಶಿವಶರಣೆಯರ ವಚನ ಸಂಪುಟ (ಸಂ) ವೀರಣ್ಣ ರಾಜೂರ

ವಚನಗಳ ಸಂಖ್ಯೆ: ೭೮, ೧೪೩, ೧೯೬, ೧೯೭, ೨೦೬, ೨೧೧, ೨೬೮, ೩೬೪, ೩೬೫, ೪೧೩

೩. ಮಧ್ಯಕಾಲೀನ ಸಾಹಿತ್ಯ -೨ :

(ಅ) ಸರ್ವಜ್ಞ: ಸರ್ವಜ್ಞನ ವಚನಗಳು-(ಸಂ) ಉತ್ತಂಗಿ ಚೆನ್ನಪ್ಪ

ವಚನಗಳ ಸಂಖ್ಯೆ: : ೫೩೧, ೫೩೪, ೫೪೫, ೫೬೩, ೮೯೩, ೧೨೩೯, ೧೧೪೫, ೧೧೪೮, ೧೧೫೫, ೧೨೭೫

(ಆ) ಕೀರ್ತನೆಗಳು :

ಪುರಂದರದಾಸ: ಧರ್ಮವೇ ಜಯವೆಂಬ ದಿವ್ಯಮಂತ್ರ

ಕನಕದಾಸ: ಕುಲಕುಲ ಕುಲವೆಂದು ಹೊಡೆದಾಡದಿರಿ

೪. ಆಧುನಿಕ ಸಾಹಿತ್ಯ :

(ಅ) ಕಾವ್ಯಗಳು : ಕುವೆಂಪು - ಅಖಂಡ ಕರ್ನಾಟಕ

ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ - ಮುಬ್ಬಿನಿಂದ ಮುಬ್ಬಿಗೆ

(ಆ) ಆಧುನಿಕ ಕತೆಗಳು : ಬಸವರಾಜ ಕಟ್ಟೀಮನಿ - ಗಿರಿಜಾ ಕಂಡ ಸಿನಿಮಾ

ಸಾ.ರಾ ಅಬೂಬಕ್ಕರ್ - ಚಪ್ಪಲಿಗಳು

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು :**

೧. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ರಂ.ಶ್ರೀ. ಮುಗಳಿ
  ೨. ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯದ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು
  ೩. ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಸಂಪುಟಗಳು : ಬೆಂಗಳೂರು ವಿ.ವಿ
  ೪. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ಕೆ.ವೆಂಕಟರಾಮಪ್ಪ
  ೫. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ : ತ.ಸು. ಶಾಮರಾಯ
  ೬. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಇತಿಹಾಸ : ರಂ.ಶ್ರೀ. ಮುಗಳಿ
-

ನಾಲ್ಕನೆಯ ಚತುರ್ಮಾಸ (ಜನವರಿ-ಮೇ ೨೦೨೨)

**ಪ್ರಧಾನ ವಿಷಯಗಳು (Hard core)**

**KND 050: ಪತ್ರಿಕೆ: ೧**

**ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಪಠ್ಯ : ಕಾವ್ಯ ಮತ್ತು ಕಾದಂಬರಿ (೨:೧=೩ ಕ್ರೆಡಿಟ್)**

**ಕಾವ್ಯ: ೧೨ ನಿಗದಿತ ಕವನಗಳು**

೧. ಶಿಶುನಾಳ ಶರೀಫ	:	ಗಿರಣಿ
೨. ದ.ರಾ.ಬೇಂದ್ರೆ	:	ನರಬಲಿ
೩. ಕುವೆಂಪು	:	ಕಲ್ಪಿ
೪. ಕೆ.ಎಸ್.ಎನ್	:	ಬಳೆಗಾರನ ಹಾಡು
೫. ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ	:	ಕಟ್ಟುವೆವು ನಾವು
೬. ಜಿ.ಎಸ್.ಎನ್	:	ಸಂಜೆದಾರಿ
೭. ಕೆ.ಎಸ್.ನಿಸಾರ ಅಹಮದ್	:	ಕುರಿಗಳು ಸಾರ್ ಕುರಿಗಳು
೮. ರಂಜನ್ ದರ್ಗಾ	:	ಪ್ರಣಾಳಿಕೆ
೯. ಸಿದ್ದಲಿಂಗಯ್ಯ	:	ಸುಂಟರಗಾಳಿ
೧೦. ಶಶಿಕಲಾ ವಸ್ತದ	:	ಗುಬ್ಬೀಮನಿ
೧೧. ಪ್ರತಿಭಾ ನಂದಕುಮಾರ	:	ನಾವು ಹುಡುಗಿಯರೇ ಹೀಗೆ
೧೨. ಉಷಾ	:	ಹವಳ ಹಾರಿದ ಹೊತ್ತು
<b>ಕಾದಂಬರಿ : ಪಠ್ಯ</b>	:	<b>ಸಂಸ್ಕಾರ : ಯು.ಆರ್. ಅನಂತಮೂರ್ತಿ</b>

**ಪಠ್ಯ ಮೂಲ : (ಕವಿತೆಗಳು)**

೧. ಶಿಶುನಾಳ ಶರೀಫರ ಗೀತೆಗಳು : ಸಂ.ಡಾ. ಶಿವಾನಂದ ಗುಬ್ಬಣ್ಣನವರ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂ: ೧೯೮೫
೨. ಶತಮಾನಗಳ ಬಾಯಾರಿಕೆ : ಸಂ.ಬಿ.ಶ್ರೀನಿವಾಸರಾಜು ಇತರರು, ನವಕರ್ನಾಟಕ ಪ್ರಕಾಶನ ಬೆಂ: ೧೯೮೬
೩. ಕುವೆಂಪು ಸಮಗ್ರ ಕಾವ್ಯ ಸಂಪುಟ-೧ : ರಾಷ್ಟ್ರಕವಿ ಕುವೆಂಪು ಪ್ರತಿಷ್ಠಾನ (ರಿ), ಕುಪ್ಪಳಿ, ೨೦೧೩
೪. ಬೆಳೆಗೆರೆ ಜಾನಕಮ್ಮ ಬದುಕು-ಬರಹ : ಸಂ.ನೇಮಿಚಂದ್ರ, ಕರ್ನಾಟಕ ಲೇಖಕಿಯರ ಸಂಘ, ಬೆಂಗಳೂರು : ೧೯೮೮
೫. ಮಲ್ಲಿಗೆಯ ಮಾಲೆ :
೬. ಹೊಸಗನ್ನಡ ಕವಿತೆ : ಸಂ.ಬಿ.ಎಚ್.ನಾಯಕ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು : ೧೯೮೫
೭. ಅದೇ
೮. ಸುವರ್ಣ ಕಾವ್ಯ : ಸಂ ಬಿ.ಎ. ಸನದಿ, ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂ: ೨೦೦೬
೯. ಬಂಡಾಯ ಕಾವ್ಯ : ಸಂ.ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂ : ೧೯೯೦
೧೦. ಸುವರ್ಣ ಕಾವ್ಯ : ಸಂ ಬಿ.ಎ. ಸನದಿ, ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಇಲಾಖೆ, ಬೆಂ: ೨೦೦೬
೧೧. ಹೊಸಗನ್ನಡ ಕವಿತೆ : ಸಂ.ಬಿ.ಎಚ್.ನಾಯಕ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು: ೧೯೮೫

೧೨. ಬಿಡುಗಡೆಯ ಬೆಳಕು :ಸಂ.ಜಿ.ಶ್ರೀನಿವಾಸರಾಜು ಇತರರು, ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿ, ಬೆಂ.೨೦೧೨

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

೧. ೨೦ನೇ ಶತಮಾನದ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಘಟ್ಟಗಳು : ಡಾ. ಬಸವರಾಜ ಸಾದರ
೨. ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿಯ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪುನರ್ ಮೌಲ್ಯೀಕರಣ ಮಾಲೆಯ ಸಂಪುಟಗಳು
೩. ಹಾಡೇ ಹಾದಿಯ ತೋರಿತು : ಎಚ್.ಎಸ್.ರಾಘವೇಂದ್ರರಾವ್
೪. ಇಹದ ಪರಿಮಳದ ಹಾದಿ : ನರಹಳ್ಳಿ ಬಾಲಸುಬ್ರಹ್ಮಣ್ಯಂ
೫. ಗಂಗೋತ್ರಿ : ಕುವೆಂಪು ಅಭಿನಂದನ ಗ್ರಂಥ
೬. ಶ್ರೀ ಕುವೆಂಪು : ಸಂ: ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
೭. ಕುವೆಂಪು ಕೃತಿ ವಿಮರ್ಶೆ : ಸಂ:ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು
೮. ಸಾಹಿತ್ಯ ಮತ್ತು ಯುಗಧರ್ಮ : ಕೀರ್ತಿನಾಥ ಕುರ್ತಕೋಟಿ
೯. ಹೊಸಗನ್ನಡ ಕಾವ್ಯದ ಎರಡು ಮಾರ್ಗಗಳು :ಸಂ.ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ

**KND \_\_\_\_\_ ಪತ್ರಿಕೆ: ೨ ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ (೨:೧=೩ ಕ್ರೆಡಿಟ್)**

- |                      |                                |
|----------------------|--------------------------------|
| ೧. ಅರಿಸ್ತಾಟಲ್        | : ಕಾವ್ಯಮೀಮಾಂಸೆ                 |
| ಹೊರೇಸ್               | : ಕಾವ್ಯಕಲೆ                     |
| ಲಾಂಜಿನಸ್             | : ಔನ್ನತ್ಯ ವಿಚಾರ ಚರ್ಚೆ          |
| ೨. ಬೆನೆಡಿಕ್ಟೊ ಕ್ರೋಚೆ | : ಅಭಿವ್ಯಕ್ತಿವಾದ                |
| ಎಡ್ವರ್ಡ್ ಬುಲ್ಲೋ      | : ಮಾನಸಿಕ ದೂರ                   |
| ೩. ಟಿ.ಎಸ್. ಎಲಿಯಟ್    | : ಪರಂಪರೆ ಮತ್ತು ವ್ಯಕ್ತಿ ಪ್ರತಿಭೆ |
| ಐ.ಎ. ರಿಚರ್ಡ್ಸ್       | : ಮೌಲ್ಯ ಸಿದ್ಧಾಂತ               |
| ೪. ಜೊನಾಥನ್ ಕಲರ್      | : ರಚನಾವಾದ ಮತ್ತು ಕಾವ್ಯಮೀಮಾಂಸೆ   |
| ಎಲೇನ್ ಶೋವಾಲ್ಡರ್      | : ಸ್ತ್ರೀನಿಷ್ಠ ಕಾವ್ಯಮೀಮಾಂಸೆ     |

**ಪರಾಮರ್ಶನ ಕೃತಿಗಳು:**

೧. ಅರಿಸ್ತಾಟಲನ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಎನ್. ಬಾಲಸುಬ್ರಹ್ಮಣ್ಯ
೨. ಹೊರೇಸನ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಎನ್. ಬಾಲಸುಬ್ರಹ್ಮಣ್ಯ
೩. ಔನ್ನತ್ಯ ವಿಚಾರ ಚರ್ಚೆ : ಎನ್.ಬಾಲಸುಬ್ರಹ್ಮಣ್ಯ
೪. ತೌಲನಿಕ ಕಾವ್ಯಮೀಮಾಂಸೆ : ಎಚ್.ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
೫. ಪಾಶ್ಚಾತ್ಯ ಕಾವ್ಯಮೀಮಾಂಸೆ : ವಿ.ಎಂ.ಇನಾಂದಾರ್
೬. ಇಂಗ್ಲಿಷ್ ಭಾಷೆಯಲ್ಲಿ ಆಧುನಿಕ ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಎಲ್.ಎಸ್.ಶೇಷಗಿರಿರಾವ್
೭. ಕಾವ್ಯಾರ್ಥ ಚಿಂತನೆ : ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
೮. ಸಾಹಿತ್ಯ ವಿಮರ್ಶೆ : ಸಿ.ಎನ್.ರಾಮಚಂದ್ರನ್
೯. ಟಿ.ಎಸ್. ಎಲಿಯಟ್ ಕವಿಯ ವಿಮರ್ಶೆಯ ವಿಚಾರಗಳು : ಎಚ್.ಬಿ. ಮಿಣಜಗಿ
೧೦. Structuralist Poetics : Jonathan Culler

೦೦. On Deconstruction	: Jonathan Culler
೦೧. The Pursuit of Signs	: Jonathan Culler
೦೨. Linguistics and Poetics	: Roman Jakobson
೦೪. Principles of Literary Criticism	: I A Richards

### KND 040: ಪತ್ರಿಕೆ : ೩ ಸಮೂಹ ಮಾಧ್ಯಮ (೨:೦=೩ ಕ್ರೆಡಿಟ್)

೦. (ಅ) ಸಮೂಹ ಮಾಧ್ಯಮದ ಅರ್ಥ, ವ್ಯಾಖ್ಯೆ, ಮಹತ್ವ  
(ಆ) ಜಾನಪದ ಮತ್ತು ಆಧುನಿಕ ಸಮೂಹ ಮಾಧ್ಯಮಗಳು  
(ಇ) ಅಭಿವೃದ್ಧಿ, ಸಾಮಾಜಿಕ ಬದಲಾವಣೆ ಮತ್ತು ಸಮೂಹ ಮಾಧ್ಯಮ
೧. (ಅ) ಪುಸ್ತಕದ ಹುಟ್ಟು ಮತ್ತು ಬೆಳವಣಿಗೆ: ಮುದ್ರಣದ ಹಿನ್ನೆಲೆ ಮತ್ತು ವಿಕಾಸ, ಪ್ರಕಾಶನ ಮತ್ತು ಮಾರಾಟ  
(ಆ) ಪತ್ರಿಕೆ ಹುಟ್ಟು ಮತ್ತು ಬೆಳವಣಿಗೆ, ಪತ್ರಿಕೆಗಳ ಸ್ವರೂಪ, ಮಹತ್ವ, ಪ್ರಕಾರಗಳು, ವರದಿ, ಸಂಪಾದಕೀಯ, ಅಂಕಣ ಬರೆಹ, ಪುರವಣಿ, ಜಾಹೀರಾತು. ಸಾಹಿತ್ಯಿಕ ಪತ್ರಿಕೆಗಳು  
(ಇ) ಆಕಾಶವಾಣಿ- ಹುಟ್ಟು ಮತ್ತು ಬೆಳವಣಿಗೆ, ಧ್ವನಿ, ಉಚ್ಚಾರಣೆ, ಸ್ಪಷ್ಟತೆ, ಸಂಗೀತ
೨. (ಅ) ದೂರದರ್ಶನ - ಹುಟ್ಟು ಮತ್ತು ಬೆಳವಣಿಗೆ, ನಿರೂಪಣೆ, ಧ್ವನಿ, ಉಚ್ಚಾರಣೆ, ಕಾರ್ಯಕ್ರಮ ಸಂಯೋಜನೆ, ಉಡುಪು ಮತ್ತು ವಿನ್ಯಾಸ, ಸಾಹಿತ್ಯ- ಸಂಗೀತ ಮತ್ತು ವಿವಿಧ ಕಾರ್ಯಕ್ರಮಗಳ ಸ್ವರೂಪ.  
(ಆ) ಚಲನಚಿತ್ರ : ಹುಟ್ಟು ಮತ್ತು ಬೆಳವಣಿಗೆ, ನಿರ್ಮಾಣದ ಕಲೆ, ಸಾಹಿತ್ಯ- ಸಂಗೀತ, ಸಂಪಾದನೆ  
(ಇ) ಸಾಮಾಜಿಕ ಜಾಲತಾಣಗಳು ಮತ್ತು ಸಮೂಹ ಮಾಧ್ಯಮ; ಫೇಸ್‌ಬುಕ್, ವಾಟ್‌ಸಾಪ್, ಟೆಲಿಗ್ರಾಮ್, ಇನ್ಸ್ಟಾಗ್ರಾಮ್, ಟ್ವಿಟರ್, ಕ್ಲಬ್‌ಹೌಸ್
೪. ಮುದ್ರಣಾಲಯಕ್ಕೆ ಭೇಟಿ ನೀಡಿ ವರದಿ ತಯಾರಿಸುವುದು; ಆಕಾಶವಾಣಿ ಕಾರ್ಯಕ್ರಮಗಳ ಅವಲೋಕನ ಮತ್ತು ವರದಿ; ಪುಸ್ತಕ ಪ್ರಕಾಶನ ಸಂಸ್ಥೆಗೆ ಭೇಟಿ ಮತ್ತು ಮುದ್ರಣ ಕಾರ್ಯದ ಬಗ್ಗೆ ವರದಿ; ನಿಯತಕಾಲಿಕ ಮತ್ತು ದಿನಪತ್ರಿಕೆಗಳಲ್ಲಿ ಬರೆಹಗಳ ಪ್ರಕಟಣೆ; ದೂರದರ್ಶನ ವೀಕ್ಷಣೆ, ಕಾರ್ಯಕ್ರಮಗಳ ಸ್ವರೂಪದ ಅವಲೋಕನ ಮತ್ತು ವರದಿ ತಯಾರಿಕೆ; ಚಲನಚಿತ್ರಗಳ ವೀಕ್ಷಣೆ ಮತ್ತು ವಿಮರ್ಶೆ.

#### ಪರಾಮರ್ಶನ ಕೃತಿಗಳು

೦. ಪತ್ರಿಕೆ/ ಸಾಹಿತ್ಯ : ಸರಜೂ ಕಾಟ್ಕರ್, ಅನ್ವೇಷಣೆ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು
೧. ಭಾರತೀಯ ಪತ್ರಿಕೋದ್ಯಮ : ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ, ಪ್ರಸಾರಾಂಗ, ಬೆಂಗಳೂರು
೨. ಆಧುನಿಕ ಭಾರತದಲ್ಲಿ ಪತ್ರಿಕೋದ್ಯಮ : ರೋಲೆಂಡ್ ಇ ಉಲ್‌ಸ್ಟೀ (ಮೂಲ) ಶ್ರೀಕರ ಎಲ್. ಭಂಡಾರ್‌ಕರ್ (ಅನುವಾದ) ಪ್ರಸಾರಾಂಗ. ಮೈಸೂರು ವಿ.ವಿ
೪. ಭಾರತದಲ್ಲಿ ಪುಸ್ತಕಗಳ ಬೆಳವಣಿಗೆ : ಅಬ್ದುಲ್ ಹಸನ್ (ಮೂಲ) ಜಿ.ಪಿ. ಶಿವರಾಂ (ಅನುವಾದ), ಮೈ.ವಿ.ವಿ
೫. ಪ್ರಾಯೋಗಿಕ ಪತ್ರಿಕೋದ್ಯಮ : (ಸಂ) ಬಿ.ವಿ. ವೈಕುಂಠರಾಜು, ಬೆಂಗಳೂರು ವಿ.ವಿ
೬. ಸಮೂಹ ಮಾಧ್ಯಮಗಳು : ಡಿ.ಬಿ. ನಾಯಕ, ಗುಲಬರ್ಗಾ ವಿ.ವಿ
೭. ಬ್ರಿಟಿಷ್ ಪತ್ರಿಕೋದ್ಯಮ : ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ, ಮೈವಿವಿ
೮. ಫೀಲಾನ್ಸ್ ಪತ್ರಿಕೋದ್ಯಮ : ನಿರಂಜನ ವಾನಳ್ಳಿ, ಮೈವಿವಿ

೯. ಸಮೂಹ ಮಾಧ್ಯಮಗಳು ಮತ್ತು ರಾಷ್ಟ್ರೀಯ ಅಭಿವೃದ್ಧಿ : ಎ.ಎಸ್. ಬಾಲಸುಬ್ರಹ್ಮಣ್ಯ, ಕರ್ನಾಟಕ ವಿವಿ	
೧೦. ಪತ್ರಿಕೋದ್ಯಮ	: ಎಂ.ಚಲಪತಿರಾವ್ (ಮೂಲ) ನಾಡಿಗ ಕೃಷ್ಣಮೂರ್ತಿ (ಅನು)
೧೧. ಗ್ರಂಥೋದ್ಯಮ	: ಸಂ.ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಪ್ರಸಾರಾಂಗ, ಮೈವಿವಿ
೧೨. ಕನ್ನಡ ಪತ್ರಿಕಾಸೂಚಿ	: ಸಂ.ಶ್ರೀನಿವಾಸ ಹಾವನೂರ, ಪ್ರಸಾರಾಂಗ ಮೈವಿವಿ
೧೩. ಜಾನಪದ ಮತ್ತು ಸಮೂಹ ಮಾಧ್ಯಮ	: ಕರ್ನಾಟಕ ಜಾನಪದ ಯಕ್ಷಗಾನ ಅಕಾಡೆಮಿ, ಬೆಂಗಳೂರು
೧೪. ಸಂವಹನ ಮಾಧ್ಯಮ	: ಎಸ್.ಎಂ.ಹಿರೇಮಠ ಮತ್ತು ಡಿ.ಬಿ. ನಾಯಕ
೧೫. ಕರ್ನಾಟಕ ಸಂಗಾತಿ	: ಕನ್ನಡ ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ ಪ್ರಕಟಣೆ

**KND 040 : ಪತ್ರಿಕೆ:೪ : ಅವಧಿಕ ಕಾರ್ಯ / ಮೈನರ್ ಪ್ರಾಜೆಕ್ಟ್ (೧:೨=೩ ಕ್ರೆಡಿಟ್)**

ಕ್ಷೇತ್ರಕಾರ್ಯ, ಮಾಹಿತಿ ಸಂಗ್ರಹ ಮತ್ತು ವರದಿ

ಘಟಕ ೧: ಅ) ಅವಧಿಕ ಪ್ರಗತಿ ಮತ್ತು ವರದಿ  
ಆ) ವಿಚಾರಗೋಷ್ಠಿ / ಚರ್ಚೆ/ ಪ್ರದರ್ಶನ

ಘಟಕ ೨ ಅ) ಕರಡು ವರದಿ  
ಆ) ಫಲಿತಾಂಶಗಳು ಹಾಗೂ ಅಂತಿಮ ವರದಿ

ಘಟಕ ೩: ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದಲ್ಲಿ ವರದಿಯ ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ಒಬ್ಬ ಆಂತರಿಕ ಹಾಗೂ ಒಬ್ಬ ಬಾಹ್ಯ ಪರೀಕ್ಷಕರನ್ನೊಳಗೊಂಡಂತೆ ಸಮಿತಿ ನಡೆಸುತ್ತದೆ - ೭೦ ಅಂಕಗಳಿಗೆ

**ಉಪಪ್ರಧಾನ ವಿಷಯಗಳು (Soft core)**

**KND 210: ಪತ್ರಿಕೆ:**

**೫.೧ ಭಾಷಾವಿಜ್ಞಾನ ಅಧ್ಯಯನ : ಕನ್ನಡ ಭಾಷಾಸ್ವರೂಪ : ಆಯ್ದು ಪಠ್ಯಗಳು**  
(೩:೧=೪ ಕ್ರೆಡಿಟ್)

೧. ಶಂ.ಬಾ.ಜೋಷಿ	: ಕಂನುಡಿಯ ಒಳ್ಳಂಪು
೨. ಎ.ಆರ್.ಕೃಷ್ಣಶಾಸ್ತ್ರಿ	: ಇಂದಿನ ಜನಜೀವನದಲ್ಲಿ ಕನ್ನಡ
೩. ಡಿ.ಎಲ್.ಎನ್	: ಪದಗಳ ಹುಟ್ಟು ನಾವು
೪. ಕುವೆಂಪು	: ಸಂಸ್ಕೃತಿ ಕರ್ನಾಟಕ
೫. ಜಿ.ಎಸ್.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ	: ಕನ್ನಡ ನಾಹಿತಿ ಮತ್ತು ಕನ್ನಡ
೬. ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ	: ಇಗೋ ಕನ್ನಡ
೭. ಯು.ಆರ್.ಅನಂತಮೂರ್ತಿ	: ಕನ್ನಡದ ಮೂರು ಹಸಿವುಗಳು
೮. ಕೆ.ವಿ.ನಾರಾಯಣ	: ತಂತ್ರಜ್ಞಾನ ಮತ್ತು ಕನ್ನಡ
೯. ಕೆ.ವಿ. ತಿರುಮಲೇಶ್	: ಕನ್ನಡತನ ನನ್ನ ದೃಷ್ಟಿಯಲ್ಲಿ
೧೦.ಬರಗೂರು ರಾಮಚಂದ್ರಪ್ಪ	: ಕನ್ನಡಾಭಿಮಾನ

**ಪಠ್ಯ ಮೂಲ :**

೧. ಶಂ.ಬಾ.ಜೋಷಿ	: ಕಂನುಡಿಯ ಹುಟ್ಟು, ಸಮಾಜ ಪುಸ್ತಕಾಲಯ, ಧಾರವಾಡ :೧೯೪೫
೨. ಎ.ಎರ್.ಕೃಷ್ಣಶಾಸ್ತ್ರಿ	: ಭಾಷಣಗಳು ಲೇಖನಗಳು, ಶಾರದಾ ಮಂದಿರ, ಮೈಸೂರು
೩. ಡಿಎಲ್‌ಎನ್	: ಪೀಠಿಕೆಗಳು ಲೇಖನಗಳು
೪. (ಸಂ) ಶಿವಾರೆಡ್ಡಿ	: ಕುವೆಂಪು ಸಮಗ್ರ ಗದ್ಯ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ
೫. ಸಂ.ರಹಮತ್ ತರೀಕೆರೆ	: ಮಾತು ತಲೆಯೆತ್ತುವ ಬಗೆ, ಸಂಪುಟಗಳು ೧, ಕವಿವಿ, ಹಂಪಿ ೨೦೧೧
೬. ಸಂ. ಎನ್.ಎಸ್. ತಾರಾನಾಥ	: ಶತಮಾನದ ಸಂಶೋಧನೆ, ಕರ್ನಾಟಕ ಸಾಹಿತ್ಯ ಅಕಾಡೆಮಿ, ಬೆಂ
೭. ಯು.ಆರ್. ಅನಂತಮೂರ್ತಿ	: ವಾಲ್ಮೀಕಿಯ ನೆಪದಲ್ಲಿ
೮. ಕೆ.ವಿ. ನಾರಾಯಣ	: ಕನ್ನಡ ಜಗತ್ತು :ಅರ್ಥಶತಮಾನ, ಕನ್ನಡ ವಿವಿ
೯. ಕೆ.ವಿ. ತಿರುಮಲೇಶ್	: ನಮ್ಮ ಕನ್ನಡ
೧೦. ಹೆಚ್.ಎಸ್.ಬಿಳಿಗಿರಿ	: ಮೂರು ದತ್ತಿ ಉಪನ್ಯಾಸಗಳು

**KND 210: ಪತ್ರಿಕೆ : ೫.೨**

**ಜಾನಪದ ಅಧ್ಯಯನ : ಕನ್ನಡದ ಜನಪದ ಸಾಹಿತ್ಯ (ಆಯ್ದ ಪಠ್ಯಗಳು)**

**(೩:೧=೪ ಕ್ರೆಡಿಟ್)**

೧. ತಾತ್ವಿಕ : ಜಾನಪದ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳ ಕುರಿತು ಈವರೆಗೆ ನಡೆದ ಅಧ್ಯಯನದ ಸ್ವರೂಪ, ಪ್ರತಿಯೊಂದು ಸಾಹಿತ್ಯ ಪ್ರಕಾರದಲ್ಲಿ ಅಧ್ಯಯನ ಮಾಡಿದ ಪ್ರಮುಖ ವಿದ್ವಾಂಸರ ಪರಿಚಯ

**ಪಠ್ಯಗಳು:**

೧. ಅ) ಕನ್ನಡ ಜನಪದ ಕತೆಗಳು : ಜಿ.ಶಂ.. ಪರಮಶಿವಯ್ಯ (ಪ್ರತಿ ಗುಂಪಿನ ಮೊದಲ ಎರಡು ಕತೆಗಳು)
  - ಆ) ಗರತಿಯ ಹಾಡು : ಹಲಸಂಗಿ ಗೆಳೆಯರು
೨. ಅ) ಗರಿಗದರಿದ ನವಿಲು : (ಸಂ) ಕಾಳೇಗೌಡ ನಾಗವಾರ - ಜಿ.ವಿ. ಆನಂದಮೂರ್ತಿ
  - ನಿಗದಿತ ಭಾಗ ಪುಟ ೧ ರಿಂದ ೧೦೭ ಮತ್ತು ೨೫೧ ರಿಂದ ೩೦೦ ರವರೆಗೆ)
೪. ಅ) ನಮ್ಮ ಸುತ್ತಿನ ಗಾದೆಗಳು : ಸುಧಾಕರ
  - ಆ) ಸಾವಿರದ ಒಗಟುಗಳು : ಸೋಮಶೇಖರ ಇಮ್ಮಾಪುರ

**KND 210 : ಪತ್ರಿಕೆ:೫.೩ ಚಾರಿತ್ರಿಕ ಅಧ್ಯಯನ: ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ: ಆಯ್ದ ಪಠ್ಯಗಳು**

೧. ಕವಿರಾಜಮಾರ್ಗಂ : ನಾಡು-ನುಡಿ ವರ್ಣನೆ
  - (ಆಶ್ವಾಸ-೧, ಪಠ್ಯಗಳು ೧ ರಿಂದ ೪೩, ಆಶ್ವಾಸ -೨೨ ಪಠ್ಯ ೨೮)
೨. ವಡ್ಡಾರಾಧನೆ : ಭದ್ರಬಾಹು ಭಟಾರರ ಕಥೆ
೩. ಅಜಿತಪುರಾಣ : ಅತ್ತಿಮಬ್ಬ ವೃತ್ತಾಂತ



(ಆಶ್ವಾಸ-೧, ಪದ್ಯಗಳು ೨೦ ರಿಂದ ೭೫)

೪. ಬಸವಣ್ಣನವರ ನಿಗದಿತ ೧೨ ವಚನಗಳು

೧. ಸಗಣಿಯ ಬೆನಕನ ಮಾಡಿ
೨. ಲೋಕದ ಡೊಂಕ ನೀವೇಕೆ
೩. ಹಬ್ಬಕ್ಕೆ ತಂದ ಹರಕೆಯ ಕುರಿ
೪. ಹಾವು ತಿಂದವರ ನುಡಿಸಬಹುದು
೫. ದೇವಲೋಕ ಮರ್ತ್ಯಲೋಕವೆಂಬುದು
೬. ಮರ್ತ್ಯಲೋಕವೆಂಬುದು ಕರ್ತಾರನ ಕಮ್ಮಟವಯ್ಯ
೭. ವ್ಯಾಧನೊಂದು ಮೊಲನ ತಂದರೆ
೮. ಕಲ್ಲನಾಗರ
೯. ವೇದಕ್ಕೆ ಒರೆಯನಿಕ್ಕುವೆ
೧೦. ಅಪ್ಪನು ಡೋಹರ ಕಕ್ಕಯ್ಯ
೧೧. ಉತ್ತಮ ಕುಲದಲಿ ಹುಟ್ಟಿದನೆಂಬ
೧೨. ಅರಸರ ಮನೆಯಲ್ಲಿ ಅರಸಿಯಾಗಿಪ್ಪುದರಿಂದ

೧. ಕೇಶಿರಾಜ ದಣ್ಣಾಯಕರ ರಗಳೆ (ಹರಿಹರ)

೨. ಸಿದ್ಧರಾಮ ಚಾರಿತ್ರ್ಯ : ನಾಲ್ಕನೆಯ ಸಂಧಿ

೩. ಬಸವಪುರಾಣ : ಸುಗ್ಗಲದೇವಿ ಹಾಗೂ ದಾಸಿಮಯ್ಯನ ಕತೆ (ಸಂಧಿ ೫೧)

೪ ರಾಮಧಾನ್ಯ ಚರಿತೆ : ಕನಕದಾಸ

೫. ರಾಮನಾಥ ಚರಿತೆ : ಶೂಲದಹಬ್ಬ (ಆಶ್ವಾಸ ೬, ಸಂಧಿ ೨, ಪದ್ಯ ೧ ರಿಂದ ೧೦೪)

೬. ರಾಜಾವಳಿ ಕಥಾಸಾರ : ನವಮಾಧಿಕಾರ

೭. ಪ್ಲೀಟರು ಸಂಗ್ರಹಿಸಿದ ಐದು ಐತಿಹಾಸಿಕ ಲಾವಣಿಗಳು : ಹಲಗಲಿಯ ಬೇಡರು

೮. ಕೈಫಿಯತ್ತು : ಉಪ್ಪಲಿ ಬಣಜಿಗರ ಕೈಫಿಯತ್ತು

**ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ: (೩೦ ಅಂಕಗಳು)**

ಪ್ರತಿ ಚತುರ್ಮಾಸ ವಿದ್ಯಾರ್ಥಿಗಳ ಇಡೀ ತಂಡಕ್ಕೆ ಒಂದೇ ರೀತಿಯ ಮೌಲ್ಯಮಾಪನ ಚಟುವಟಿಕೆಗಳು ಮತ್ತು ಮಾನದಂಡಗಳನ್ನು ಅನುಸರಿಸಬೇಕು

ಟೆಸ್ಟ್	ಅವಧಿ	ಅಂಕಗಳು
ಟೆಸ್ಟ್-1	ಪ್ರತಿ ಚತುರ್ಮಾಸ 2ನೆ ತಿಂಗಳ ಅಂತ್ಯದಲ್ಲಿ (ಒಂದು ಗಂಟೆ)	10
ಟೆಸ್ಟ್-2	ಪ್ರತಿ ಚತುರ್ಮಾಸ 4ನೆ ತಿಂಗಳ ಅಂತ್ಯದಲ್ಲಿ (ಒಂದು ಗಂಟೆ)	10
	ಪ್ರತಿ ಚತುರ್ಮಾಸ ಆರಂಭದ ಎರಡು ತಿಂಗಳ ಅವಿರತ ಮೌಲ್ಯಮಾಪನ (ಟ್ಯುಟೋರಿಯಲ್)	05
	ಪ್ರತಿ ಚತುರ್ಮಾಸ ಅಂತಿಮ ಎರಡು ತಿಂಗಳ ಅವಿರತ ಮೌಲ್ಯಮಾಪನ (ಟ್ಯುಟೋರಿಯಲ್)	05
	<b>ಒಟ್ಟು</b>	<b>30</b>

3. ವಿಚಾರಗೋಷ್ಠಿ / ಚರ್ಚಾಗೋಷ್ಠಿ / ಪ್ರದರ್ಶನ - ಇಂತಹ ಸದೃಶ ಚಟುವಟಿಕೆಗಳು

ವಿಷಯ ಸಂಗ್ರಹಣೆ, ಪ್ರಬಂಧ ರಚನೆ, ಮಂಡನೆ ಮತ್ತು ಚರ್ಚೆಯಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆ - ಗರಿಷ್ಠ 5 ಅಂಕಗಳು

1. ಮೌಲ್ಯಮಾಪನ ಘಟಕ : 3 : ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ಮೂರು ಗಂಟೆ ಅವಧಿಯ ಗರಿಷ್ಠ 70 ಅಂಕಗಳ ಪರೀಕ್ಷೆ ನಡೆಸುತ್ತದೆ.

2. ಅ) ಅವಧಿಕ ಕಾರ್ಯ / ಮೈನರ್ ಪ್ರಾಜೆಕ್ಟ್ (4 ಕ್ರೆಡಿಟ್ ಗಳು) ಮೌಲ್ಯಮಾಪನ ಕ್ಷೇತ್ರಕಾರ್ಯ, ಮಾಹಿತಿ ಸಂಗ್ರಹಣೆ ಮತ್ತು ವರದಿ

ಘಟಕ 1: ಅ) ಅವಧಿಕ ಪ್ರಗತಿ ಮತ್ತು ವರದಿ - 7.5 ಅಂಕಗಳು  
ಆ) ವಿಚಾರಗೋಷ್ಠಿ / ಚರ್ಚೆ / ಪ್ರದರ್ಶನ - 7.5 ಅಂಕಗಳು

ಘಟಕ 2: ಅ) ಕರಡು ವರದಿ - 7.5 ಅಂಕಗಳು  
ಆ) ಫಲಿತಾಂಶಗಳು ಹಾಗೂ ಅಂತಿಮ ವರದಿ - 7.5 ಅಂಕಗಳು

ಘಟಕ 3: ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ವರದಿಯ ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ಒಬ್ಬ ಆಂತರಿಕ ಹಾಗೂ ಒಬ್ಬ ಬಾಹ್ಯ ಪರೀಕ್ಷಕರನ್ನೊಳಗೊಂಡಂತೆ ಸಮಿತಿ ನಡೆಸುತ್ತದೆ-70 ಅಂಕಗಳಿಗೆ

ಘಟಕ 4: ವಿದ್ಯಾರ್ಥಿಯು ಮೂರನೆಯ ಚತುರ್ಮಾಸದಲ್ಲಿ ವಿಭಾಗದ ಅಧ್ಯಾಪಕರೊಂದಿಗೆ ಚರ್ಚಿಸಿ ವಿಷಯ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು ನಾಲ್ಕನೆಯ ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ವಿಭಾಗಕ್ಕೆ ಸಲ್ಲಿಸಬೇಕು. ಎ-4

ಅಳತೆಯ ಕಾಗದದಲ್ಲಿ 14 ಪಾಯಿಂಟ್ ಅಕ್ಷರಗಳಲ್ಲಿ 50 ಪುಟಗಳಿಗೆ ಕಡಿಮೆ ಇಲ್ಲದಂತೆ ಮತ್ತು 80 ಪುಟಗಳಿಗೆ ಮೀರದಂತೆ ಅವಧಿಕ ಕಾರ್ಯವಿರಬೇಕು

ಘಟಕ 5: ಚತುರ್ಮಾಸ ಅಂತ್ಯದಲ್ಲಿ ವರದಿಯ ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ಅಧ್ಯಯನ ಮಂಡಳಿ / ಅಧ್ಯಯನ ವಿಭಾಗ / ಪರೀಕ್ಷಾ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರು ಅಥವಾ ಅವರ ನಾಮಾಂಕಿತರು ಮೇಲ್ವಿಚಾರಕರು ಹಾಗೂ ಇತರ ವಿಶ್ವವಿದ್ಯಾಲಯ / ಉದ್ಯಮ / ಸಮಾಜ / ಸಮುದಾಯದಿಂದ ಆಹ್ವಾನಿತರಾದ ಒಬ್ಬ ಬಾಹ್ಯ ಪರೀಕ್ಷಕರನ್ನೊಳಗೊಂಡ ಸಮಿತಿ ನಡೆಸುತ್ತದೆ.- 10 ಅಂಕಗಳು (60+10=70)

4ನೇ ಚತುರ್ಮಾಸದ ವಿಷಯವಾದ 'ಅವಧಿಕ ಕಾರ್ಯ' ಬರಹದ ಮೌಲ್ಯಮಾಪನವನ್ನು 60 ಅಂಕಗಳಿಗೆ ನಡೆಸಲಾಗುವುದು. 10 ಅಂಕಗಳಿಗೆ ಮೌಖಿಕ ಪರೀಕ್ಷೆಯನ್ನು ನಡೆಸಲಾಗುವುದು.

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ಮಾದರಿ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ

2022-23 ನೇ ಸಾಲಿನ ಸ್ನಾತಕೋತ್ತರ ಎಂ.ಎ ಕನ್ನಡ ಚತುರ್ಮಾಸ ಪರೀಕ್ಷೆಗಳು

(ಸಿಬಿಸಿಎಸ್-ಸಿಎಜಿಪಿ ಮಾದರಿ)

ಪತ್ರಿಕೆಯ ಶೀರ್ಷಿಕೆ:

ಸಮಯ: 3 ಗಂಟೆಗಳು

ಅಂಕಗಳು: 70

ಸೂಚನೆ : ಎಲ್ಲಾ ಪ್ರಧಾನ ಪ್ರಶ್ನೆಗಳು ಕಡ್ಡಾಯ

(ಎ) ಅಥವಾ (ಬಿ)

ಅಂಕಗಳು : 14

(ಸಿ) ಅಥವಾ (ಡಿ)

ಅಂಕಗಳು : 14

(ಇ) ಅಥವಾ (ಎಫ್)

ಅಂಕಗಳು: 14

(ಜಿ) ಅಥವಾ (ಎಚ್)

ಅಂಕಗಳು : 14

ಯಾವುದಾದರೂ ಏಳು ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ

ಅಂಕಗಳು: 7X2=14

(ಐ) (ಒ)

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(ಎನ್) (ಟಿ)

ಪ್ರಶ್ನೆಗಳನ್ನು ಪಠ್ಯಕ್ರಮದ ಎಲ್ಲಾ ಘಟಕಗಳನ್ನು ಒಳಗೊಂಡಂತೆ ತಯಾರಿಸುವುದು.

JSS MAHAVIDYAPEETA  
**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**  
(Affiliated to University of Mysore)  
Autonomous, NAAC 'A' grade and College with Potential for Excellence  
B N Road, Mysuru – 570025

**PROPOSED SCHEME of INSTRUCTION**  
and  
**SYLLABI**  
for  
**M.Sc. MATHEMATICS**  
under  
**CHOICE BASED CREDIT SYSTEM (CBCS)**

**PG DEPARTMENT OF MATHEMATICS**  
**2017 – 18**

1. **Scheme of Admission:**

- 50% seats of the total intake for M.Sc. Mathematics Programme of the College will be filled by the University of Mysore through Centralized Admission Cell as per University regulations.
- Remaining 50% seats will be filled by the College under College Quota.

2. **Eligibility:** B.Sc. degree with Mathematics as Major/Optional subject with 45% or B.Sc.Ed., degree of Regional Institute of Education with Mathematics as a special subject.

3. **Scheme of Examination:**

- (i) Theory paper of 03 hours duration (C<sub>3</sub> component) : **70 marks**
- (ii) Internal Assessment: **30 marks**  
(C<sub>1</sub> Component: 15 marks, C<sub>2</sub> Component: 15 marks)

4. **Pattern of Question Paper: Theory paper:** There are 5 questions. All questions must be answered. Each question carries 14 marks.

5. **Minimum Marks for Securing Credits:** 40% (with minimum of 30% in C<sub>1</sub> and C<sub>2</sub> and minimum of 30% in C<sub>3</sub>).

6. **Minimum Credits for getting the M.Sc. Mathematics degree:** 76 credits.

7. **Scheme of study for Masters:**

Total No. of credits to be earned	76 credits
Minimum No. of credits to be earned from Hard Core papers	44 credits
Minimum No. of credits to be earned from Soft Core papers	28 credits
Minimum No. of credits to be earned from Open elective papers	4 credits



# JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

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B N Road, Mysuru – 570025

## PG DEPARTMENT OF MATHEMATICS

CBCS - M.Sc. Mathematics

### List of courses with credit pattern

Sl. No.	Code	Type of the paper	Title of the Paper	Credit pattern in L:T:P	Credit Value	No. of hrs
<b>FIRST SEMESTER</b>						
1	MAA 010	HC	Algebra I	3 : 1 : 0	4	5
2	MAA 020	HC	Real Analysis I	3 : 1 : 0	4	5
3	MAA 030	HC	Real Analysis II	3 : 1 : 0	4	5
4	MAA 040	HC	Complex Analysis I	3 : 1 : 0	4	5
5	MAA 210	SC	Linear Algebra	3 : 1 : 0	4	5
<b>SECOND SEMESTER</b>						
6	MAB 010	HC	Algebra II	3 : 1 : 0	4	5
7	MAB 020	HC	Real Analysis III	3 : 1 : 0	4	5
8	MAB 030	HC	Complex Analysis II	3 : 1 : 0	4	5
9	MAB 210	SC	Ordinary and Partial Differential Equations	3 : 1 : 0	4	5
10	MAB 230	SC	Graph Theory	3 : 1 : 0	4	5
<b>THIRD SEMESTER</b>						
11	MAC 010	HC	Elements of Functional Analysis	3 : 1 : 0	4	5
12	MAC 020	HC	Topology I	3 : 1 : 0	4	5
13	MAC 210	SC	Commutative Algebra	3 : 1 : 0	4	5
14	MAC 220	SC	Theory of Numbers	3 : 1 : 0	4	5
15	CSC/MCC/ZOC/ BTC/BOC/BCC 580	OE (For others)	Basic Mathematics	3 : 1 : 0	4	5
<b>FORTH SEMESTER</b>						
16	MAD 010	HC	Measure and Integration	3 : 1 : 0	4	5
17	MAD 020	HC	Topology-II	3 : 1 : 0	4	5
18	MAD 220	SC	Theory of Partitions	3 : 1 : 0	4	5
19	MAD 230	SC	Differential Geometry	3 : 1 : 0	4	5
Total Credits					76	

## **Program Outcomes**

PO1 : Apply the underlying unifying structures of mathematics (i.e. sets, relations and functions, logical structure) and the relationships among them

PO2 : To include methods of facilitating learning such as projects, group work and participative learning.

PO3 : To Innovate, invent and solve complex mathematical problems using the knowledge of pure and applied mathematics.

PO4 : To impart knowledge of some basic concepts and principles of the discipline.

PO5 : To establish inter-disciplinarily between mathematics and other subjects from Humanities and the Social Sciences.

PO6 : To encourage collaborative learning through group activities and hands-on learning.

PO7 : To provide in-service training for school teachers. To learn to apply mathematics to real life situations and help in problem solving

## **Program Specific Outcomes**

PSO1 : Explain the importance of mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results

PSO2 : Propose new mathematical and statistical questions and suggest possible software packages and/or computer programming to find solutions to these questions

PSO3 : Continue to acquire mathematical and statistical knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematics

PSO4 : Ability to use computer calculations as a tool to carry out scientific investigations and develop new variants of the acquired methods, if required by the problem at hand.

PSO5 : Crack lectureship and fellowship exams approved by UGC like CSIR – NET and SLET.

PSO6 : Apply knowledge of Mathematics, in all the fields of learning including higher research and its extensions.



## First Semester

<b>Course Code MAA 010</b>	<b>Algebra I</b>
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### Course Outcome

Students are able to

- CO1 Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization
- CO2 Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues
- CO3 Assess properties implied by the definitions of groups.
- CO4 Analyze Permutation groups
- CO5 Uses various canonical types of groups and canonical types of rings
- CO6 Analyze and demonstrate examples of subgroups, normal subgroups and quotient groups.
- CO7 Use the concepts of isomorphism and homomorphism for groups
- CO8 Demonstrate knowledge of conjugates, the Class Equation and Sylow theorems.

## COURSE CONTENT

### Unit I

Number theory - Congruences, residue classes, theorems of Fermat, Euler and Wilson, linear congruences, elementary arithmetical functions, primitive roots, quadratic residues and the law of quadratic reciprocity.

### Unit II

Groups - Lagrange's Theorem, homomorphism and isomorphism, normal subgroups and factor groups.

### Unit III

The fundamental theorem of homomorphism, two laws of isomorphism.

### Unit IV

Permutation groups and Cayley's theorem, Sylow's theorems.

**Books for Reference:**

1. D. M. Burton – Elementary Number Theory, Tata McGraw-Hill, New Delhi, 6th Ed.,
2. I. Niven, H. S. Zuckerman and H. L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.,
3. G. A. Jones and J. M. Jones – Elementary Number Theory, Springer, 1998.
4. Thomas W. Hungerford – Algebra, Springer International Edition, New York.
5. Michael Artin – Algebra, Prentice-Hall of India, New Delhi.
6. J. A. Gallian – Contemporary Abstract Algebra, Narosa Publishing House, 4th Ed.,
7. D. S. Dummit and R. M. Foote – Abstract Algebra, John Wiley and Sons, 1999.
8. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.
9. J. B. Fraleigh – A First course in Abstract Algebra, Addison-Wesley,
10. N. S. Gopalakrishnan – University Algebra, New Age International, 2nd Ed.

<b>Course code MAA020</b>
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<b>Real Analysis I</b>
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**Course Outcome**

Students are able to

- CO1 Describe fundamental properties of the real numbers that lead to the formal development of real analysis
- CO2 Describe the real line as a complete ordered field
- CO3 Acquire knowledge extended real number system, the n-dimensional Euclidean space
- CO4 Study the types of mean inequalities and application
- CO5 Use the definitions of convergence as they apply to sequences, series, and functions
- CO6 Use the definitions of convergence as they apply to re-arrangements. Double series, infinite products

**COURSE CONTENT****Unit I**

The extended real number system, the n-dimensional Euclidean space, the binomial inequality, the inequality of the arithmetic and geometric means, the inequality of the power means, Cauchy's, Holder's inequality and Minkowski's inequality.

## Unit II

Numerical sequences, convergent sequences, Cauchy sequences, upper and lower limits.

## Unit III

Series of real numbers series of non-negative terms, the number 'e', tests of convergence.

## Unit IV

Multiplications of series, re-arrangements. Double series, infinite products.

### Books for Reference:

1. W. Rudin – Principles of Mathematical Analysis, International Student edition, McGraw Hill, 3rd Ed.
2. T. M. Apostol – Mathematical Analysis, Addison Wesley, Narosa, New Delhi, 2nd Ed.
3. R. R. Goldberg – Methods of real Analysis, Oxford and IBH, New Delhi.
4. Torence Tao – Analysis I, Hindustan Book Agency, India, 2006.
5. Torence Tao – Analysis II, Hindustan Book Agency, India, 2006.
6. Kenneth A. Ross – Elementary Analysis: The Theory of Calculus, Springer International Edition, 2004.

<b>Course code MAA 030</b>	<b>Real Analysis II</b>
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### Course Outcome

Students are able to

- CO1 Determine the basic topological properties of subsets of the real numbers
- CO2 Analyze Sets and functions , distinguish between finite, countable and uncountable sets
- CO3 Determine the Riemann integrability and the Riemann-Stieltjes integrability of a bounded function and prove a related of theorems concerning integration
- CO4 Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to

problems in the context of real analysis

CO5 Prove Taylor's theorem, determine maxima and minima, study the Functions of bounded variation

CO6 Produce rigorous proofs of results that arise in the context of real analysis.

## **COURSE CONTENT**

### **Unit I**

Finite, countable and uncountable sets, the topology of the real line.

### **Unit II**

Continuity, uniform continuity, properties of continuous functions, discontinuities, monotonic functions.

### **Unit III**

Differentiability, **mean value theorems**, L' Hospital rule, Taylor's theorem, maxima and minima, Functions of bounded variation.

### **Unit IV**

The Riemann-Stieltje's integral, criterion for integrability. Properties of the integral, classes of integrable functions. The integral as the limit of a sum. First and second mean value theorems. Integration and differentiation.

### **Books for Reference:**

1. W. Rudin – Principles of Mathematical Analysis, International Student edition, McGraw-Hill, 3rd Ed..
2. Torence Tao – Analysis I, Hindustan Book Agency, India, 2006.
3. Torence Tao – Analysis II, Hindustan Book Agency, India, 2006.
4. T. M. Apostol – Mathematical Analysis, Addison Wesley, Narosa, 2nd Ed.,
5. R. R. Goldberg – Methods of real Analysis, Oxford and IBH Publishing Company, New Delhi.
6. Kenneth A. Ross – Elementary Analysis: The Theory of Calculus, Springer International Edition, 2004.

## **Course Outcome**

Students are able to

- CO1 Represent complex numbers algebraically and geometrically,
- CO2 Define and analyze limits and continuity for complex functions as well as consequences of continuity
- CO3 Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra
- CO4 Analyze sequences and series of analytic functions and types of convergence.
- CO5 Apply Cauchy's theorem for disk and the integral formula.
- CO6 Understand Local properties of Analytic functions

## **COURSE CONTENT**

### **Unit I**

Algebra of complex numbers, geometric representation of complex numbers. Riemann sphere and Stereographic projection, Lines, Circles. Limits and Continuity.

### **Unit II**

Analytic functions, Cauchy-Riemann equations, Harmonic functions, Polynomials and Rational functions. Elementary theory of power series - sequences, series, uniform convergence of power series, Abel's limit theorem, The elementary functions.

### **Unit III**

Topology of the complex plane. Linear fractional transformations, Cross-ratio, Symmetry, Elementary conformal mappings. Complex integration – Line integrals, Rectifiable arcs.

### **Unit IV**

Cauchy's theorem for a rectangle. Cauchy's theorem in a Circular disk, Cauchy's integral formula. Local properties of analytic functions.

### **Books for Reference:**

1. L. V. Ahlfors – Complex Analysis, McGraw-Hill, Kogakusha, 1979.
2. J. B. Conway – Functions of one complex variable, Narosa, New Delhi.
3. R. P. Boas – Invitation to Complex Analysis, The Random House, 1987
4. B. C. Palka – An Introduction to Complex Function Theory, Springer, 1991.
5. S. Ponnusamy – Foundations of Complex Analysis, Narosa, 1995.

<b>Course code MAA 210</b>	<b>Linear Algebra</b>
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### **Course Outcome**

Students are able to

- CO1 Solve systems of linear equations,
- CO2 Analyze vectors in  $\mathbb{R}^n$  geometrically and algebraically,
- CO3 Recognize the concepts of the terms span, linear independence, basis, and dimension, and apply these concepts to various vector spaces and subspaces,
- CO4 Use matrix algebra and the related matrices to linear transformations,
- CO5 Compute and use determinants, and use eigenvectors and eigenvalues,
- CO6 Determine and use orthogonality, have thorough understanding of the Linear Transformations
- CO7 Study Inner Products and Norms, The Gram-Schmidt Orthogonalization Process and Orthogonal Complements.
- CO8 Analyze the elementary canonical forms, rational and Jordan forms, Apply the inner product space

### **COURSE CONTENT**

#### **Unit I**

Vector Spaces, Subspaces, Linear Combinations and Systems of Linear Equations, Linear Dependence and Linear Independence, Bases and Dimension, Maximal Linearly Independent Subsets; Linear Transformations, Null Spaces, and Ranges, The Matrix Representation of a Linear Transformation, Composition of Linear Transformations and Matrix Multiplication, Invertibility and Isomorphisms, The Change of Coordinate Matrix, The Dual Space; Elementary Matrix Operations and Elementary Matrices, The Rank of a Matrix and Matrix Inverses, Systems of Linear Equations.

### **Unit II**

Properties of Determinants, Cofactor Expansions, Elementary Operations and Cramer's Rule, Eigenvalues and Eigenvectors, Diagonalizability, Invariant Subspaces and the Cayley-Hamilton Theorem; Inner Products and Norms, The Gram-Schmidt Orthogonalization Process and Orthogonal Complements.

### **Unit III**

The Adjoint of a Linear Operator, Normal and Self-Adjoint Operators, Unitary and Orthogonal Operators and Their Matrices, Orthogonal Projections and the Spectral Theorem; Bilinear and Quadratic Forms;

### **Unit IV**

The Diagonal form, The Triangular form; The Jordan Canonical Form; The Minimal Polynomial; The Rational Canonical Form.

### **Books for Reference:**

1. S. Friedberg, A. Insel, and L. Spence - Linear Algebra, Fourth Edition, PHI, 2009.
2. Jimmie Gilbert and Linda Gilbert – Linear Algebra and Matrix Theory, Academic Press, An imprint of Elsevier.
3. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.
4. Hoffman and Kunze – Linear Algebra, Prentice-Hall of India, 1978, 2nd Ed.,
5. P. R. Halmos – Finite Dimensional Vector Space, D. Van Nostrand, 1958.
6. S. Kumeresan – Linear Algebra, A Geometric approach, Prentice Hall India, 2000.

## **SECOND SEMESTER**

<b>Course code MAB 010</b>	<b>Algebra II</b>
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### **Course Outcome**

Students are able to

- CO1 Assess properties implied by the definitions of rings.
- CO2 Analyze and demonstrate examples and properties of ideals and quotient rings
- CO3 Demonstrate knowledge of polynomial rings and associated properties
- CO4 Derive and apply Gauss Lemma, Eisenstein criterion for irreducibility of rationals
- CO5 Demonstrate the characteristic of a field and the prime subfield.

## **COURSE CONTENT**

### **Unit I**

Rings, Integral domains and Fields, Homomorphisms, Ideals and Quotient Rings, Prime and Maximal ideals.

### **Unit II**

Euclidean and principal ideal rings, Polynomials, Zeros of a polynomial, Factorization, Irreducibility criterion.

### **Unit III**

Adjunction of roots, algebraic and transcendental extensions, Finite fields.

### **Unit IV**

Separable and inseparable extensions, Perfect and imperfect fields. Theorem on the primitive element.

### **Books for Reference:**

1. Thomas W. Hungerford – Algebra, Springer International Edition, New York.
2. Michael Artin – Algebra, Prentice-Hall of India, New Delhi.
3. Joseph A. Gallian – Contemporary Abstract Algebra, Narosa, 4th Ed.,
4. D. S. Dummit and R. M. Foote – Abstract Algebra, John Wiley and Sons, 1999, 2nd Ed.,
5. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.
6. J. B. Fraleigh – A First course in Abstract Algebra, Addison-Wesley,
7. N. S. Gopalakrishnan – University Algebra, New Age International, 2nd ed.,



## **Course Outcome**

Students are able to

- CO1 Understand the concept of sequences and series with respect to the real numbers system and establish whether a given series/ sequences is convergent/ divergent at a specified point or interval
- CO2 Recognize the difference between pointwise and uniform convergence of a sequence/series of functions
- CO3 Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability
- CO4 Derive and apply properties of convergence of power series.
- CO5 Analyze Functions of several variables, partial derivatives, continuity and differentiability
- CO6 Understand the importance of the Implicit function theorem, Taylor's theorem, the Maxima and Minima, Lagrange's multipliers

## **COURSE CONTENT**

### **Unit I**

Sequences and series of functions, Uniform convergence, Uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation.

### **Unit II**

Power series, The exponential and logarithmic functions, The trigonometric functions. Improper integrals and their convergence.

### **Unit III**

Functions of several variables, partial derivatives, continuity and differentiability, the chain rule, Jacobians.

### **Unit IV**

The Implicit function theorem, Taylor's theorem, the Maxima and Minima, Lagrange's multipliers.

**Books for Reference:**

1. W. Rudin – Principles of Mathematical Analysis, International Student edition, McGraw-Hill, 3rd Ed.,
2. T.M. Apostol – Mathematical Analysis, Addison Wesley, Narosa, 2nd Ed.,
3. R.R. Goldberg – Methods of Real Analysis, Oxford and IBH, New Delhi.
4. D.V. Widder – Advanced Calculus, Prentice Hall of India, New Delhi, 2nd Ed.,
5. Torence Tao – Analysis I, Hindustan Book Agency, India, 2006.
6. Torence Tao – Analysis II, Hindustan Book Agency, India, 2006.
7. Kenneth A. Ross – Elementary Analysis: The Theory of Calculus, Springer International Edition, 2004.

<b>Course code MAB 030</b>	<b>Complex Analysis II</b>
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**Course Outcome**

Students are able to

- CO1 Classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.
- CO2 Apply the Cauchy integral theorem in its various versions, and the Cauchy integral formulas
- CO3 Evaluate complex contour integrals directly and by the fundamental theorem
- CO4 Study Residue theorem and the argument principle
- CO5 State and prove the Cauchy Riemann Equation and use it to show that a function is Analytic
- CO6 Represent functions as Taylor, power and Laurent series
- CO7 Study properties of Partial fractions, Infinite products, Canonical products, The Gamma and Beta functions

**COURSE CONTENT**

## Unit I

The Calculus of Residues – The residue theorem, argument principle, Evaluation of definite integrals.

## Unit II

Harmonic functions – Definition and basic properties, mean value property, Poisson's formula, Schwarz's theorem, reflection principle.

## Unit III

Power series expansions – The Weierstrass theorem, The Taylor series, The Laurent series.

## Unit IV

Partial fractions and factorization – Partial fractions, Mittag - Leffer's theorem, Infinite products, Canonical products, The Gamma and Beta functions, Sterling's formula. Entire functions – Jensen's formula, Hadamard's theorem.

### Books for Reference:

1. L. V. Ahlfors – Complex Analysis, McGraw-Hill, Kogakusha, 1979.
2. J. B. Conway – Functions of one complex variable, Narosa, New Delhi.
3. R. P. Boas – Invitation to Complex Analysis, The Random House, 1987.
4. B. C. Palka – An Introduction to the Complex Function Theory, Springer, 1991.
5. S. Ponnusamy – Foundations of Complex Analysis, Narosa, 1995.

<b>Course code MAB 210</b>	<b>Ordinary and Partial Differential Equations</b>
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### Course Outcome

Students are able to

- CO1 Solve problems in ordinary differential equations, dynamical systems, stability theory, and a number of applications to scientific and engineering problems
- CO2 Study of Differential focuses on the existence and uniqueness of solutions also emphasizes the rigorous justification of methods for approximating solutions in pure and applied mathematics.

- CO3 Implement solution methods using appropriate technology
- CO4 Investigate the qualitative behavior of solutions of systems of differential equations
- CO5 Recognize the major classification of PDEs and the qualitative differences between the classes of equations
- CO6 Solve linear PDEs using classical solution methods.
- CO7 Solve differential equations widely used in formulating many fundamental laws of physics and chemistry.

## **COURSE CONTENT**

### **Unit I**

Linear Second Order Equations - Initial value problem, Existence and Uniqueness by Picard's Theorem, Wronskian, separation and comparison theorems, Poincare phase plane, variation of parameters.

### **Unit II**

Power series solutions - Solution near ordinary and regular singular point. Convergence of the formal power series, applications to Legendre, Bessel, Hermite, Laguerre and hypergeometric differential equations with their properties.

### **Unit III**

Partial differential equations - Cauchy problems and characteristics, Classification of Second order PDE's, reduction to canonical forms, derivation of the equations of mathematical physics and their solutions by separation of variables.

### **Unit IV**

Boundary value problems - Transforming Boundary value problem of PDE and ODE, Sturm - Liouville system, eigen values and eigen functions, simple properties, expansion in eigen functions, Parseval's identity, Green's function method.

### **Books for Reference:**

1. E. A. Coddington and N. Levinson – Theory of Ordinary Differential equations, Tata McGraw-Hill, New Delhi.
2. R. Courant and D. Hilbert – Methods of Mathematical Physics, Vol. I. & II, Tata McGraw-Hill, New Delhi, 1975.

3. G. F. Simmons – Differential Equations with applications and Historical Notes, Tata McGraw-Hill, New Delhi, 1991.
4. I. N. Sneddon – Theory of Partial differential equations, McGraw-Hill, International Student Edition.
5. S. G. Deo and V. Raghavendra – Ordinary Differential Equations and Stability Theory, Tata McGraw-Hill, New Delhi.

<b>Course code MAB 230</b>	<b>Graph Theory</b>
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### **Course Outcome**

Students are able to

- CO1 Construct examples and proofs pertaining to the basic theorems.
- CO2 Understand the definitions of cut vertex, bridge, blocks and Automorphism group of a graph.
- CO3 Study the properties of trees and connectivity
- CO4 Discuss and understand the importance of the concepts Matchings and Menger's theorem

### **COURSE CONTENT**

#### **Unit I**

Types of Graphs, Walk and connectedness, degrees, Extremal graphs, Intersection graph, Operations on graphs.

#### **Unit II**

Cutpoints, Bridges and Blocks, Block graphs and cutpoints.

#### **Unit III**

Characterization of trees, Centers and Centroids, Spanning Tree .

#### **Unit IV**

Connectivity and line connectivity, Menger's theorem, Coverings Independence, Critical points and lines.

### **Books for Reference:**

1. F. Harary – Graph Theory, Addition Wesley Reading Mass, 1969.
2. N. Deo – Graph Theory With Applications to Engineering and Computer Science, Prentice Hall of India, 1987.
3. K. R. Parthasarathy – Basic Graph Theory, Tata McGraw-Hill, New Delhi, 1994.
4. G. Chartand and L. Lesniak – Graphs and Diagraphs, Qwadsworth and Brooks, 2nd Ed.,
5. Clark and D. A. Holton – A First Look at Graph Theory, Allied publishers.
6. D. B. West – Introduction to Graph Theory, Pearson Education Inc., 2001, 2nd Ed.,
7. J. A. Bondy and U. S. R. Murthy – Graph Theory with applications, Elsevier, 1976.

### **THIRD SEMESTER**

<b>Course code MAC 010</b>	<b>Elements of Functional Analysis</b>
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#### **Course Outcome**

Students are able to

- CO1 Explain the fundamental concepts of functional analysis.
- CO2 Understand the approximation of continuous functions.
- CO3 Understand concepts of Hilbert and Banach spaces
- CO4 Understand the definitions of linear functional and prove the Hahn-Banach theorem, open mapping theorem, uniform boundedness theorem, etc.
- CO5 Define linear operators, self adjoint, isometric and unitary operators on Hilbert spaces.

#### **COURSE CONTENT**

##### **Unit I**

Metric completion. Banach's contraction mapping theorem and applications, Baire' category theorem, Ascoli - Arzela theorem.

##### **Unit II**

Linear spaces and linear operators, Norm of a bounded operator, The Hahn – Banach extension theorem, Stone - Weirstrass theorem.

### **Unit III**

Open mapping and Closed Graph theorems. The Banach - Steinhaus Principle of Uniform Boundedness.

### **Unit IV**

Hilbert spaces- The orthogonal projection, Nearly orthogonal elements, Riesz's lemma, Riesz's representation theorem.

#### **Books for Reference:**

1. G. F. Simmons – Introduction to Topology and Modern Analysis, Tata McGraw-Hill, New Delhi.
2. A. E. Taylor – Introduction to Functional Analysis, Wiley, New York, 1958.
3. A. Page and A. L. Brown – Elements of Functional Analysis.
4. George Bachman and Lawrence Narici – Functional Analysis, Dover Publications, Inc., Mineola, New York.
5. J. B. Conway – A Course in Functional Analysis, GTM, Vol. 96., Springer, 1985.

<b>Course code MAC 020</b>	<b>Topology I</b>
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### **Course Outcome**

Students are able to

- CO1 Define and illustrate the concept of topological spaces and continuous functions
- CO2 Provide precise definitions and appropriate examples and counter examples of fundamental concepts in topology.
- CO3 Define and illustrate the concept of product topology, metric and quotient topology
- CO4 Prove a selection of theorems concerning topological spaces, continuous functions product topologies, and quotient topologies
- CO5 Define connectedness and compactness, and prove a selection of related theorems

## **COURSE CONTENT**

### **Unit I**

Set theoretic preliminaries. Topological spaces and continuous maps - topological spaces, basis for a topology, the order topology, the product topology on  $X \times X$ , the subspace topology.

### **Unit II**

Closed sets and limit points, continuous functions, the product topology, the metric topology, the quotient topology.

### **Unit III**

Connectedness - connected spaces, connected sets on the real line, path connectedness.

### **Unit IV**

Compactness - compact spaces, compact sets on the line, limit point compactness, local compactness.

### **Books for Reference:**

1. J. R. Munkres – A First Course in Topology, Prentice Hall India, 2000, 2nd Ed.,
2. G. F. Simmons – Introduction to Topology and Modern Analysis, McGraw-Hill, Kogakusha, 1968.
3. S. Willard – General Topology, Addison Wesley, New York, 1968.
4. J. Dugundji – Topology, Allyn and Bacon, Boston, 1966.
5. J. L. Kelley – General Topology, Van Nostrand and Reinhold Co., New York, 1955.

<b>Course code MAC 210</b>	<b>Commutative Algebra</b>
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### **Course Outcome**

Students are able to

- CO1 Know the basic definition of commutative rings, local rings, prime and maximal Ideals over commutative rings
- CO2 Explain basic concepts of The prime spectrum of a ring, the nil radical and Jacobson radical
- CO3 Study the operation on ideals and extension and contraction



- CO4 Be Familiar with the notions of Noetherian and Artinian modules
- CO5 Discuss and understand the Free modules Finitely generated modules, Simple modules, Exact sequences of modules
- CO6 Know how to localize rings and modules, and familiar with important applications of localization
- CO7 Know basic theory of Noetherian rings and study the Hilbert basis theorem .

## **COURSE CONTENT**

### **Unit I**

Rings and ideals - Rings and ring homomorphisms, Ideals, Quotient rings, zero-divisors, nilpotent elements, units, prime ideals and maximal ideals.

### **Unit II**

The prime spectrum of a ring, the nil radical and Jacobson radical, operation on ideals, extension and contraction.

### **Unit III**

Modules - Modules and modules homomorphisms, submodules and quotient modules, Direct sums, Free modules Finitely generated modules, Nakayama Lemma, Simple modules, Exact sequences of modules.

### **Unit IV**

Modules with chain conditions - Artinian and Noetherian modules, modules of finite length, Artinian rings, Noetherian rings, Hilbert basis theorem.

### **Books for Reference:**

1. M. F. Atiyah and I. G. Macdonald – Introduction to Commutative Algebra, Addison-Wesley.
2. C. Musili – Introduction to Rings and Modules, Narosa Publishing House.
3. Miles Reid – Under-graduate Commutative Algebra, Cambridge University Press.
4. N. S. Gopalakrishnan, Commutative Algebra, Oxonian Press.

<b>Course code MAC 220</b>	<b>Theory of Numbers</b>
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### **Course Outcome**

Students are able to

- CO1 Define and interpret the concepts of divisibility, congruence, greatest common

divisor, prime, and prime-factorization

- CO2 Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues
- CO3 Produce rigorous arguments (proofs) centered on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principle in the proof of theorems
- CO4 Know the diophantine equations, irrational numbers, continued fractions

## **COURSE CONTENT**

### **Unit I**

Prime numbers, The Fundamental theorem of Arithmetic, The series of Reciprocals of primes, The Euclidean Algorithm. Fermat and Mersenne numbers. Farey series, Farey dissection of the continuum, Irrational numbers-Irrationality of  $m^{\text{th}}$  root of  $N$ ,  $e$  and  $\pi$ .

### **Unit II**

Arithmetical Functions – The Mobius function, The Euler' function and Sigma function, The Dirichlet product of Arithmetical functions, Multiplicative functions. Averages of Arithmetical functions – Euler summation formula, Some elementary asymptotic formulas, The average orders of  $d(n)$ ,  $\sigma(n)$ ,  $\varphi(n)$ ,  $\mu(n)$ . An application to the distribution of lattice points visible from the origin.

### **Unit III**

Approximation Irrational numbers, Hurwitz's Theorem, Representation of a number by two or four squares, Definition  $g(k)$  and  $G(k)$ , Proof of  $g(4) < 50$ , Perfect numbers. The series of Fibonacci and Lucas.

### **Unit IV**

Continued fractions - Finite continued fractions, Convergent of a continued fraction, Continued fractions with positive quotients. Simple continued fractions, The representation of an irreducible rational fraction by a simple continued fraction. The continued fraction algorithm and Euclid's algorithm. The difference between the fraction and its convergents, Infinite simple continued fractions, the representation of an irrational number by an infinite continued fraction, Equivalent numbers and periodic continued fractions, some special quadratic surds.

### **Books for Reference:**

1. G. H. Hardy and E. M. Wright – An Introduction to Theory of Numbers, Oxford University Press, 1979, 5th Ed.,

2. I. Niven, H. S. Zuckerman and H. L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.,
3. Bruce C. Berndt – Ramanujan's Note Books Volume-1 to 5, Springer.
4. G. E. Andrews – Number Theory, Dover Books, 1995.
5. T. M. Apostol – Introduction to Analytic Number Theory, Narosa Publishing House, New Delhi.

**OPEN ELECTIVE (For others)**

<b>Coursecode</b> MCC/BCC/BTC/BOC/ZOC/CSC 580	<b>Basic Mathematics</b>
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**Course Outcome**

Students are able to

- CO1 Write an argument using logical notation and determine if the argument is or is not valid
- CO2 Identify sets as well defined collections, represents sets in roster and set builder form, conversion from set builder form to roster form and vice versa.
- CO3 Understand the meaning of equal and equivalent sets and differentiate between equal and equivalent sets.
- CO4 Identify the subsets of the given sets, find the complement of a subset of a given Set, within a given universe. Represent venn diagram using sets.
- CO5 Use the simple method to solve small linear programming models by hands, given a basic feasible point
- CO6 Solve a two dimensional linear programming problem graphically
- CO7 Understand the definitions of graphs, path, connectedness, cut vertex, bridge, blocks of a graph.
- CO8 Study the properties of trees and matrix of a graph

**COURSE CONTENT**

**Unit I**

Mathematical Logic: Connection – Normal Forms – Theory of Inferences – Predicate Calculus.

**Unit II**

Set Theory: Operations on Sets – Basic Set Identities – Relations and Orderings, Functions.

### **Unit III**

Introduction: formulation of LP problems, Graphical solution of LP problems. Introduction to Simplex, revised simplex methods and Dual simplex, Game theory.

### **Unit IV**

Graph Theory: Basic Concepts of Graph Theory- Paths – Connectedness – Matrix Representation of Graphs – Trees – List structures and Graphs

#### **Books for Reference:**

1. C. L. Liu – Elements of Discrete Mathematics, McGraw-Hill, 1986.
2. Kenneth H. Rosen – Discrete Mathematics and its Applications, McGraw-Hill, 2002.
3. F. Harary – Graph Theory, Addition Wesley Reading Mass, 1969.
4. N. Deo – Graph Theory With Applications to Engineering and Computer Science, Prentice Hall of India, 1987.
5. K. R. Parthasarathy – Basic Graph Theory, Tata McGraw-Hill, New Delhi, 1994.
6. G. Chartand and L. Lesniak – Graphs and Diagraphs, wadsworth and Brooks, 2<sup>nd</sup> Ed.,
7. Clark and D. A. Holton – A First Look at Graph Theory, Allied publishers.
8. D. B. West – Introduction to Graph Theory, Pearson Education Inc.,2001, 2nd Ed.,
9. J. A. Bondy and U. S. R. Murthy – Graph Theory with applications, Elsevier, 1976.
10. S. D Sharma- Operations Research.

### **Fourth Semester**

<b>Course code MAD 010</b>	<b>Measure and Integration</b>
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#### **Course Outcome**

Students are able to

- CO1 Understand the fundamental concepts of Mathematical Analysis and the classical theorems in Advanced Real Analysis
- CO2 Be familiar with measurable sets and functions

- CO3 Discuss the Integration a measurable function
- CO4 Discuss theorems on monotonic functions, functions of bounded variation, differentiation of an integral, absolute continuity
- CO5 Understand the fundamentals of measure theory and be acquainted with the proofs of the fundamental theorems underlying the theory of integration.
- CO6 Learn about measure theory of Signed measures, product measures

## **COURSE CONTENT**

### **Unit I**

Lebesgue measure - outer measure, measurable sets and Lebesgue measure, a nonmeasurable set, measurable functions.

### **Unit II**

The Lebesgue integral – the Lebesgue Integral of a bounded function over a set of finite measure, the integral of a non-negative function, the general Lebesgue integral.

### **Unit III**

Differentiation and integration - Differentiation of monotonic functions, functions of bounded variation, differentiation of an integral, absolute continuity.

### **Unit IV**

Measure and integration - Measure spaces, Measurable functions, integration, Signed measures, the Radon - Nikodym theorem, Measure and outer measure, outer measure and measurability, the extension theorem, product measures.

### **Books for Reference:**

1. H. L. Royden – Real Analysis, Prentice Hall, 3rd Ed.,
2. G. de Barra – Measure Theory and Integration, Wiley Eastern Limited.
3. Inder K. Rana – An Introduction to Measure and Integration, Narosa, 1997.

<b>Course code MAD 020</b>	<b>Topology II</b>
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### **Course Outcome**

Students are able to

- CO1 Define and illustrate the concepts of the countability and separation axioms.
- CO2 Appreciate the beauty of deep mathematical results like Uryzohn's lemma and Tietze's extension theorem and understand the dynamics of the proof techniques.
- CO3 Discuss Tychonoff's theorem, locally compact spaces, Compactness of metric spaces
- CO4 Study Stone-Weierstrass theorems
- CO5 Describe different examples distinguishing general, geometric, and algebraic topology.
- CO6 Construct of the fundamental group of a topological space and applications to covering spaces and homotopy theory.

## **COURSE CONTENT**

### **Unit I**

Countability and Separation axioms - the countability axioms, the separation axioms, normality of a compact Hausdorff space.

### **Unit II**

Urysohn's lemma, Tietze's extension theorem, Urysohn's metrization theorem, Partitions of unity.

### **Unit III**

Tychonoff's theorem on the product of compact spaces. Local finiteness, Paracompactness, Normality of a paracompact space.

### **Unit IV**

The Fundamental group and the Fundamental group of a circle, The Fundamental group of the punctured plane, Essential and Inessential Maps, The Fundamental Theorem of Algebra.

### **Books for Reference:**

1. James R. Munkres - A First Course in Topology , Prentice Hall India, 2000, 2<sup>nd</sup> Ed.,
2. G. F. Simmons – Introduction to Topology and Modern Analysis, McGraw-Hill, Kogakusha, 1968.
3. S. Willard – General Topology, Addison Wesley, New York, 1968.
4. J. Dugundji – Topology, Allyn and Bacon, Boston, 1966.

5. J. L. Kelley – General Topology, Van Nostrand and Reinhold Co., New York, 1955.

<b>Course code MAD 230</b>	<b>Differential Geometry</b>
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### **Course Outcome**

Students are able to

- CO1 Define and analyze the basic concepts of space curves and plane curves
- CO2 Introduce the fundamentals of differential geometry primarily by focusing on the theory of curves and surfaces in three space.
- CO3 Compute quantities of geometric interest such as curvature, as well as develop a facility to compute in various specialized systems
- CO4 Understand the global properties of curves such as the four vertex theorem.
- CO5 Know the theory of surfaces introduces the fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surfaces, and the Gauss theorem.
- CO6 Introduce the method of the moving frame and over determined systems of differential equations as they arise in surface theory.

## **COURSE CONTENT**

### **Unit I**

Plane curves and Space curves – Frenet-Serret Formulae. Global properties of curves – Simple closed curves, The isoperimetric inequality, The Four Vertex theorem. Surfaces in three dimensions – Smooth surfaces, Tangents, Normals and Orientability, Quadric surfaces.

### **Unit II**

The First Fundamental form – The lengths of curves on surfaces, Isometries of surfaces, Conformal mappings of surfaces, Surface area, Equiareal Maps and a theorem of Archimedes.

### **Unit III**

Curvature of surfaces – The Second Fundamental form, The Curvature of curves on a surface, Normal and Principal Curvatures.

### **Unit IV**

Gaussian Curvature and The Gauss' Map – The Gaussian and The mean Curvatures, The Pseudo sphere, Flat surfaces, Surfaces of Constant Mean Curvature, Gaussian Curvature of Compact surfaces, The Gauss' Map.

**Books for Reference:**

1. A. Pressley – Elementary Differential Geometry, Under-graduate Mathematics Series, Springer.
2. T. J. Willmore – An Introduction to Differential Geometry, Oxford University Press.
3. D. Somasundaram – Differential Geometry: A First Course, Narosa, 2005.

<b>Course code MAD 220</b>	<b>Theory of Partitions</b>
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**Course Outcome**

Students are able to

- CO1 Know the definitions of partitions
- CO2 Apply the q-binomial theorem and Ramanujan  ${}_1\psi_1$  - summation formula
- CO3 Know the congruence of partition
- CO4 Apply the q-series

**COURSE CONTENT**

**Unit I**

Partitions - partitions of numbers, the generating function of  $p(n)$ , other generating functions, two theorems of Euler, Jacobi's triple product identity and its applications.

**Unit II**

${}_1\psi_1$  - summation formula and its applications, combinatorial proofs of Euler's identity, Euler's pentagonal number theorem, Franklin's combinatorial proof.

**Unit III**

Congruence properties of partition function, the Rogers - Ramanujan Identities.

**Unit IV**

Elementary series - product identities, Euler's, Gauss', Heine's, Jacobi's identities. Restricted Partitions – Gaussian, Frobenius partitions.

**Books for Reference:**

1. G. H. Hardy and E. M. Wright – An Introduction to Theory of Numbers, Oxford University Press, 1979, 5th Ed.,



2. I. Niven, H. S. Zuckerman and H. L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.,
3. Bruce C. Berndt – Ramanujan's Note Books Volumes-1 to 5.
4. G. E. Andrews – The Theory of Partitions, Addison Wesley, 1976.
5. A. K. Agarwal, Padmavathamma, M. V. Subbarao – Partition Theory, Atma Ram & Sons, Chandigarh, 2005.

**JSS MAHA VIDYAPEETHA**

**JSS College of Arts, Commerce and Science**

**Ooty Road, Mysuru - 570 025**

**Department of Master of Computer Applications**



**OVERALL COURSE GRID OF  
Master of Computer Applications**

**2021-2022**

# **Master of Computer Applications**

**2 Years / 4 Semesters**

## **1. Introduction:**

MCA is Masters of Computer Application is a PG course of two years and has it is a master Course in Computer Application the MCA subjects are related to computer languages computer software and the MCA syllabus is divided into 4 semesters has the MCA subjects consists 5 number but their brief knowledge is given in two years so the MCA syllabus is made in such a way that the students learn MCA subjects in two years in such a pattern that the gain all the knowledge

The MCA course includes classroom teaching, practical assignments, and project work which is a mandate in the MCA course syllabus. MCA course syllabus emphasis the latest programming languages and tools to develop better and faster applications. Some colleges encourage students to spend a full semester working in the industry to explore and understand how IT works.

To train MCA course subjects offered by the universities are Data Structures and files using C, Project Visual C++, Computer Networks and Java programming etc. MCA syllabus varies from university to university and some of them are- Internet & JAVA Programming, Modeling and Simulation, Computer and 'C' Programming, Management Information System, and many others.

The MCA course list also emphasis certain specialization topics like Troubleshooting, System Engineering, Software Development, Hardware Technology, etc.

## **2. Lecture-Practical/Project-Tutorial (L-P-T)**

A course shall have either or all the three components, i.e. a course may have only lecture component, or only practical/project component or a combination of any two/three components

Lecture (L): Classroom sessions delivered by faculty in an interactive mode. It should be conducted as per the scheme of lectures indicated in respective course.

Practical/Project(P): Practical / Project Work consisting of Hands-on experience /Field Studies / Case studies that equip students to acquire the much required skill component. Besides separate Practical/Project course, three course in each semester include few practical assignment and it will be evaluated under internal evaluation

Tutorial (T): Session consisting of participatory discussion/ self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture sessions

A Mini project is an assignment that the student needs to complete at the end of every semester in order to strengthen the understanding of fundamentals through effective application of the courses learnt. The details guidelines have been given in the course structure.

The Project Work to be conducted in the FINAL Semester and evaluated at the end of the semester. The detail guidelines have been in the respective course structure.

The teaching / learning as well as evaluation are to be interpreted in a broader perspective as follows:

- i) Teaching – Learning Processes: Classroom sessions, Group Exercises, Seminars, Small Group Projects, Self-study, etc.
- ii) Evaluation: Tutorials, Class Tests, Presentations, Field work, Assignments, competency based Activity, etc.

The MCA Programme is a combination of:

- a. Four-Credit Courses (100 Marks each): 4 Credits each
- b. One-Credit Courses (50 Marks each):

Following are the session details per credit for each of L-P-T model

- 1) Every ONE-hour session per week of L amounts to 1 credit per Semester,
- 2) Minimum of TWO hours per week of P amounts to 1 credit per Semester
- 3) Minimum of ONE hours per week of T amounts to 1 credit per Semester

## Scheme and Syllabus

Semester I					
Course Title	Course Code	Credits	Contact hours	EXT	INT
Java Programming	IT11	4:0:0	4	70	30
Data Structure and Algorithms	IT12	4:0:0	4	70	30
Computer Organisation and Architecture	IT13	4:0:0	4	70	30
Operating System Concepts	IT14	4:0:0	4	70	30
Computer Networks	IT15	4:0:0	4	70	30
Management Information System	BT11	4:0:0	4	70	30
Mathematical foundations	MT11	4:0:0	4	70	30
Java Programming Lab	IT11L	0:0:1	2	30	20
Data Structure and Algorithms Lab	ITC11	0:0:1	2	30	20
	<b>TOTAL</b>	30	32	550	250

Semester II						
Sl. No.	Course Title	Course Code	Credits	Contact Hours	EXT	INT
1	Python Programming	IT21	4:0:0	4	70	30
2	Software Architecture	IT22	4:0:0	4	70	30
3	Optimization Techniques	MT21	4:0:0	4	70	30
4	Advanced Internet Technologies	IT23	4:0:0	4	70	30
5	Analysis and Design of Algorithms	IT24	4:0:0	4	70	30
6	DBMS	IT 25	4:0:0	4	70	30
7	Elective	ET2X	4:0:0	4	70	30
8	Python Programming Lab	IT21L	0:0:1	2	30	20
9	Advanced Internet Technologies Lab	IT23L	0:0:1	2	30	20
			30	32	550	250

**ELECTIVES:**

Machine Intelligence Stream		Data Sciences Stream		Applications Stream	
ET21	Artificial Intelligence and Robotics	ET22	NOSQL	ET23	Enterprise Resource Planning

Semester III						
Sl. No.	Course Title	Course Code	Credits	Contact Hours	EXT	INT
1	Mobile Application Development	IT31	4:0:0	4	70	30
2	Data Warehousing and Data Mining	IT32	4:0:0	4	70	30
3	Software Testing and Quality Assurance	IT33	4:0:0	4	70	30
4	.NET Technologies	IT34	4:0:0	4	70	30
5	Cloud Computing	IT35	4:0:0	4	70	30
6	Cryptography and Network Security	IT36	4:0:0	4	70	30
7	Elective	OC32	4:0:0	4	70	30
8	Mobile Application Development Lab	IT31L	0:0:1	2	30	20
9	Data Warehousing and Data Mining Lab	IT32L	0:0:1	2	30	20
			30	32	550	250

ELECTIVES:

Machine Intelligence Stream		Data Sciences Stream		Applications Stream	
ET31	Soft Computing	ET32	Big Data Analytics	ET33	Software Project Management and Practices



Semester IV					
Sl. No.	Course Title	Course Code	CP	EXT	INT
1	Business Intelligence	BM41	4:0:0	70	30
2	Project	ITC41	0:0:12	150	100
			16	220	130

Semester	Credit	IE	UE
Semester I	30	260	540
Semester II	30	260	540
Semester III	30	260	540
Semester IV	16	130	220
Total	106	910	1840
			2750

**IT : Information Technology**

**BT: Business Technology**

**MT: Mathematics Technology**

## Semester I

Course Code: IT-11

Course Name: Java Programming

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

Course Description:

### **COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

CO1: Demonstrate and implement programs using components and constructs of a Java language

CO2: Identify classes, objects, members of a class and use packages and interfaces appropriately.

CO3: Demonstrate for Java program for multithread, synchronization and exception handling concepts.

CO4: Use the concept of string, event handling, simple data structures like arrays and members of classes of Java API in application development

CO5: Design and develop Java based UI and Networking applications using applets, swing components and networking concepts.

### **TOPICS COVERED:**

#### UNIT 1 – Java Basics 10 Hours

History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, exploring string class

## UNIT 2 – OOP Concepts in Java, Packages and Interfaces 10 Hours

Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class.

Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Exploring java.io.

## UNIT 3 - Exception Handling and Multi Threading 10 Hours

Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. String handling, Exploring java.util.

Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads; inter thread communication, thread groups, daemon threads. Enumerations, auto boxing, annotations, generics.

## UNIT 4 - String and Event Handling 10 Hours

String fundamentals, String Constructors, Three string related language features, The Length() method, Obtaining the characters within the string, String comparison, using index Of() and lastIndexOf(), changing the case of the characters within the string, String buffer and String builder.

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

## UNIT 5 – Applets, Swings and Networking with Java.Net 12 Hours

Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Swings- Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Networking fundamentals, Networking Classes & Interfaces, The InetAddress class, The Socket class, URL class, URL connection class, Http URL connection class, Exploring collection framework, Collection overview, Collection classes and interfaces, Array class.

## TEXT BOOKS / REFERENCES:

1. Herbert Schildt. Java - The Complete Reference, Ninth Edition. Oracle Press, McGraw Hill Education (India) Edition- 2014.

Reference books:

1. Cay S. Horstmann, Gary Cornell. Core Java, Core Java Volume-1 – Fundamentals, 9th edition, Pearson Education, 2014.
2. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

**ADDITIONAL LEARNING SOURCES:**

1. <http://www.oracle.com/technetwork/java/index-jsp-135888.html>
2. <http://www.javaworld.com/article/2074929/core-java>
3. <http://www.javaworld.com/>
4. <http://www.learnjavaonline.org/>
5. <https://www.codecademy.com/learn/learn-java>
6. <http://www.tutorialspoint.com/java/>
7. <http://www.java-examples.com/>
8. <http://www.homeandlearn.co.uk/java/java.html>

Course Code: IT-12

Course Name: Data Structure and Algorithms

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, the student will be able to:

- CO1: Design and analyze programming problem statements.
- CO2: Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- CO3: Apply mathematical abstraction to solve problems.
- CO4: Demonstrate various methods of organizing large amounts of data.
- CO5: Analyze algorithms and to determine algorithm correctness and time efficiency class.
- CO6: demonstrate linear data structures linked list, stack and queue (apply)
- CO7: implement tree, graph, hash table and heap data structures (apply)
- CO8: apply brute force and backtracking techniques (apply)
- CO9: demonstrate greedy and divide-conquer approaches (apply)
- CO10: implement dynamic programming technique (apply)

UNIT 1 - Introduction and overview of C Programming

12 Hours

Introduction to C programming, Variables, Data types, Constants, Declarations, Operators, Precedence, Associativity, Order of evaluation. Input and output statements; Control Statements, Arrays – Single dimension, Two dimensional, Multi dimensional Arrays, Strings. Functions, Categories of functions. Examples Pointers, Pointer arithmetic, Call by value, Pointer Expression, Pointer as function arguments, recursion, passing strings to functions, Call by reference, Functions returning pointers, Pointers to functions, Programming Examples. Structures and Unions.

UNIT 2 - Introduction to Data Structures 8 Hours

Information and its meaning: Abstract Data Types, Sequences as Value Definitions, ADT for Varying length character Strings, pointers and review of Pointers, Dynamic Memory Allocation - definition, malloc, calloc, and realloc, free. Data Structures: Array as an ADT, Arrays as Parameters, String as an ADT.

### UNIT 3 - The Stack

12 Hours

Definition and examples, Primitive operations, Example, The stack as an ADT, Representing stacks, Implementing the pop, push operations using function overloading, Examples for infix, postfix, and prefix expressions, Basic definition and Examples. Applications of Stacks: Expression Evaluations, Expression conversion, Recursion as application of stack, Properties of recursive definition or algorithm. Binary search, Towers of Hanoi problem.

### UNIT 4 - Queues and Linked List

12 Hours

The queue and its sequential representation, the queue as ADT, Basic operations using polymorphism and inheritance, Priority queue, Array implementation of a priority queue. Linked lists, inserting and removing nodes from a list, Linked implementations of stacks, Linked implementation of queues, linked list as a data Structure. Example of list operations.

### UNIT 5 - Linked Lists and Trees

8 Hours

Other list structures: Circular lists, Stack as circular lists, doubly linked lists. Application of linked lists: Stacks, Queues, double-ended queues, priority queues. Sorting and Searching: Applications and implementation with function overloading. Tree: Definition and representation, Types of trees, Basic operations on Tree.

### **TEXT BOOKS/ REFERENCES :**

Text Books :

1. Programming in ANSI C, Third Edition, E. Balaguruswamy. 6th Edition (2013).
2. Data Structures Using C and C++ by Aaron.M. Tenenbaum, Yedidyah Langsam and Moshe J. Augustine, PHI, Edition, 2011.

Reference Books :

1. Data structures, Algorithms and Applications in C++, S. Sahani, University Press (India) Pvt Ltd, 2nd Edition.
2. The complete reference C, Herbert Schildt, Fifth Edition, Tata McGraw Hill.

### **ADDITIONAL LEARNING SOURCES:**

1. <http://www.tutorialspoint.com/Data-Structures-in-C-Online-Training/classid=13>
2. [http://nptel.ac.in/datastructures\\_c](http://nptel.ac.in/datastructures_c)
3. [www.javatpoint.com](http://www.javatpoint.com)
4. [www.oracle.com](http://www.oracle.com)
5. [www.geeksforgeeks.org/java](http://www.geeksforgeeks.org/java)

Course Code: IT-13

Course Name: Computer Organisation and Architecture

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

Upon Successful Completion of this Course, Student will know

CO1: Computer Architecture-Hardware, software

CO2: Design of Interfaces

CO3: Addressing Modes

#### **UNIT-1**

**12 Hours**

Principles of Computer design - Software, hardware interaction layers in computer architecture. Central processing unit. Machine language instructions, Addressing modes, instruction types, Instruction set selection, Instruction cycle and execution cycle.

#### **UNIT-2**

**12 Hours**

Control unit, Data path and control path design, Microprogramming V s hardwired control, RISC Vs CISC, Pipelining in CPU design: Superscalar processors.

#### **UNIT-3**

**12 Hours**

Memory system, Storage technologies, Memory array organization, Memory hierarchy, interleaving, cache and virtual memories and architectural aids to implement these.

#### **UNIT-4**

**8 Hours**

Input-output devices and characteristics. Input-output processing, bus interface, data transfer techniques, I/O interrupts, channels.

#### **UNIT-5**

**8 Hours**

Performance evaluation - SPEC marks, Transaction Processing benchmarks.

#### **TEXT BOOKS/ REFERENCES :**

1. Pal Chauduri, P., "Computer Organisation and Design", Prentice Hall of India, New Delhi, 1994.
2. Rajaraman, V., and Radhakrishnan, T., "Introduction to Digital Computer Design" (4th edition). Prentice Hall of India, New Delhi, 1997.
3. Stallings. W, "Computer Organization and Architecture, (2nd edition) Prentice Hall of India, New Delhi

Course Code: IT-14

Course Name: Operating System and Linux

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, the student will be able to:

**CO1:** Recognize the structure of operating system, interaction of an operating system and application programs.

**CO2:** Analyze the various programming paradigms viz., multi-process and multi-threaded programming.

**CO3:** Examine the various resource and memory management techniques.

**CO4:** Distinguish the different features of real time and mobile operating systems.

**CO5:** Identify current issues in system security; demonstrate various factors can influence the overall performance of an operating system.

**TOPICS COVERED:**

**UNIT 1- Computer and Operating Systems Structure            11 Hours**

Basic Elements, Processor Registers, Instruction Execution, The Memory Hierarchy, Cache Memory, I/O Communication Techniques, Introduction to Operating System, Mainframe Systems, Desktop Systems, Multiprocessor Systems, Distributed Systems, Clustered Systems, Real - Time Systems, Handheld Systems, Feature Migration, Computing Environments.

System Structures: System Components, Operating – System Services, System Calls, System Programs, System Structure, Virtual Machines, System Design and Implementation, System Generation

**UNIT 2 - Process Management and Mutual Execution            10 Hours**

Process, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, Processes and Threads, Symmetric Multiprocessing(SMP), Micro kernels, CPU Scheduler and Scheduling. Principles of Concurrency, Mutual Exclusion: Hardware Support, Semaphores, Monitors, Message Passing, Readers/Writes Problem.



UNIT 3 - Deadlock and Memory Management

11 Hours

Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategy, Dining Philosophers Problem Memory Management: Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing

UNIT 4 - File System and Secondary Storage

10 Hours

File Concept, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection, File – System Structure, File – System Implementation, Directory Implementation, Allocation Methods, Free–Space Management, Disk Structure, Disk Scheduling, Disk Management.

UNIT 5 - Computer Security and Case study of Linux Operating system

10 Hours

The Security Problem, User Authentication, Program Threats, System Threats. Linux System Linux history, Design Principles, Kernel modules, Process, management, scheduling, Memory management, File systems, Input and output, Inter-process communications.

**TEXT BOOKS/REFERENCES:**

TEXT BOOKS :

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
2. William Stallings, “Operating System Internals and Design Principles” Pearson, 6th edition, 2012

REFERENCES:

1. Dhananjay M. Dhamdhare, “Operating Systems – A Concept – Based Approach”, TataMcGraw – Hill, 3rd Edition, 2012.
2. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.
3. Chakraborty , “Operating Systems” Jaico Publishing House, 2011

**ADDITIONAL RESOURCES:**

1. [https://www.tutorialspoint.com/operating\\_system/os\\_linux](https://www.tutorialspoint.com/operating_system/os_linux)
2. <https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems>.

Course Code: IT-15

Course Name: Computer Networks

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

**CO1:** Analyze and distinguish the basic concepts, principles and techniques of data communication along with the layers of OSI and TCP/IP model.

**CO2:** Independently understand and distinguish the concept of links, nodes and data transmission issues in the network.

**CO3:** Capability to categorize wired LANs: Ethernet, IPv4 addresses and performance of The network-layer.

**CO4:** Design and demonstrate the services of TCP and UDP.

**CO5:** Ability to summarize and interpret the basic concepts of Application-Layer paradigms and standard client-server protocols.

**TOPICS COVERED:**

UNIT 1 - Basics of Data Communications and Physical Layer      10 Hours

Data Communications: Components, Data Representation, Data Flow, Networks; Network Criteria, Physical Structures, Network Types: LAN, WAN, Switching, Network Models: Protocol Layering: Principles of Protocol Layering, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in the TCP/IP Protocol Suite, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model; OSI versus TCP/IP, Lack of OSI Model's Success, Introduction to Physical Layer, Data and Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance, Switching: Circuit-Switched Networks, Packet Switching, Datagram Networks, Virtual Circuit Networks.

UNIT 2 - Data Link Layer      10 Hours

Introduction to Data-Link Layer, Link-Layer Addressing: Address Resolution Protocol (ARP), Error Detection and Correction: Introduction, Types of Errors, Redundancy, Detection versus Correction, Coding, Block coding: Error Detection, Cyclic Code: Cyclic Redundancy Check,

Polynomials, Cyclic Code Analysis and its Advantages, Checksum, Forward Error Correction: Using Hamming Distance, Using XOR, Chunk Interleaving.

### UNIT 3 - LANs and Network Layer 10 Hours

Ethernet Protocol, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency of Standard Ethernet, Implementation, Changes in the Standard, Fast Ethernet (100 MBPS): Access Method, Physical Layer, 10 Gigabit Ethernet, Introduction to Network Layer, Network- Layer Services: Packetizing, Routing and Forwarding, Packet Switching: Datagram Approach, Virtual-Circuit Approach, Network Layer Performance: delay Throughput, Packet loss, Congestion Control, IPv4 addresses.

### UNIT 4 - Transport Layer 10 Hours

Introduction to Transport-Layer: Transport-Layer Services; Transport-Layer Protocols: Port Numbers, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers.

### UNIT 5 - Application Layer and Standard Client-Server Protocols 12 Hours

Introduction to Application Layer, Services, Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication using UDP, Iterative Communication using TCP, Concurrent Communication, World Wide Web and HTTP: FTP: Two Connections, Control Connection, Data Connection, Security for FTP, E-Mail: Architecture, Web-Based Mail, TELNET: Local versus Remote Logging, Secure Shell (SSH): Components, Applications, Domain Name System (DNS): Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, DDNS, Security of DNS.

### **TEXT BOOKS / REFERENCES:**

Text books:

B. A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Education (India) Private Limited, 2013.

Reference books:

1. William Stallings, Data and Computer Communications, 10th Edition, Pearson, 2013.
2. Larry L. Peterson and Bruce S. David: Computer Networks – A Systems Approach, 5th Edition, Elsevier, 2011.
3. Andrew S. Tanenbaum, Computer Networks, Fourth Edition, PHI, 2008.

4. Fred Halsall, Data Communications, Computer Networks and Open Systems, 4th Edition, Pearson Education, 2005.

1. [www.nptel.ac.in/courses](http://www.nptel.ac.in/courses)

2. <http://freevideolectures.com/Course/2276/Computer-Networks>

Course Code: BT-11

Course Name: Management Information System

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

Course Description:

**COURSE OUTCOMES:**

Upon successful completion of this course, the student will be able to:

CO1: Apply the different strategies for the management of business to formulate business process.

CO2: Analyze the need for business process re-engineering, and the process of making.

CO3: Analyze and examine business information needs to facilitate evaluation of strategic alternatives.

CO4: Apply Management Information Systems knowledge and skills learned to facilitate the acquisition, development, deployment, and management of information systems.

CO5: Effectively communicate strategic alternatives to facilitate decision-making.

**TOPICS COVERED:**

UNIT 1- Systems Engineering, Information and Knowledge

12 Hours

System concepts, system control, types of systems, handling system complexity, Classes of systems, General model of MIS, Need for system analysis, System analysis for existing system & new requirement, system development model, MIS & system analysis. Information concepts, classification of information, methods of data and information collection, value of information, information: A quality product, General model of a human as information processor, Knowledge, Introduction of MIS: MIS: Concept, Definition, Role of the MIS, Impact of MIS, MIS and the user, Management as a control system, MIS support to the management, Management effectiveness and MIS, Organization as system. MIS: organization effectiveness.

UNIT 2- Decision Making and DSS 10 Hours

Decision making concepts; decision making process, decision-making by analytical modeling, and Behavioral concepts in decision making, organizational decision-making, Decision structure, DSS components, and Management reporting alternatives

Technology of Information System : Introduction, Data processing, Transaction processing, Application processing, information system processing, TQM of information systems, Human factors & user interface, Strategic nature of IT decision, MIS choice of information technology.

UNIT 3- Electronic Business systems            10 Hours

Enterprise business system – Introduction, cross-functional enterprise applications, real world case, Functional business system, - Introduction, marketing systems, sales force automation, CIM, HRM, online accounting system, Customer relationship management, ERP, Supply chain management (real world cases for the above)

E-business Technology: Introduction to E-business, model of E-business, internet and World Wide Web, Intranet/Extranet, Electronic, Impact of Web on Strategic management, Web enabled business management, MIS in Web environment.

UNIT 4- Strategic Management of Business & Developing Business/IT Strategies /IT Solutions 10 Hours

Concept of corporate planning, Essentiality of strategic planning, Development of the business strategies, Type of strategies, short-range planning, tools of planning, MIS: strategic business planning. Planning fundamentals (real world cases), Organizational planning, planning for competitive advantage, (SWOT Analysis), Business models and planning. Business/IT planning, identifying business/IT strategies, Implementation Challenges, Change management., Developing business systems, (real world case), SDLC, prototyping, System development process, implementing business system .

UNIT 5: E-Commerce Introduction 10 Hours

Introduction to e-commerce, E-commerce Business Models and Concepts, Ecommerce Infrastructure: The Internet and World Wide Web, Web design, JavaScript Internet Information Server (IIS); Personal Web Server (PWS).

E-Commerce techniques and Issues: Introduction to Active Server Pages (ASP), Building an E-Commerce Web Site, E-Commerce Payment Systems, E-Commerce Marketing Techniques, Building product catalogue, Search product catalogue, Web Spider and search agent, Ethical, Social and Political Issues in E-Commerce.

**TEXT BOOKS /REFERENCES:**

Text Books :

1. Waman S Jhawadekar: Management Information System, 3rd Edition, Tata McGraw Hill.
2. James A O'Brien and George M Marakas: Management Information System, 7th Edition, Tata McGraw Hill, 2006
3. Turban, Rainer, and Potter, Introduction to E-Commerce, second edition, 2003
4. H. M. Deitel, P. J. Deitel and T. R. Nieto, E-Business and E-Commerce: How to Program, Prentice hall, 2001

Reference Books:

1. Ralph M Stair and George W Reynolds: Principles of Information Systems, 7th Edition, Thomson, 2010.
2. Steven Alter: Information Systems - The Foundation of E-Business, 4th Edition, Pearson Education, 2001
3. Elizabeth Chang: E-Commerce Fundamentals and Applications, Wile India Edition.

**ADDITIONAL LEARNING RESOURCES:**

1. <http://mbaexamnotes.com/management-information-system-notes>
2. [https://www.tutorialspoint.com/management\\_information\\_system](https://www.tutorialspoint.com/management_information_system)

Course Code: MT-11

Course Name: Mathematical Foundations

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

**CO1:** Implement statistical measures and explore its applications

**CO2:** Analysis of computational errors and design of algorithms to solve a set of linear equations.

**CO3:** Applying the concepts of vector and linear functions in real time applications.

**CO4:** Apply the notion of relations on finite structures, like strings and analyze algorithms using the concept of functions.

**CO5:** Explore the properties of Graph theory and its applications in computer science.

**TOPICS COVERED:**

UNIT 1- Statistics 10 hours

Univariate data – different measures of location, dispersion, relative dispersion, skewness and kurtosis, Moments, Measures based on them – comparison with moment measures, Correlation and Regression Analysis.

UNIT 2 – Number Systems and Vector & Matrix Algebra 10 hours

Errors in Numerical Computations, Types of Errors, Analysis and Estimation of Errors, Vector Algebra: Vector spaces with real field, Basis and dimension of a vector space, Orthogonal vectors, Properties of Matrices and Determinants: Matrix Operations, Elementary Matrices, Inverse Matrix, Diagonal Matrix, Symmetric Matrix, and Determinant Matrix.

UNIT 3 - Linear Algebraic Systems 11 hours

Numerical methods for Linear Systems, Direct Methods for Linear Systems: Cramer's Rule, Gauss Elimination Method, Gauss Jordan Elimination Method, Pivoting Strategies, Gauss- Jordan Method, LU Decomposition Method, Tridiagonal Systems of Linear Equations, Iterative Methods



for Solving Linear Systems, Jacobis Iteration Method, Gauss-Seidel Iterative Method, Convergence Criteria, Eigen Values and Eigen Vectors.

#### UNIT 4 – Relations and Functions 10 hours

Cartesian products and Relations, Properties of Relations, Functions: Plain and One-to-One, Onto Functions: Stirling Numbers and the Second Kind, Special functions, The Pigeon-hole principle, Function composition and inverse functions.

#### UNIT 5 - Graph Theory 11 Hours

Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree: Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Coloring and Chromatic Polynomials.

#### **TEXT BOOKS / REFERENCES:**

##### TEXT BOOKS :

1. Sant Sharan Mishra, “Computer Oriented Numerical and Statistical Methods”, PHI Learning Private Limited, 2013.
2. Rizwan Butt, “Introduction to Numerical Analysis Using Matlab”, Infinity Science Press LLC, 2008
3. Ralph P Grimaldi, B.V.Ramana, “Discrete & Combinatorial Mathematics, An Applied Introduction” 5th Edition, Pearson Education, 2009.

##### REFERENCES:

1. D.S. Chandrasekharaiah, Discrete Mathematical Structures, 4th Edition, PRISM Pvt. Ltd. 2012.
2. Bondy and U.S.R.Murty: Graph Theory and Applications ( Freely downloadable from Bondy's website; Google-Bondy)
3. S. Kumarsean, “Linear Algebra A geometric approach”, Prentice Hall of India Private Limited, 2001
4. Kenneth H Rosen, “Discrete Mathematics & its Applications" 7th edition, McGraw- Hill, 2010.

#### **ADDITIONAL LEARNING SOURCES:**

1. <http://www.personal.kent.edu/~rmuhamma/GraphTheory/graphTheory.htm>
2. [http://www.tutorialspoint.com/discrete\\_mathematics/](http://www.tutorialspoint.com/discrete_mathematics/)
3. <http://nptel.iitm.ac.in/>
4. <http://www.maths.lu.se/english/library/e-resources/>
5. <http://sunzi.lib.hku.hk/ER/detail/hkul/3743848>
6. <https://www.math.ucdavis.edu/~linear/linear-guest.pdf>

Course Code: IT11L

Course Name: Java Programming Practicals

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
--	3 Hrs./Week	1		50		50	100

Upon successful completion of this course, students will be able to:

CO1: Demonstrate and implement programs using components and constructs of a Java language

CO2: Identify classes, objects, members of a class and exhibit use packages and interfaces appropriately.

CO3: Demonstrate for Java program for multithread, synchronization and exception handling concepts.

CO4: Use the concept of string, event handling, simple data structures like arrays and members of classes of Java API in application development

CO5: Design and develop Java based UI and Networking applications using applets, swing components and networking concepts.

**LIST OF PROGRAMS TO BE COVERED:**

1. Display Hello world
2. Check entered number is ODD or EVEN
3. Find factorial of number
4. Find the sum of the digits of a given number
5. Swap two numbers without using a temporary variable
6. Accept a name and display the name with greeting message using Class.
7. Generate a salary for an employee using class, object, constructors, methods and access control. Different parameters to be considered are Emp\_No, Emp\_Name, Age, Basic, DA, HRA, CA, PT, IT.
8. Generate a sales report for a sales executive using class, object, constructors, methods and access control. Different parameters to be considered are Emp\_No, Emp\_Name, Sales\_Q1, Sales\_Q2, Sales\_Q3, Sales\_Q4.
9. Demonstrate Constructor Overloading and Method Overloading.
10. Implement Inner class and demonstrate its Access protection.
11. Write a program in Java for String handling which performs the following:
  - a. Checks the capacity of String Buffer objects.
  - b. Reverses the contents of a string given on console and converts the resultant string in upper case.
  - c. Reads a string from console and appends it to the resultant string of ii.
12. Demonstrate Inheritance.

13. Simple Program on Java for the implementation of Multiple inheritance using
  - a. interfaces to calculate the area of a rectangle and triangle.
14. Write a JAVA program which has
  - a. A Class called Account that creates account with 500Rs minimum balance, a deposit() method to deposit amount, a withdraw() method to withdraw amount and also throws Less Balance Exception if an account holder tries to withdraw money which makes the balance become less than 500Rs.
  - b. A Class called Less Balance Exception which returns the statement that says withdraw amount ( Rs) is not valid.
  - c. A Class which creates 2 accounts, both account deposit money and one account tries to withdraw more money which generates a Less Balance Exception take appropriate action for the same.
15. Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept.
16. Write a JAVA program to implement a Queue using user defined Exception Handling (also make use of throw, throws.).
17. Complete the following:
  - a. Create a package named shape.
  - b. Create some classes in the package representing some common shapes like Square,
  - c. Triangle and Circle. Import and compile these classes in other program.
18. Write a JAVA Program
  - a. Create an enumeration Day of Week with seven values SUNDAY through SATURDAY. Add a method is Workday( ) to the Day of Week class that returns true if the value on which it is called is MONDAY through FRIDAY. For example, the call Day Of Week SUNDAY is Workday ( ) returns false.
19. Write a JAVA program which has
  - a. A Interface class for Stack Operations
  - b. A Class that implements the Stack Interface and creates a fixed length Stack.
  - c. A Class that implements the Stack Interface and creates a Dynamic length Stack.
  - d. A Class that uses both the above Stacks through Interface reference and does the Stack operations that demonstrates the runtime binding.
20. Print a chessboard pattern.
21. Write a JAVA Program which uses File Input Stream / File Output Stream Classes.
22. Demonstrate utilities of Linked List Class.
23. Write a JAVA applet program, which handles keyboard event.
24. Write a JAVA Swing program, to design a form.
25. Create a simple Student Registration application using Swings, JDBC and MySQL.
26. Write a JAVA program which uses Datagram Socket for Client Server Communication.

## TEXT BOOKS / REFERENCES:

### Text books:

1. Herbert Schildt. Java - The Complete Reference, Ninth Edition. Oracle Press, McGraw Hill Education (India) Edition- 2014.

### Reference books:

1. Cay S. Horstmann, Gary Cornell. Core Java, Core Java Volume-1 – Fundamentals, 9th edition, Pearson Education, 2014.
2. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

## ADDITIONAL LEARNING SOURCES:

1. <http://www.oracle.com/technetwork/java/index-jsp-135888.html>
2. <http://www.javaworld.com/article/2074929/core-java>
3. <http://www.javaworld.com/>
4. <http://www.learnjavaonline.org/>
6. <https://www.codecademy.com/learn/learn-java>
7. <http://www.tutorialspoint.com/java/>
8. <http://www.java-examples.com/>
5. <http://www.homeandlearn.co.uk/java/java.html>

Course Code: IT12L

Course Name: Data Structure and Algorithms Practicals

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
--	3 Hrs./Week	1		50		50	100

### **COURSE OUTCOMES:**

Upon successful completion of this course, the student will be able to:

CO1: Design and analyze programming problem statements.

CO2: Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.

CO3: Apply mathematical abstraction to solve problems.

CO4: Demonstrate various methods of organizing large amounts of data.

CO5: Analyze algorithms and to determine algorithm correctness and time efficiency class.

### **LIST OF EXPERIMENTS COVERED:**

#### PROGRAMS ON C.

1. Programs to learn and explore C data types, looping and decision making structures. {mean, median, lcm, gcd, min max}
2. Calculate the salary of an employee given his basic pay, HRA = 10% of basic pay, TA=5% of his basic pay and deductions IT = 2.5% of his basic pay.
3. Solve quadratic equations to find the roots of the equation.
4. Programs to implement arrays and structures. {Ex: Students marks calculation, matrix operations}
5. Calculate the average marks of the student test marks and display the result using structure.
6. Programs to implement dynamic memory allocation: malloc, calloc, realloc and free.

#### STACK

7. Write a C program to evaluate the validity of an expression
8. Write a C program to evaluate a postfix expression.
9. Write a C program to convert an expression from infix to postfix.
10. Write a C program to implement multiple stack of integers.

#### QUEUES

11. Write a C program to perform basic operations on queue of integers, the program should provide the appropriate message to handle all concerned conditions
12. Write a C program to perform basic operations on list of students information stored in circular queue.

Let student information include regno, course title, year of study

13. Write a C program to implement dual queue.

#### LINKED LIST

14. Write a C program to implement stack operations using linked list.

15. Write a C program to implement queue operations using linked list.

16. Write a C program to create the students mark list based on the rank. Let the student record contain student-id, name, total marks.

17. Write a C program to perform operations.

a. Creation of list.

b. Insertion of new element [At Front, from rear, based on the position]

c. Deletion of a node [At Front, from rear, based on the position]

d. Display the list.

e. Replace the content of one element by another element.

f. Swap two nodes

18. Write a C program to perform the following operations on doubly linked list.

a. Creation of list by :

Insertion [ At beginning, At end, In between ] Deletion [ At beginning, At end, In between ]

b. Display all the nodes.

c. Swap two nodes based on specific criteria.

#### TREES

19. Write a C program to perform / implement the binary tree using array and hence perform the following

a. To print the left and right child of specified node

b. To print all the ancestors of a specified node

c. To print all the node in a specific level

d. To print only the leaf node

20. Write a C program to perform / implement the binary tree using linked list and hence perform the following

a. To print the left and right child of specified node

b. To print all the ancestors of a specified node

c. To print all the node in a specific level

d. To print only the leaf node

21. Write a C program with recursive routines to traverse the binary tree in all possible orders

a. Create a tree

b. Pre-Order traversal

c. In-Order traversal

d. Post-Order traversal

22. Write a C program to construct a heap of n integers and hence sort them using heap sort Algorithm

23. Implement the search techniques

- a. Linear Search
- b. Binary Search

Text Books :

1. Programming in ANSI C, Third Edition, E. Balaguruswamy. 6th Edition (2013).
2. Data Structures Using C and C++ by Aaron.M. Tenenbaum, Yedidyah Langsam and Moshe J. Augustine , PHI, Edition, 2011.

Reference Books :

1. Data structures, Algorithms and Applications in C++, S. Sahani, University Press (India) Pvt Ltd, 2nd Edition.
2. The complete reference C, Herbert Schildt, Fifth Edition, Tata McGraw Hill.

1. <http://www.tutorialspoint.com/Data-Structures-in-C-Online-Training/classid=13>

2. [http://nptel.ac.in/datastructures\\_c](http://nptel.ac.in/datastructures_c)

## Semester II

Course Code: IT-21

Course Name: Python Programming

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

### COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

CO1: Design and apply a solution clearly, accurately in a program using python.

CO2: Comprehend and Apply knowledge in real time situational problems and think creatively about solutions.

CO3: Apply the best features of mathematics, engineering and natural sciences to program using python.

CO4: Apply object-oriented programming concepts to develop dynamic interactive Python applications.

CO5: Demonstrate how to build and package python modules for reusability.

### TOPICS COVERED:

#### UNIT 1 - Introduction to Python

10 Hours

Python Basics: Data Types, Operators, Input/Output Statements, Creating Python Programs, Python Flow Control statements: Decision making statements, Indentation, Conditionals, loops, break, continue, and pass statements. Strings, lists, Tuples, Dictionaries

#### UNIT 2 - Python Functions

10 Hours

Defining functions, DOC strings, Function parameters: default, keyword required and variable length arguments, key-word only parameters, local and global variables, pass by reference versus value, Anonymous functions, Recursion. Functional Programming: Mapping, Filtering and Reduction, Lambda Functions, List Comprehensions.



### UNIT 3 - Object Oriented Programming

10 Hours

Definition and defining a class, Constructor, Destructor, self and del keywords, Access to Attributes and Methods, getattr and setattr attributes, Data Attributes and Class Attributes, Data Hiding, Inheritance, Static Members. Regular Expressions: Defining Regular Expressions and String Processing.

### UNIT 4 - File Handling and Python GUI Programming

10 Hours

File object attributes, Read and Write into the file, Rename and Delete a File, Exceptions Handling: Built-in Exceptions and User defined Exceptions GUI Programming, Introduction to Python GUI Programming, Tkinter Programming, Tkinter widgets, Events and Bindings

### UNIT 5 - Working with Django 12 Hours

Rendering Templates into HTML and Other Formats, Understanding Models, Views, and Templates, Separating the Layers (MVC) - Models, Views, Templates, Overall Django Architecture, Defining and Using Models, Using Models, Templates and Form Processing, Setting up the Database, Using a Database Server, Using SQLite, Creating the Tables

#### **TEXT BOOKS / REFERENCES:**

Text books:

1. Timothy A. Budd: Exploring Python, Tata McGraw-Hill, 2011.
2. Jeff Forcier, Paul Bissex, Wesley Chun: Python Web Development with Django, Addison-Wesley, 2008.

Reference books:

1. Ascher, Lutz: Learning Python, 4th Edition, O'Reilly, 2009.
2. Wesley J Chun: Core Python Applications Programming, Pearson Education, 3rd Edition, 2013.
3. Paul Gries, Jennifer Campbell, Jason Montojo , Practical Programming: An introduction to Computer Science Using Python, second edition, Pragmatic Bookshelf.
4. Allen Downey , Jeffrey Elkner , Learning with Python: How to Think Like a Computer Scientist Paperback –, 2015

#### **ADDITIONAL LEARNING SOURCES:**

<http://www.network-theory.co.uk/docs/pytut/> <http://docs.python.org/tutorial/>  
<http://zetcode.com/tutorials/pythontutorial/> <http://www.sthurlow.com/python/>  
<http://www.tutorialspoint.com/python/> <http://www.djangoproject.com/>  
<http://www.djangobook.com/>

Course Code: IT-22

Course Name: Software Architecture

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, the student will be able to:

CO1: Comprehend the need and importance of software architectures.

CO2: Differentiate various architectural styles based on requirement.

CO3: Implement system qualities during architecture development for the application.

CO4: Apply pattern oriented architecture by understanding patterns and their descriptions.

CO5: Design and document the software architecture.

**TOPICS COVERED:**

**UNIT 1 - Introduction, Architectural Styles 12 Hours**

The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a “good” architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views.

Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures.

**UNIT 2 - Understanding and Achieving Quality Attributes 10 Hours**

Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities.

Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles.

**UNIT 3 - Architectural Patterns – From Mud to Structures, Distributed Systems 12 Hours**

Introduction: From mud to structure: Layers, Pipes and Filters, Blackboard. Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control.

UNIT 4 - Adaptable Systems & Other systems            08 Hours

Adaptable Systems: Microkernel; Reflection. Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy.

UNIT 5 - Designing and Documenting Software Architecture            10 Hours

Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; Choosing the relevant views; Documenting a view; Documentation across views.

**TEXT BOOKS / REFERENCES:**

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 3d Edition, Pearson Education, 2013.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2012.
3. Mary Shaw and David Garlan: Software Architecture -Perspectives on an Emerging Discipline, Prentice Hall of India, 2010.

Reference books:

1. Richard N. Taylor, Nenad Medvidovic and Eric M. Dashofy: Software Architecture: Foundations, Theory, and Practice, Wiley- India 2012.

**ADDITIONAL LEARNING SOURCES:**

1. <http://www.sei.cmu.edu/architecture/>
2. <http://handbookofsoftwarearchitecture.com/>
3. <https://leanpub.com/software-architecture-for-developers/read>
4. <http://www.hillside.net/patterns/>

Course Code: MT-21

Course Name: Optimization Techniques

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30			70	100

Prerequisite: Basic mathematical knowledge is essentials.

Course Objectives:

1. To understand the role and principles of optimization techniques in business world.
2. To understand the process of problem statement formulation of the business scenario.
3. To understand the implementation of various decision-making techniques in the process of decision making.
4. To gain the techniques and skills on how to use optimization techniques to support the decision making in business world.

Course Outcomes:

Student will be able to

CO1: Understand the role and principles of optimization techniques in business world (Understand)

CO2: Demonstrate specific optimization technique for effective decision making (Apply)

CO3: Apply the optimization techniques in business environments (Apply)

CO4: Illustrate and infer for the business scenario (Analyze)

CO5: Analyze the optimization techniques in strategic planning for optimal gain. (Analyze)

UNIT 1 Linear Programming

10 Hours

Various definitions, statements of basic theorems and properties, Advantages and Limitations

application areas of Linear programming ,Linear Programming – Concept

Formulation of Linear programming, Solution of LPP using Graphical method

Simplex Method and Problems, Two Phase Simplex Method and problems

UNIT 2 Markov Chains & Simulation Techniques:

12 Hours

Markov chains: Applications related to technical functional areas,

Steady state Probabilities and its implications, Decision making based on the inferences Monte Carlo Simulation. Application of Markov chain in Queuing theory, Simulation techniques used in Machine learning and bioinformatics.

### UNIT 3 Sequential model and related Problems

10 Hours

Processing  $n$  jobs through 2 machines ,Processing  $n$  jobs through 3 machines  
Processing  $n$  jobs through  $m$  machine. PERT and CPM: Basic differences between PERT and CPM. Network diagram:Time estimates (Forward Pass Computation, Backward Pass Computation ,Critical Path,Probability of meeting scheduled date of completion, Calculation on CPM network. Various floats for activities, Event Slack: calculation on PERT network. Application of schedule based on cost analysis and crashing Case study-based problems

### UNIT 4 Game Theory

12 Hours

Introduction, $n \times m$  zero sum game with dominance ,Solution using Algebraic, Arithmetic and Matrix strategy

Decision Analysis

Introduction to Decision Analysis, Types of Decision-making environment

Decision making under uncertainty and under risk, Concept of Decision Tree.

Text Books:

1. Operations Research by Pannerselvam
2. Operations Research Theory and Application by J. K. Sharma –Mac-Millan Publication
3. Statistical and Quantitative Methods – Mr. Ranjit Chitale

Reference Books:

1. Statistical Methods – S.P.Gupta, Sultan Chand, New Delhi
2. Operation Research by V. k. Kapoor
3. Operations Research by Kanti Swaroop, P. K. Gupta and Man Mohan
4. Introduction to Operations Research by Hiller & Lieberman, Tata Mc Graw Hill
5. Operations Research by H. A. Taha
6. Operation Research by Hira & Gupta
7. What is Game Theory?, David K. Levine, Economics, UCLA

Practicals to be conducted on the following topics. It is expected that, Applications to be covered using Python and /or R

1. Linear Programming
2. Markov Chain and Simulation Techniques
3. Sequential models and related problems
4. CPM and PERT
5. Game Theory
6. Decision Analysis

Course Code: IT-23

Course Name: Advanced Internet Technologies

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30	-	-	70	100

Course Description:

Course Outcomes:

Student will be able to

CO1: Outline the basic concepts of Advance Internet Technologies (Understand)

CO2: Design appropriate user interfaces and implements webpage based on given problem Statement (Apply)

CO3: Implement concepts and methods of NodeJS (Apply)

CO4: Implement concepts and methods of Angular (Apply)

CO5: Build Dynamic web pages using server-side PHP programming with Database Connectivity (Apply)

Course Structure:

#### UNIT 1 Introduction to HTML5

Basics of HTML5 – Introduction, features, form new elements, attributes and semantics in HTML5, <canvas>, <video>, <audio>.

Introduction to Scalable Vector Graphics (SVG), Introduction to Version compatibility  
Installation of Apache Tomcat (Xampp/Lampp/MySQL)

#### UNIT 2 Introduction to CSS3

Architecture of CSS, CSS Modules, CSS Framework, Selectors and Pseudo Classes, Fonts and Text Effects, Colors, Background Images, and Masks, Transitions, Transforms and Animations Embedding Media, Gradients, Bootstrap

#### UNIT 3 Node JS

introduction and how it works, installation of node js, REPL, NPM, How modules work, Webserver Creation, Events

Extra Reading: Node.js with MySQL

#### UNIT 4 Angular (Latest Stable Version)

Introduction (Features and Advantage), Type Script , Modules, Components, Directives, Expression, Filters, Dependency Injection, Services, Routing, SPA (Single Page Application)

#### UNIT 5 PHP

##### Installing and Configuring PHP

Introduction, PHP and the Web Server Architecture, PHP Capabilities, PHP and HTTP, Environment Variables, Variables, Constants, Data Types, Operators  
Working with Arrays, Decision Making, Flow Control and Loops, Introduction to Laravel, Creating a Dynamic HTML Form with PHP, Database Connectivity with MySQL, Performing basic database operations (CRUD), Using GET, POST, REQUEST, SESSION, and COOKIE Variables

Extra Reading: Sending Emails, PHP with AJAX and XML, Payment Gateway Integration

#### Text Books:

1. Complete reference HTML, TMH
2. HTML5 & CSS3, Castro Elizabeth 7th Edition
3. Beginning Node.js by Basarat Ali Syed
4. Angular: Up and Running- Learning Angular, Step by Step by Shyam Seshadri
5. Beginning PHP, Apache, MySQL web development Reference Books
6. Introducing HTML5 - Bruce Lawson, Remy Sharp
7. Node.js in Action, 2ed by Alex Young, Bradley Meck
8. Mastering Node.js by Pasquali Sandro
9. Angular Essentials by Kumar Dhananjay Complete Ref. PHP

Course Code: IT-24

Course Name: Advanced DBMS

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Course Description:

### 1. Introduction DBMS – Concepts & Architectures

Database and Need for DBMS, Characteristics of DBMS

Database 3-tier schema (ANSI/SPARC) and system architecture of DBMS

Views of data- Schemas and instances, Data Independence

Centralized, Client-Server system, Transaction servers, Data servers, Cloud based servers

Indexing and Hashing - Basic concepts of indexing, ordered index, B+ tree index, B+ tree extensions, Multiple key access, Hashing concepts, types of hashing, Bitmap indices.

### 2. Data Modelling and Relational Database Design

Data Modelling using ER Diagram: Representation of Entities, Attributes, Relationships and their Type, Cardinality, Generalization, Specialization, Aggregation.

Relational data model: Structure of Relational Database Model, Types of keys, Referential Integrity Constraints, Codd's rules, Database Design using E-R, E-R to Relational

Normalization – Normal forms based on primary (1 NF, 2 NF, 3NF, BCNF)

Note: Case studies based on E-R diagram & Normalization

Extra Reading: Database languages - Relational Algebra, Relational database languages, Data definition in SQL, Views and Queries in SQL, Joins, specifying constraints and Indexes in SQL, Specifying constraints management systems Postgres/ SQL/MySQL.

### 3. Transaction and Concurrency control

Concept of transaction, ACID properties, States of transaction

Concurrency control, Problems in concurrency controls

Scheduling of transactions, Serializability and testing of serializability

Lock-based Protocol and Time stamp-based ordering protocols, Deadlock Handling

### 4. Parallel Databases



Introduction to Parallel Databases, Parallel Database Architectures  
I/O parallelism, Inter-query and Intra-query parallelism  
Inter-operational and Intra-operational parallelism  
Key elements of parallel database processing: Speed-up, Scale-up Synchronization and Locking

## 5. Distributed Databases

Introduction to Distributed Database System, Homogeneous and Heterogeneous Databases, Distributed data storage (Fragmentation and Replication), Distributed transactions, Concurrency control schemes in DDBMS  
Commit protocols 2 phase and 3 Phase Commit Protocol

## 6. Object Oriented Databases & Applications

Overview of Object- Oriented Database concepts & characteristics  
Database design for OODBMS – Objects, OIDs and reference type  
Spatial data and Spatial indexing (Any two techniques)  
Mobile Database: Need, Structure, Features, Limitations and Applications  
Temporal databases, temporal aspects valid time, transaction time or decision time  
Multimedia Database: Architecture, Type and Characteristics.

## 7. Crash Recovery and Backup, Failure classifications, Recovery & Atomicity, Log based recovery, Checkpoint and Shadow Paging in Data recovery, Database backup and types of backups

## 8. Security and Privacy

Database security issues, Discretionary access control based on grant & revoking privilege, Mandatory access control and role-based access control for multilevel security, Encryption & public key infrastructures

## 9. NO-SQL Database

Introduction, Types of NOSQL, Need of NoSQL databases, Use Cases

Recommended Books:

1. Introduction to database systems C.J. Date, Pearson.
2. Fundamentals of Database Systems by Elmasri Navathe
3. Principles of Database Management James Martin, PHI
4. Database System Concepts by Abraham Silberschatz, H. Korth, Sudarshan

Reference Books:

Database Management System by Raghu Ramakrishnan / Johannes Gherke

Database Management System (DBMS) A Practical Approach. By Rajiv Chopra

Database system practical approach to design, implementation & management by Connolly & Begg,

NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence Martin Fowler

List of Practicals (if any)

To install and configure database software (ORACLE/MYSQL)

To design a database (logical & physical database)

To Perform all SQL operations and queries on designed physical database

To install and configure NO-SQL database and practice for core operations

To perform experiments on database crash and recovery

To perform experiments on database Backup – restoring operations on database server

To perform some operations on Object oriented databases

Course Code: IT-25

Course Name: Analysis and Design of Algorithms

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

**CO 1:** Apply object oriented techniques to solve bigger computing problems

**CO 2:** Explore the knowledge of computational complexity, approximation and randomized algorithms

**CO 3:** Analyze the range of the algorithm and the notion of tractable and intractable problems

**CO 4:** Design and analyze a wide range of searching and sorting algorithms

**CO 5:** Implementation of graph and matching algorithms

**TOPICS COVERED:**

**UNIT 1 - Introduction and overview of C++ Programming 12 Hours**

C++ Class Overview- Class Definition, OOPs concepts ,Objects, Class Members, Access Control, Class Scope, Inheritance and Polymorphism ,Constructors and destructors, parameter passing methods, Inline functions, static class members, this pointer, friend functions, dynamic memory allocation and deallocation (new and delete), Exception handling.

**UNIT 2 - Introduction and the fundamentals of the Analysis of Algorithm Efficiency 12 Hours**

Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental data Structures. Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples

**UNIT 3 - Brute Force and Divide and Conquer 10 Hours**

Selection Sort and Bubble Sort, Sequential Search and String Matching, Exhaustive Search, Merge- sort, Quick-sort, Binary Search, Binary tree Traversals and related properties.

#### UNIT 4 - Decrease-and-Conquer, Transform-and-Conquer 10 Hours

Insertion Sort, Depth First search and Breadth First Search, Topological sorting, Algorithms for Generating Combinatorial Objects. Presorting, Balanced Search Trees, Heaps and Heap sort, Problem Reduction.

#### UNIT 5 - Space and Time Tradeoffs and Dynamic Programming 10 Hours

Sorting by Counting, Input Enhancement in String Matching, Computing a binomial coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions.

#### Text Book:

1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson Education, 2003.
2. Herbert Schildt: The Complete Reference C++, 6th Edition, Tata McGraw Hill 2013.

#### References:

1. Cormen T.H., Leiserson C.E., and Rivest R.L.: Introduction to Algorithms, PHI, 1998.
2. Horowitz E., Sahani S., Rajasekharan S.: Computer Algorithms, Galgotia Publications, 2001.

#### ADDITIONAL LEARNING SOURCES:

1. [https://www.tutorialspoint.com/data\\_structures\\_algorithms/](https://www.tutorialspoint.com/data_structures_algorithms/)
2. <http://nptel.ac.in/courses/106101060/>

Course Code: IT-21L

Course Name: Practicals

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
-	10 Hrs./Week	5	-	75	-	50	125

Course Description:

This Practical course contains 2 sections. –

1. List of Practicals – Python Programming
2. List of Practicals – Advanced Internet Technologies

Course Outcomes:

Student will be able to

CO1: implement python programming concepts for solving real life problems. (Apply)

CO2: Implement Advanced Internet Technologies (Apply)

Course Structure:

List of Practicals – Python Programming

Note:

- Recommended IDE for python – IDLE
- Exception handling concepts should be used with file handling programs.
  1. Python installation and configuration with windows and Linux
  2. Programs for understanding the data types, control flow statements, blocks and loops
  3. Programs for understanding functions, use of built in functions, user defined functions
  4. Programs to use existing modules, packages and creating modules, packages
  5. Programs for implementations of all object-oriented concepts like class, method, inheritance, polymorphism etc. (Real life examples must be covered for the implementation of object- oriented concepts)
  6. Programs for parsing of data, validations like Password, email, URL, etc.
  7. Programs for Pattern finding should be covered.
  8. Programs covering all the aspects of Exception handling, user defined exception, Multithreading should be covered.
  9. Programs demonstrating the IO operations like reading from file, writing into file from different file types like data file, binary file, etc.
  10. Programs to perform searching, adding, updating the content from the file.
  11. Program for performing CRUD operation with MongoDB and Python

12. Basic programs with NumPy as Array, Searching and Sorting, date & time and String handling
13. Programs for series and data frames should be covered.
14. Programs to demonstrate data pre-processing and data handling with data frame
15. Program for data visualization should be covered.

#### List of Practicals – Advanced Internet Technologies

1. Program to implement Audio and Video features for your web page.
2. Program to design form using HTML5 elements, attributes and Semantics.
3. Programs using Canvas and SVG.
4. Programs to demonstrate external and internal styles in the web page using font, text, background, borders, opacity and other CSS 3 properties.
5. Implement Transformation using Translation, Rotation and Scaling in your web page.
6. Program to show current date and time using user defined module
7. Program using built-in modules to split the query string into readable parts.
8. Program using NPM which will convert entered string into either case
9. Write a program to create a calculator using Node JS. (Install and configure Node JS and Server)
10. Write Program for Form validation in Angular.
11. Program to demonstrate the ngif, ngfor, ngswitch statements.
12. Create angular project which will demonstrate the usage of component directive, structural directive and attribute directives
13. Create angular project which has HTML template and handle the click event on click of the button (Installation of Angular and Bootstrap 4 CSS Framework)
14. Program for basic operations, array and user interface handling.
15. Program to demonstrate session management using various techniques.
16. Program to perform the CRUD Operations using PHP Script.

Course Code: ET-21

Course Name: Artificial Intelligence and Robotics

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to:

**CO1:** Find appropriate idealizations for converting real world problems into AI problems formulated using the appropriate search algorithm.

**CO2:** Formulate and implement the appropriate search algorithms to find the solutions for real time and heuristics problems.

**CO3:** Represent and debug knowledge in an appropriate first order logic representation with the understanding of the fundamentals of knowledge representation.

**CO4:** Choose and Implement the appropriate algorithms for a real world supervised learning problem.

**CO5:** Inculcate the basic knowledge of Robotics along with the Artificial Intelligence

TOPICS COVERED:

UNIT: 1 – Introduction to AI, Informed Search and Exploration 10 Hours

Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem solving agents; Example problems; Searching for solution; uninformed search strategies.

Informed search strategies; Heuristic functions; On-line search agents and unknown environment.

UNIT: 2 - Constraint Satisfaction, Adversial Search, Logical Agent 10 Hours

Constraint satisfaction problems; Backtracking search for CSPs. Adversial search: Games; Optimal decisions in games; Alpha-Beta pruning. Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

UNIT: 3 - First-Order Logic, Inference in First-Order Logic:  
Hours

12

Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting; Forward chaining; Backward chaining; Resolution.

UNIT: 4 - Knowledge Representation and Learning, AI: Present and Future 10 Hours

Ontological engineering; Categories and objects; Actions, situations, and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories; Reasoning with default information; Truth maintenance systems.

Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory. AI: Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed? Game theory.

UNIT: 5 – Introduction to Robotics :

10 Hours

Introduction; Robot Hardware: sensors and Effectors; Robotic Perception: localization, mapping, other types of perception; Planning to Move: configuration space, cell decomposition methods and skeletonization methods; Planning uncertain movements: robust methods; Moving: dynamics and control, potential field control and reactive control; Robotic Software: architectures, subsumption architecture , three-layer architecture and robotic programming languages ; Application domains.

#### TUTORIALS:

1. Program to design tic-tac-toe game.
2. Program for breadth first and depth first search.
3. Program to N-Queens Problem.
4. To implement max-min problem.
5. To implement simulated Annealing Algorithm.
6. Write a program to implement A\* program.
7. To implement Hill-Climbing Algorithm.

Text Book / References:

Text Book:

1. Stuart Russel, Petr Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003.

References:

1. Elaine Rich, Kevin Knight: Artificial Intelligence, 2nd Edition, Tata McGraw Hill, 1991.
2. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.



Course Code: ET-22  
 Course Name: NOSQL

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to :

- CO1:** Demonstrate competency in describing how NoSQL databases differ from relational databases from a theoretical perspective.
- CO2:** Demonstrate competency in designing NoSQL database management systems
- CO3:** Use of a number of NoSQL databases to store and retrieve data and perform aggregation functions
- CO4:** Demonstrate competency in selecting a particular NoSQL database for different applications.
- CO5:** Execute various CRUD operations with MongoDB.

**TOPICS COVERED:**

**UNIT 1 – An Overview and Characteristics of NoSQL      10 Hours**

Introduction to NoSQL : An Overview of NoSQL , Defining NoSQL, History, What NoSQL is and what it is not, Why NoSQL?, List of NoSQL Databases. Characteristics of NoSQL: Application, RDBMS approach, Challenges, NoSQL approach.

**UNIT 2 – NoSQL Storage Types      12 Hours**

Modifying and managing NOSQL, Data stores, Indexing and ordering datasets (MongoDB/ CouchDB / Cassandra) NoSQL Storage Types : Storage types, Column-oriented databases, Document store, key-value store, graph store, multi-storage type databases, comparing the models.

**UNIT 3 – Advantages and Drawbacks      10 Hours**

Advantages and Drawbacks : Transactional application, Computational application, Web-scale application. Performing CURD operations : Creating records, accessing data, updating and deleting data.

**UNIT 4 - Querying SQL      10 Hours**

Querying NoSQL stores : similarities between NoSQL and MongoDB query features. Managing data stores and managing evolutions.

## UNIT 5 – Indexing and Ordering 10 Hours

Indexing and ordering data sets: Essential concepts behind database index, indexing and ordering in MongoDB, indexing and ordering in CouchDB, Comparative Study of NoSQL Products Comparison: Technical comparison, Implementation language, Engine types, Speed, Features, Limits, Bulk operations, Bulk read, Bulk insert, Bulk update, Bulk delete, Query options.

### TUTORIAL

#### Case Study

1. Application definition, Requirement analysis, Implementation using MongoDB, Features and constraints.
2. Database design, Database queries, Database modeling, Schema definition, Writing queries.
3. Queries for a single entity, simple result, Queries for a single entity, Aggregate, Queries for a one to one relationship.
4. Queries for a one to many relationship, Queries for a many to many relationship, Miscellaneous queries.
5. Pagination, Limiting items in an array in result set.
6. Plug-in and dynamic data support, Model refinements.
7. Reference using non-ID property, Demoralizations and document embedding.
8. Complete document embedding and Partial document embedding.
9. Bucketing, Cache document approach, Miscellaneous changes.

#### TEXT BOOKS / REFERENCES:

##### TEXT BOOKS :

1. Shanshank Tiwari “Professional NOSQL”, WROX Press, 2011
- Pramod.J.Sadalage and Martin Fowler, “NoSQL Distilled : A Brief guide to the emerging world of polygot persistence”, Pearson Education corporation, I Edition, 2014.

##### Reference Books :

1. The definitive guide to MONGODB, The NOSQL Database for cloud and desktop computing, Apress 2010.

##### ADDITIONAL LEARNING SOURCES:

1. <https://www.mongodb.com/nosql-explained>
2. <http://www.dbta.com/Editorial/Trends-and-Applications/NoSQL-for-the-Enterprise-80198.aspx>
3. <http://www.oracle.com/technetwork/database/databasetechnologies/nosqlldb/overview/in dex.html>

Course Code: ET-23

Course Name: Enterprise Resource Planning

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to,

CO1: Comprehend the basics and concepts of ERP

CO2: Apply different ERP related technologies

CO3: Implement ERP system by utilizing various concepts of ERP

CO4: Analyze different business models of ERP

CO5: Analyze the present and future trends of ERP.

**TOPICS COVERED:**

**UNIT 1 - Introduction 10 Hours**

Enterprise—An Overview, Business Processes, Introduction to ERP, Basics ERP Concepts, Justifying ERP Investments, Risks of ERP, Benefits of ERP.

**UNIT 2 - ERP and Technology 10 Hours**

ERP and Related Technologies, Business Intelligence (BI) and Business Analytics (BA), E-Commerce and E-Business, Business Process Reengineering (BPR), Data Warehousing and Data Mining, On-line Analytical Processing (OLAP).

**UNIT 3 - ERP and Technology 10 Hours**

Product Life Cycle Management (PLM), Supply Chain Management (SCM), Customer Relationship Management (CRM), Geographic Information System (GIS), Advanced Technology and ERP Security.

**UNIT 4 - ERP Implementation 10 Hours**

To be or not to be..., Implementation Challenges, ERP Implementation (Transition) Strategies, ERP Implementation Life Cycle, Pre Implementation Tasks: Getting Ready, Requirements Definition, Implementation Methodologies, ERP Development Methods, Process Definition, Contracts with Vendors, Consultants and Employees, Training and

Education, Data Migration, Project Management and Monitoring, Post-Implementation Activities, Success and Failure Factors of an ERP Implementation

UNIT 5 - The Business Modules      12 Hours

Business Modules of an ERP Packages, Financials, Manufacturing (Production), Human Resource Management, Plant Maintenance, Materials Management, Quality Management, Marketing, Sales, Distribution and Services.

TEXT BOOKS / REFERENCES:

Text books:

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, 14 Aug 2014.

Reference books:

1. Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, “Concepts in Enterprise Resource Planning”, Thomson Learning, 2001.
2. Vinod Kumar Garg and N.K .Venkata Krishnan, “Enterprise Resource Planning – concepts and Planning”, Prentice Hall, 1998.
3. Jose Antonio Fernandz, “The SAP R /3 Hand book”, Tata McGraw Hill, 2006.

TUTORIALS:

Developing Following Applications. Using any Database Systems.

1. Financial System.
2. Manufacturing System.
3. Human Resource Planning.
4. Plant Maintenance.
5. Materials Management System.
6. Quality Management System.
7. Marketing, Sales, & Distributing System etc..

ADDITIONAL LEARNING SOURCES:

1. <http://www.netsuite.com/portal/resource/articles/erp/what-is-erp.shtml>
2. <https://www.managementstudyguide.com/enterprise-resource-planning-1-articles.htm>

## Semester III

Course Code: IT-31

Course Name: Mobile Applications

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be to:

**CO1:** Gain broad understanding of the discipline of Mobile Application Development using J2ME Technology.

**CO2:** Develop User Interface for a J2ME application

**CO3:** Manage data on both service-side components and client-side applications and Address Portability and Compatibility issues between PDA'S and Cell phones.

**CO4:** Implement the design using Android SDK.

**CO5:** Implement the design using Objective C and Ios

TOPICS COVERED:

### Unit 1 - J2ME Overview, Architecture and Development Environment      12 Hours

Java 2 micro edition and the world of java, inside J2ME, J2ME and wireless devices. small computing technology: wireless technology , radio data networks, microwave technology, mobile radio Networks, messaging, personal digital assistants.

J2ME architecture, small computing device requirements, run time environment, midlet programming, java language for J2ME, J2ME software development kits, hello world J2ME style, multiple midlets in a midlet suite, J2ME wireless toolkit.

### Unit 2 - J2ME Best Practices and Patterns      10 Hours

The reality of working in a J2ME world, best practices commands, items, and event processing: J2ME user interfaces , display class, the palm OS emulator, C command class, item class, exception handling. high level display screens: screen class, alert class, form class, item class, list class, text box class, ticker class. low-level display canvas:

The Canvas, User Interactions, Graphics, Clipping Regions, Animation.

### Unit 3 - Record Management System 10 Hours

Record storage, writing and reading records, record enumeration, sorting records, searching records, record listener. JDBC objects: The concept of JDBC, JDBC driver types, JDBC packages, overview of the JDBC process, database connection, statement objects, result set, transaction processing, metadata, data types, and exception.

#### Unit 4 - Technology-I Android-12

10 Hours

Introduction – establishing the development environment – android architecture – activities and views

– interacting with UI – persisting data using SQLite – packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

#### Unit 5 - Technology-II IOS-12

10 Hours

Introduction to objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

#### TEXT BOOKS / REFERENCES:

##### Text Books:

1. James Keogh , J2ME The Complete Reference , Tata McGrawHill.
2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012.
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS.

##### Reference Books:

1. Michael Juntao Yuan, Enterprise J2ME, Developing Mobile Java Applications Pearson Education , 2011.
2. Sing Li, Jonathan B. Knudsen, Beginning J2ME: From Novice to Professional, Third Edition, Apress, 2015.
3. Development: Exploring the iOS SDK”, Apress, 2013.

#### ADDITIONAL LEARNING SOURCES:

1. <http://developer.android.com/develop/index.html>.

Course Code: IT-32

Course Name: Software Testing and Practices

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Course Description:

Upon successful completion of this course, students will be able to: CO1: Gain knowledge on basics of Software Testing, Test case selection and creation . CO2: Illustrate various perspectives of testing with examples. CO3: Use by differentiating boundary value testing, Equivalence class testing, Decision table based testing. CO4: Implement Path testing and Data flow testing based on the requirements CO5: Comprehend different levels of testing, Integration testing and Fault based testing.
TOPICS COVERED:

UNIT 1- Basics of Software Testing 12 Hours

Humans, Errors and Testing, Software Quality; Requirements, Behavior and Correctness, Correctness Vs Reliability; Testing and Debugging; Test Metrics; Software and Hardware Testing; Testing and Verification; Defect Management; Execution History; Test Generation Strategies; Static Testing; Test Generation from Predicates.

Basic Principles, Test case selection and Adequacy

Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback, Test Specification and cases, Adequacy Criteria, Comparing Criteria

UNIT 2- A perspective on Testing, Examples 8 Hours

Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Level of testing, Examples: Generalized pseudocode, The triangle problem, theNextDate function, The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter, Saturn windshield wiper.

UNIT 3 - Boundary value, Equivalence class and Decision table based testing 8 Hours

Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for triangle problem, Next Date function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem.

UNIT 4 - Path Testing, Data flow testing, Levels and Integration Testing 12 Hours

DD Paths, Test coverage metrics, Basis path testing, guidelines and observations, Definition Use testing, Slice based testing, Guidelines and observations. Traditional view of testing

levels, Alternative life cycle models, the SATM systems, separating integration and system testing, Guidelines and observations.

#### UNIT 5 - Fault Based Testing

12 Hours

Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis; From Test case specification to Test Cases, Scaffolding, Generic vs specific Scaffolding, Test Oracles, Self checks as oracles, Capture and Replay.

#### Agile Testing

Definition and description, how is it different from traditional testing, ten principals for testers, business-facing the test that support the testing.

#### TEXT BOOKS / REFERENCES:

##### TEXT BOOKS :

1. Adithya P. Mathur “ Foundations of Software Testing – Fundamental Algorithms and Techniques”, Pearson Education India, 2011
2. Mauro Pezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques”, Wiley India, 2012
3. Paul C Jourgensen, “Software Testing A Craftmans Approach”, Aueredach publications, 3rd edition, 2011
4. Lisa Crisping, Janet Gregory, “Agile Testing : A Practical Guide for Testers and Agile Team”, The Addison Wesley Signature Series, 2009.

##### REFERENCE BOOKS:

1. KshirasagaraNaik, PriyadarshiTripathy: Software Testing and Quality Assurance, Wiley India 2012
2. M.G.Limaye: Software Testing-Principels, Techniques and Tools – McGrawHill, 2009
3. Brain Marick: The Craft of Software Testing, Pearson Education India, 2008
4. Ron Patton: Software Testing, 2nd Edition, Pearson Education, India, 2013

##### ADDITIONAL LEARNING SOURCES:

1. <http://www.softwaretestinghelp.com/agile-scrum-methodology-for-development-and-testing/>
2. <http://crbtech.in/Testing/agile-model-software-testing/>
3. <https://www.getzephyr.com/test-management/agile-model-in-software-testing>
4. <http://www.mountangoatsoftware.com/>
5. <http://www.testingexperience.com/>
6. <http://www.infoq.com/> <http://www.qasymphony.com/>



Course Code: IT-33

Course Name: Cloud Computing

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, the student will be able to:

CO1: Interpret the basic concepts, principles and techniques of data mining.

CO2: Apply knowledge discovery techniques while mining the data; recognize & fixing the issues in data mining.

CO3: To apply the techniques of clustering, classification, association finding, feature selection and visualization of real world data.

CO4: Demonstrate the real world problem has a data mining solution.

CO5: Apply evaluation metrics to select data mining techniques.

**Topics Covered:**

**UNIT 1- Introduction to Cloud Computing**

11 Hours

Defining Cloud Computing, Cloud types, The NIST model, The Cloud Cube Model, Deployment models, Service models, Examining the Characteristics of Cloud Computing, paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing, Assessing the role of open standards. Assessing the Value Proposition: Measuring the Cloud's Value, Early adopters and new application, The laws of clouconomics, Cloud computing obstacles, Behavioral factors relating to cloud adoption, Measuring cloud computing costs, Avoiding Capital Expenditures, Right-sizing, Computing the total cost of ownership, Specifying service level agreements, Defining licensing models. Understanding Cloud Architecture: Exploring the cloud computing stack, Composability, Infrastructure, Platforms. Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud, The Jolicloud Netbook OS, Chromium OS: The browser as an Operating System.

**UNIT 2- Understanding Service and Application by Type**

10 Hours

Defining Infrastructure as a service (IaaS), Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), Defining Identity as a Service (IDaaS), and Defining Compliance as a Service (CaaS). Understanding Abstraction and Virtualization: Using Virtualization technologies, Load Balancing and Virtualization, Understanding Hypervisors,

Understanding Machine Imaging, Porting Applications. Capacity Planning: Capacity Planning, Defining Baseline and Metrics, Network Capacity, Scaling.

UNIT 3 - Exploring Platform as a Service

10 Hours

Defining Services, Using PaaS Application Frameworks Using Google Web Services: Exploring Google Applications, Surveying the Google Application Portfolio, Exploring the Google Toolkit, Working with the Google App Engine. Managing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards.

UNIT 4 - Understanding Cloud Security

10 Hours

Securing the cloud, Securing data, Establishing identity and Presence. Moving Application to the Cloud: Application in the Cloud, Applications and cloud APIs. Working with cloud-based storage: Measuring the digital universe, Provisioning Cloud Storage, Exploring Cloud Backup Solutions, Cloud Storage Interoperability.

UNIT 5: Using Webmail Services

10 Hours

Using Webmail Services: Exploring the cloud Mail Services, Working with syndication services. Communicating with the cloud: Exploring instant messaging, Exploring collaboration technologies, Using social networks. Working with Mobile Devices: Defining the Mobile Market, Using Smart phones with the Cloud.

Text Books/ References:

Text Books:

1. Barrie Sosinsky “Cloud Computing Bible” 2011 by Wiley Publishing, Inc.

Reference Books:

1. Cloud Computing Principles and Paradigms by Rajkumar Buyya 2011, Published by John Wiley & Sons
2. Cloud Computing Theory and Practice by Dan C. Marinescu, 2013, Published by Morgan Kaufmann.

Additional Resource :

1. <https://cloudacademy.com/ebooks>
2. [www.freebookcentre.net](http://www.freebookcentre.net) › Networking Books

Course Code: IT-34

Course Name: Data Warehousing

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

**CO1:** Design a data warehouse or data mart to present information needed by management in a form that is usable for management client & Comprehend several data preprocessing methods.

**CO2:** Ability to do Conceptual, Logical, and Physical design of Data Warehouse

**CO3:** Able to produce and document dimensional models for a data warehouse based on an informal domain description.

**CO4:** Utilize the concept of data warehouse and OLAP for data Warehousing and tools.

**CO5:** xtrapolate knowledge and skills to design a data warehouse to support and provide business solutions

**TOPICS COVERED:**

**Unit 1 - Introduction 12 Hours**

Introduction to Data Warehouse. A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data warehousing to Data Mining. The need for data warehousing, paradigm shift, business problem definition, operational and informational data stores, characteristics. Overview of client/server architecture, server specialization in client/server computing environments, server functions, server hardware architecture, system considerations, risc versus cisc, multiprocessor systems.

**Unit 2 - Data Warehousing Components 10 Hours**

Overall Architecture, data warehouse database, sourcing, acquisition, cleanup and transformation tools, metadata, access tools, data marts, data warehouse administration and management. Business Considerations, design considerations, technical considerations, implementation considerations, benefits of data warehousing.

**Unit 3 - Mapping the data warehouse 10 Hours**

Relational database technology for data warehouse, types, database architectures for parallel processing, parallel RDBMS features, alternative technologies, parallel dbms vendors, data layouts for best access, multidimensional data models, bitmapped indexing, complex data types.

Unit 4 - Data Extraction, Cleanup and Transformation Tools 12 Hours

Tool requirements, vendor approaches, access to legacy data, vendor solutions, transformation engines. Meta data: defined, meta data interchange initiative, metadata repository, metadata management, implementation examples, meta data trends. Need for OLAP, OLAP Guidelines, Categorization of OLAP Tools.

Unit 5 - Business Analysis 08 Hours

Tool Categories, Need for applications, cognos impromptu, applications, methodology, business intelligence market definition, situation overview, future outlook, essential guidance.

Tutorials:

Case Studies:

1. Data Warehousing Solution for One of Europe's Largest Financial Services Groups.
2. Data Warehousing for a Health Benefits Company
3. Data warehousing solution for banking system.
4. Data warehousing solutions for tax fraud with advanced analytics.
5. Data warehousing solutions for international satellite TV service provider.
6. Data warehousing solutions for Correlating data across the business.
7. Business Reporting & Customer Information Datamart Architecture Setup & Roll-out for a global technology company.
8. Global Planning Data Automation.
9. COTS-Anti Money Laundering.
10. Management Information System for Trade Finance.

TEXT BOOKS / REFERENCES:

Text books:

1. Alex Berson, Stephen J smith : Data Warehousing, Data Mining, & OLAP, Tata Mcgraw- Hill, 2012.
2. Gajendra Sharma: Data Mining, Data Warehousing and OLAP, Katson Books, 2010.
3. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2012.

Reference books:

1. Paulraj Ponnaiah : Data Warehousing fundamentals for IT professionals, wiley student publishers, second edition , 2014.
2. Ralph Kimball, Margy Ross : The data warehouse toolkit, third edition , wiley publishers, 2012.

ADDITIONAL LEARNING SOURCES:

1. <https://www.coursera.org/specializations/data-warehousing>.
2. [www.knowledge-management-tools.net/data-warehousing.htm](http://www.knowledge-management-tools.net/data-warehousing.htm).
3. [www.slideshare.net/2cdude/data-warehousing](http://www.slideshare.net/2cdude/data-warehousing).
4. <https://www.edx.org/course/delivering-relational-data-warehouse-microsoft-dat216x>.

Course Code: IT-35

Course Name: NET Technologies

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, the student will be able to:

CO1: Develop application using the concept of .NET framework and basics of C# .NET. CO2: Create server side applications using C#.NET.

CO3: Develop web applications using the ASP.NET.

CO4: Comprehend ASP.NET web form, state management and error handling mechanism.

CO5: Access and manipulate data in a database by using Microsoft ADO.NET

**TOPICS COVERED:**

**UNIT 1 –Introduction to .NET and Basics of C#.NET 12 Hours**

The .NET Framework: The Evolution of Web Development-HTML and HTML Forms, Server-Side Programming, Client-Side Programming. The .NET Framework - C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library, Visual Studio. The .NET Languages, C# Language Basics, Case Sensitivity, Commenting, Statement Termination, Blocks, Variables and Data Types-Assignment and Initializes, Strings and Escaped Characters, Arrays, Enumerations, Variable Operations- Advanced Math, Type Conversions. Object-Based Manipulation- String, DateTime and TimeSpan Types, The Array Type. Conditional Logic-The if, switch Statement. Loops- The for, foreach, while loop, Methods-Parameters, Method Overloading, Optional and Named Parameters, Delegates.

**UNIT 2 – C#.NET Types, Objects, and Namespaces10 Hours**

The Basics About Classes-Static Members, A Simple Class, Building a Basic Class-Creating an Object, Adding Properties, Automatic Properties, Adding a Method, Adding a Constructor, Adding an Event, Testing the Product Class. Value Types and Reference Types-Assignment Operations, Equality Testing, Passing Parameters by Reference and by Value, Reviewing .NET Types. Understanding Namespaces and Assemblies- Using Namespaces, Importing Namespaces, Assemblies. Advanced Class Programming-Inheritance, Static Members, Casting Objects, Partial Classes, Generics.

### UNIT 3 - Developing ASP.NET Applications 10 Hours

Visual Studio: Creating Websites-Creating an Empty Web Application, Websites and Web Projects, The Hidden Solution Files, The Solution Explorer, Adding Web Forms, Designing a Web Page-Adding Web Controls, The Properties Window, and The Anatomy of a Web Form-The Web Form Markup, The Page Directive, The Doctype, The Essentials of XHTML. Writing Code-The Code-Behind Class, Adding Event Handlers, Outlining, IntelliSense, Code Formatting and Coloring, Visual Studio Debugging-The Visual Studio Web Server, Single-Step Debugging, Variable Watches, The Anatomy of an ASP.NET Application-ASP.NET File Types, ASP.NET Application Directories. Introducing Server Controls-HTML Server Controls, Converting an HTML Page to an ASP.NET Page, View State, The HTML Control Classes, Adding the Currency Converter Code, Event Handling, Error Handling

### UNIT 4 – ASP.NET Web Form Basics, State Management & Error Handling 10 Hours

ASP.NET Configuration- The web.config File, Nested Configuration, Storing Custom Settings in the web.config File, The Website Administration Tool (WAT), Web Controls-Basic Web Control Classes, The Web Control Tags, Web Control Classes, List Controls, Table Controls, Web Control Events and AutoPostBack, A Simple Web Page. The Problem of State-View State, Transferring Information Between Pages, Cookies, Session State, Session State Configuration, Application State, An Overview of State Management Choices. Error Handling, Logging, and Tracing-Common Errors, Exception Handling-The Exception Class, The Exception Chain, Handling Exceptions, Throwing Your Own Exceptions, Logging Exceptions, Page Tracing.

### UNIT 5 – ADO.NET Fundamentals 10 Hours

Understanding Databases, Configuring Your Database-SQL Server Express, Browsing and Modifying Databases in Visual Studio, The *sqlcmd* Command-Line Tool. SQL Basics - Running Queries in Visual Studio, The Select, Update, Insert, Delete statement. The Data Provider Model: Direct Data Access-Creating a Connection, The Select Command, The DataReader, Putting It All Together, Updating Data. Disconnected Data Access-Selecting Disconnected Data, Selecting Multiple Tables, Defining Relationships. Introducing Data Binding-Types of ASP.NET Data Binding, How Data Binding Works, Single-Value Data Binding, Repeated-Value Data Binding, Data Source Controls.

### TEXT BOOKS / REFERENCES:

Text books:

1. Matthew MacDonald. Beginning ASP.NET 4 in C# 2010, APRESS, 2010

Reference books:

1. Joseph Mayo. Visual studio 2010 - A beginners guide – BPB Publications 2010
2. Greg Buczek: ASP.Net Developer's Guide, Tata McGraw Hill Edition 4th Edition, 2005.
3. Pro ASP.NET 4 in C# 2010, MacDonald and Freeman

ADDITIONAL LEARNING SOURCES:

1. <https://msdn.microsoft.com/en-us/library/4w3ex9c2.aspx>
2. <http://www.asp.net/>
3. <http://www.aspfree.com/>
4. <http://www.devx.com/dotnet>
5. [asp.net-tutorials.com/localization/local-and-global-resources/](http://asp.net-tutorials.com/localization/local-and-global-resources/)
6. [https://www.tutorialspoint.com/asp.net/asp.net\\_ado\\_net.htm](https://www.tutorialspoint.com/asp.net/asp.net_ado_net.htm)
7. [www.w3schools.com/asp/ado\\_intro.asp](http://www.w3schools.com/asp/ado_intro.asp)
8. <https://www.tutorialspoint.com/soa/index.htm>

Course Code: IT-36

Course Name: Cryptography and Network Security

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to:

**CO 1:** Explore the need for computer security concepts.

**CO 2:** Apply the principles and techniques of symmetric key encryption and public key encryption.

**CO 3:** Demonstrate the specifics of message authentication codes and hash algorithms.

**CO 4:** Analyze the facts of e-mail security and IP security evolution.

**CO 5:** Comprehend Web Security, Secure Electronic Transaction, Intruder detection and Firewalls.

TOPICS COVERED:

#### UNIT 1 – Introduction and Classical Encryption Technique

9 Hours

Computer Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, Model for Network Security. Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

#### UNIT 2 - Block Ciphers, Public Key Cryptography and Key Management

11 Hours

Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The strength of DES, Block Cipher Design Principles, AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example, Principles of Public Key Cryptosystem, The RSA Algorithm, Key Management, Diffie Hellman Key Exchange.

#### UNIT 3 - Cryptographic Hash Functions, Message Authentication Codes

12 Hours

Applications of Cryptographic Hash Functions, Message Authentication, Digital Signatures, Two Simple Hash Functions, Requirements and Security, Security Requirements for Cryptographic Hash Functions, Brute-Force Attacks, Cryptanalysis, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3, Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs.



UNIT 4 – Electronic Mail Security and IP Security

10 Hours

Pretty Good Privacy (PGP), S/MIME, IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations.

UNIT 5 - User Authentication Protocols and Entity Authentication

10 Hours

Web Security Considerations; Secure Socket Layer (SSL) and Transport Layer Security (TLS); Secure Electronic Transaction (SET), Intruders, Intrusion Detection, Firewall Design Principles- Characteristics, Types of Firewall and Firewall Configuration.

Text books:

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, 6th Edition, Pearson Education, 2014.
2. Behrouz A. Forouzan and Debdeep Mukhopadhyay: “Cryptography and Network Security”, 2nd Edition, Tata McGraw-Hill, 2014.

Reference books:

1. Atul Kahate, “Cryptography and Network Security” 2nd Edition, Tata McGraw-Hill Publishing Company, 2010.
2. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi, 2011.
3. Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi, 2010.
4. Network Security Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata McGraw-Hill, 2009.

ADDITIONAL LEARNING SOURCES:

1. <https://mrjacse.wordpress.com/2012/01/06/cryptography-network-security-ebooks/>
2. [www.williamstallings.com/Crypto/Crypto4e.html](http://www.williamstallings.com/Crypto/Crypto4e.html)

Course Code: ET-31

Course Name: Soft Computing

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

Upon successful completion of this course, students will be able to,

**CO1:** Identify and describe soft computing techniques and their roles in building intelligent machines.

**CO2:** Recognize the feasibility of applying a soft computing methodology for a particular problem.

**CO3:** Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.

**CO4:** Apply genetic algorithms to combinatorial optimization problems.

**CO5:** Apply neural networks to pattern classification and regression problems .

TOPICS COVERED:

#### UNIT 1 - Introduction 10 Hours

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets- fuzzy sets crisp relations and fuzzy relations: Cartesian product of relation – classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction – biological background – traditional optimization and search techniques – Genetic basic concepts.

#### UNIT 2 - Neural Networks 10 Hours

McCulloch-Pitts neuron – linear separability – hebb network – supervised learning network: perceptron networks adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto- associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network – unsupervised learning networks: Kohonenself organizing feature maps, LVQ – CP networks, ART network.

#### UNIT 3 - Fuzzy Logic 10 Hours

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle – fuzzy measures – measures of fuzziness -fuzzy integrals –

fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning- fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

#### UNIT 4 – Genetic Algorithm 10 Hours

Genetic algorithm and search space – general genetic algorithm – operators – Generational cycle – stopping condition – constraints – classification genetic programming – multilevel optimization – real life problem- advances in GA.

#### UNIT 5 – Hybrid Soft computing Techniques and Applications 12 Hours

Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

#### TUTORIALS:

Solving simple programs using MATLAB in the following areas:

1. FUZZY Logic techniques.
2. Neural networks techniques.
3. Genetic Algorithm techniques.
4. Hybrid Soft Computing Techniques.

#### TEXT BOOKS / REFERENCES:

Text books:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education,2004.
2. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 2011.

Reference books:

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications”, Prentice-Hall of India Pvt. Ltd., 2006.
2. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.

#### ADDITIONAL LEARNING SOURCES:

1. [http://www.myreaders.info/html/soft\\_computing.html](http://www.myreaders.info/html/soft_computing.html)
2. <http://www.soft-computing.de/>

Course Code: ET-32

Course Name: Big data Analytics

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be

**CO1:** Demonstrate the knowledge, significance structure and sources of Big Data.

**CO2:** Ability to think critically in making decisions based on data analytics, specific to Big Data.

**CO3:** Apply the technical skills in predicative and perspective modelling to support business decisions.

**CO4:** Comprehend decision tools and techniques for data streaming using various algorithms.

**CO5:** Demonstrate the Knowledge gained on mining social network data.

**TOPICS COVERED:**

**UNIT 1 - Introduction to Big Data**

**12Hours**

What is big data? Is the "big" part or the "data" part more important? How is big data different? How is big data more of the same? Risks of big data -why you need to tame big data -the structure of big data- exploring big data, most big data doesn't matter- filtering big data effectively -mixing big data with traditional data- the need for standards-today's big data is not tomorrow's big data. Web data: the original big data -web data overview -what web data reveals -web data in action? A cross-section of big data sources and the value they hold.

**UNIT 2 : Data Analysis**

**08 Hours**

Evolution of analytic scalability – convergence – parallel processing systems – cloud computing – grid computing – map reduce – enterprise analytic sand box – analytic data sets – analytic methods – analytic tools – cognos – microstrategy - pentaho. Analysis approaches – statistical significance – business approaches – analytic innovation – traditional approaches – iterative

**UNIT 3 - Mining Data Streams**

**10 Hours**

Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating

moments, counting oneness in a window, decaying window, realtime analytics platform(rtap) applications, case studies, real time sentiment analysis, stock market predictions.

#### UNIT 4 - Frequent Item sets and Clustering

10 Hours

Mining frequent itemsets - market based model – apriori algorithm – handling large data sets in main memory – limited pass algorithm – counting frequent itemsets in a stream – clustering techniques – hierarchical – k- means – clustering high dimensional data – clique and proclus – frequent pattern based clustering methods – clustering in non-euclidean space – clustering for streams and parallelism.

#### UNIT 5 : Frameworks and Visualization

10 Hours

Mapreduce – hadoop, hive, mapr – sharding – nosql databases - s3 - hadoop distributed file systems –visualizations - visual data analysis techniques, interaction techniques; systems and applications.

#### TUTORIALS

Case Studies:

1. Medicare and Medicaid Services : Integrity of health care data and secure payment processing.
2. Tesco PLC.
3. American Express Co.
4. Mobile Telecom Harnesses Big Data with Combined Actuate and Hadoop Solution.
5. Re-engineering a Telecom Market Share Analytical Application.
6. Telco Case Study: Vodafone and Argyle Data on using big data to combat fraud.
7. MTS India relies on HP Vertica in a highly competitive telecom market.
8. McLaren’s Formula One racing team : real time car sensor data during car races.

#### TEXT BOOKS / REFERENCES:

Text books:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2013.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014

Reference books:

1. Paul Zikopoulos, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Professional, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, Big Data Glossary, O’Reilly.

3. Chuck Lam, “Hadoop in Action”, Dreamtech Press.

ADDITIONAL LEARNING SOURCES:

1. [https://www.tutorialspoint.com/big\\_data\\_tutorials.html](https://www.tutorialspoint.com/big_data_tutorials.html).
2. <https://www.lynda.com/Big-Data-training-tutorials/2061-0.html>.
3. [https://www.tutorialspoint.com/hadoop/hadoop\\_big\\_data\\_overview.html](https://www.tutorialspoint.com/hadoop/hadoop_big_data_overview.html).
4. <https://bigdatauniversity.com>.

Course Code: ET-33

Course Name: SOFTWARE PROJECT MANAGEMENT

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

CO1: Comprehend software project management basics and approaches

CO2: Analyze different project management initiation techniques

CO3: Apply proper project planning and scheduling techniques

CO4: Execute software projects with efficient control mechanisms

CO5: Decide on closure of projects using standard and agile methodologies

**TOPICS COVERED:**

**UNIT 1 -Software Project Basics**

10 Hours

Introduction, Types of Software Projects, Classifications of Software Projects, Based on Software Development Life Cycle, Approach Driven, Maintenance, Web Application, Agile Development, Conclusion

Approaches to Software Project Management:Alignment of Software Engineering Methodology with Project Management Methodology, The Ad Hoc Methods-Based Approach, The Process-Driven Approach, So, What Is the Right Approach?, The Ad Hoc Approach, The Process-Driven Approach, But Is a Process-Driven Approach the Right Choice?, In a Process-Driven Approach: What Process and How Much?

Software Project Acquisition:From an External Client, The Request for Proposal, The Proposal, Negotiation, Contract Acceptance, From an Internal Client, The Feasibility Study, Preparing the Proposal, Finalizing the Proposal, Reference.

**UNIT2 -Software Project Initiation**

10 Hours

Introduction, Initiation Activities, Project Management Office-Level Activities, Identifying the Software Project Manager, Preparing/Handing Over the Project Dossier to the Software Project Manager, Coordinating Allocation of Project Resources, Assisting the Software Project Manager in Obtaining Necessary Service Level, Agreements from Departments in the Organization, Assisting the Software Project Manager with the Project Kickoff Meeting, Software Project Manager-Level Activities, Ensuring that Project Specifications Are

Complete, Reviewing Estimates and Revisions/Updates of Estimates, Identifying Necessary Resources and Raising Requests, Preparing Project Plans, Setting Up the Development Environment, Arranging for Project-Specific Skill Training, Organizing the Project Team, Training the Project Team on the Project Plans, Conducting a Project Kickoff Meeting, Arranging for a Phase-End Audit, Common Pitfalls in Project Initiation, Identifying the Wrong Software Project Manager, Identifying Inappropriate Resources, Incurring Delays in Software Project Initiation Activities.

#### UNIT3 -Software Project Planning 10 Hours

Introduction, Planning Defined, Plans Prepared in Software Project Management, The Project Management Plan, Resources, Skill Sets, Computer Systems, Project Management Method, The Configuration Management Plan, Naming Conventions, Change Management, The Quality Assurance Plan, The Schedule Plan, The Induction Training Plan, The Risk Management Plan, The Build Plan, The Deployment Plan, The User Training Plan, The Handover Plan, The Software Maintenance Plan, The Documentation Plan, Roles in Planning.

Scheduling: Introduction, The Initial Work Breakdown Structure, A Work Breakdown Structure with Predecessors Defined, A Work Breakdown Structure with Initial Dates, A Work Breakdown Structure with Resource Allocation, Scheduling in Practice, Graphic Representation of a Schedule

#### UNIT 4 -Software Project Execution 10 Hours

Introduction, Work Management, Work Registers, De-allocation, Configuration Management, Information Artifacts, Code Artifacts, Configuration Registers, Configuration Management Tools, Quality Management, Verification Techniques, Validation Techniques, Product Testing, Allocation of Quality Assurance Activities, Productivity Management, Stakeholder Expectations Management, Product Integration Management.

Software Project Execution Control: Introduction, Aspects of Control in Project Execution, Scope Control, Cost Control, Schedule/Progress Control, Quality Control, Effort Control, Productivity Monitoring, Control Mechanisms, Progress Assessment: Earned Value Analysis.

#### UNIT 5 - Software Project Closure 12 Hours

Introduction, Identifying Reusable Code Components, Documenting the Best Practices, Documenting the Lessons Learned, Collecting/Deriving and Depositing the Final Project Metrics in the Organizational Knowledge Repository, Conducting Knowledge-Sharing Meetings with Peer Software Project Managers, Depositing Project Records with the Project Management Office, Depositing Code Artifacts in the Code Repository, Conducting the Project Postmortem, Releasing the Software Project Manager, Closing the Project, The Role of the Organization in Project Closure, The Project Management Office, The Configuration Control Board, The Systems Administration Department, Reference.



Agile Project Management: Introduction, Project Management Roles, Agile Project Management Characteristics, Metaphor, Teamwork and Collaboration, Guiding Principles, Open Information, Use a Light Touch, Monitoring and Adjustment, The Nuts and Bolts of Agile Project Management, Planning the Work, Controlling the Work, Process Improvement, Reference.

#### TUTORIALS:

Writing Cases for the following.

1. Writing requirement Proposal.
2. Writing Negotiation Proposal.
3. Writing Feasibility Study Proposal.
4. Software Project Planning Proposal.
5. Software Project Execution Control Proposal.
6. Writing Schedules
7. Software Project Closure

#### TEXT BOOKS / REFERENCES:

Text books:

1. “Mastering Software Project Management: Best Practices, Tools and Techniques”, Murali Chemuturi, Thomas M. Cagley, J. Ross Publishing, 2010,

Reference books:

1. “IT Project Management – On track from Start to Finish”, Book by Joseph Phillips, 2002.
2. “Managing the unmanageable” by Mantle and Lichty, 2012.
3. Making Things Happen: Mastering Project Management by Scott Berkun, 2008.

#### ADDITIONAL LEARNING SOURCES:

1. [https://www.tutorialspoint.com/software\\_engineering/software\\_project\\_management.htm](https://www.tutorialspoint.com/software_engineering/software_project_management.htm)
2. <http://searchsoftwarequality.techtarget.com/tutorials/Software-Project-Management-Process>

Course Code: BM-41

Course Name: BUSINESS INTELLIGENCE

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
4 Hrs./Week	-	4	30		-	70	100

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to,

CO1: Comprehend the basics and fundamentals of BI with its business and technical needs

CO2: Use the requirements and architectural framework of BI

CO3: Know and differentiate different components of the BI framework

CO4: Design BI concepts by understanding the requirement needs

CO5: Analyze and implement advanced BI techniques and analytics

**TOPICS COVERED:**

**UNIT 1-The Business Demand for Data, Information, and Analytics**

**10 Hours**

Just One Word:Data, Welcome to the Data Deluge, Data Volume, Variety, and Velocity, Taming the Analytics Deluge, The Importance of Analytics, Analytics Challenge, Analytics Strategy, Too Much Data, Too Little Information, The Difference Between Data and Information, The Role of BI in Creating Actionable Information, The Information Backbone, Data Capture versus Information Analysis, The Roles of BI and Operational Systems, Operational BI Blurs the Lines, Where Data Warehousing Fits in, The Five Cs of Data, Common Terminology from Our Perspective, References.

Justifying BI: Building the Business and Technical Case:Why Justification is Needed, Building the Business Case, Review Organization's Business Initiatives and Processes, Solicit BI Sponsorship, Enlist BI Stakeholders, Identify Business Processes Affected by BI, Document Business Benefits, Determine Business Value(Tangible Benefits), Business the Technical Case, Technology and Product Short Lists, Convincing Business People, Convincing the Technologists, Assessing Readiness, Data and Data Quality, Expertise and Experience, Organizational and Cultural Change, Financial and Resource Commitment, Creating a BI Road Map, Developing Scope, Preliminary Plan and Budget, Project Scope, Project Plan, Project Budget, Calculating Benefits and ROI, Obtaining Approval, Common Justification Pitfalls, Overzealous Business Sponsor, CIO is Sole Sponsor, Intangible or Too High-Level Benefits, Confusion Between BI Technology and Business Value.

**UNIT 2-Defining Requirements-Business, Data and Quality**

**10 Hours**

The Purpose of Defining Requirements, Goals, Deliverables, Roles, BI Team Participants, Business Participants, Other IT Participants, Defining Requirements Workflow, Business Requirements, Data (and Data Quality) Requirements, Functional Requirements, Regulatory/Compliance Requirements, Technical Requirements, Reverse Engineering (When Necessary), Putting It All Together, Prioritizing Requirements, Interviewing, Preparation for Interviews, Conducting the Interviews, Reviewing Interview Content, Interview Follow-ups, Documenting Requirements.

Architecture Framework: The Need for Architectural Blueprints, Architectural Framework, Information Architecture, Data Architecture, The Rise of the Enterprise Data Warehouse, Data Warehousing Replaces the Data Warehouse, Technical Architecture, Business Intelligence, Data Warehouse and BI Data Stores, Data Integration, Source Systems, BI Technology Keeps Evolving, Product Architecture, Metadata, What is It?, What to do About It, Security and Privacy, Getting Started, Implementing the Plan, Avoiding Accidents with Architectural Planning, The Signs of Accidental Architectural Planning, Recovering from an Accidental Architecture, Do Not Obsess over the Architecture.

#### UNIT 3-Information Architecture

10 Hours

The Purpose of an Information Architecture, Data Integration Framework, DIF Information Architecture, Data Preparation, Data Franchising, BI and Analytics, Data Management, Metadata Management, Operational BI versus Analytical BI, Shift All Reporting to the Application-Specific Environment, Shift All Reporting to the DW- Based BI Environment, Blend Application-Specific and DW BI Environments, Master Data Management, Identify the Data, Find the Problem Areas, Assess a Solution.

Data Architecture: The Purpose of a Data Architecture, History, Prehistory, In the Beginning, Data Warehousing Goes Public, The Data Mart, Multiple Data Marts, Operational Data Store (ODS), Federated DWs, BI Accidental Architecture, Hub-and-Spoke, Data Architectural Choices, Data Categories, Selecting a Data Architecture, The Same But Different, Analytical Data Architecture (ADA), Data Integration Workflow, Data Integration Workflow— Hub-and-Spoke, Data Workflow of the System of Integration (SOI), Data Workflow of the System of Analysis (SOA), Data Workflow— Rise of EDW Again, Operational Data Store, The Relational for an ODS, ODS Reexamined, ODS is Dead, Long Live ODS, References.

#### UNIT 4-Technology & Product Architectures

10 Hours

Where are the Product and Vendor Names?, Evolution Not Revolution, Technology Platforms, Enterprise Applications, Data Management, Technology Architecture, Business Intelligence and Analytics, Information Access and Data Integration, Databases, Product and Technology Evaluations, BI Product Vendors, Dazed and Confused, Technology and Product Evaluations, Product Migration.

Business Intelligence Applications: BI Content Specifications, Revise BI Applications List, BI Personas, Casual Consumers, Analyst, Power Users, Data Scientists, BI Design Layout—

Best Practices, Focus on the Purpose, Design Layout, Data Design for self-Services BI, The Last Data Preparation Step, When Inconsistency is Reintroduced, OLAP Cubes and In-Memory Columnar Databases, Matching types of analysis to Visualizations, Comparative Analysis, Time-series or Trending Analysis, Contribution Analysis, Correlation Analysis, Geographic Data, Distribution Analysis.

#### UNIT 5-BI Design and Development

12 Hours

BI Design, BI User Interface(UI) Standards, Create Privacy, Security and Access Standards, Designing Each BI Application, BI Development, Prototyping Lifecycle, BI Application Development Tasks, BI Application Testing.

Advanced Analytics: Advanced Analytics Overview and Background, The Window to the Future, Don't Ignore the Past, Advanced Analytics in Action, Predictive Analytics and Data Mining, Setting Up a Predictive Analytics or Data Mining Program, Tasks for Developing and Using Models, Selecting Tools, Architecture for Predictive Analytics and Data Mining, Techniques for Predictive Analytics and Data Mining, Resources and Skills, Roadblocks to Success, Analytical Sandboxes and Hubs, Analytical Sandboxes, Analytical Hubs, Hub and Sandbox Design Principles, Hub and Sandbox Architecture Options, Advice for Hubs and Sandboxes, Big Data Analytics, Scope, The Program, Hybrid Architecture, The Big Data Team, Big Data Analytics Worst Practices, Data Visualization, Why Data Visualization is Needed, Why Data Visualization is Not, References.

#### TUTORIALS:

1. Case study on requirement specification.
2. Defining a requirement workflow.
3. Writing technical requirement specification.
4. Prioritizing the requirements.
5. Writing a BIE roadmap.
6. Writing & Defining scope objectives & outcomes.
7. Writing a plan & budget.
8. Writing Data Management techniques.
9. Creating data marts & operational data stores.
10. Creating OLAP Cubes.

#### TEXT BOOKS / REFERENCES:

Text books:

1. "Business Intelligence Guidebook: From Data Integration to Analytics" Book by Rick Sherman, 1st Edition, 2014.

Reference books:

1. Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications by Larissa T. Moss and ShakuAtre, February 25th 2003.

2. Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big Data Hardcover– Import, 1 Nov 2013.
3. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Revised and Updated Paperback– 22 Feb 2016.

ADDITIONAL LEARNING SOURCES:

1. <https://thebipalace.com/>
2. <https://www.analyticsvidhya.com/learning-paths-data-science-business-analytics-business-intelligence-big-data/tableau-learning-path/>

# MASTER OF SOCIAL WORK

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MSW

## **SYLLABUS**

**CREDIT BASED, CHOICE BASED CONTINUOUS ASSESSMENT PATTERNED  
EDUCATION SYSTEM**

(Regulations, Scheme of Examination and Course Content)

To be effective from the Academic Year 2022-23

**DEPARTMENT OF STUDIES IN SOCIAL WORK  
JSS COLLEGE OF ARTS, COMMERCE AND  
SCIENCE, OOTY ROAD, MYSORE**

# JSS College of Arts, Commerce and Science

(Autonomous)

Ooty Road, Mysore

## Master of Social Work Programme

### DISTRIBUTION OF COURSE CONTENT AND CREDITS

MSW- I Semester

Compulsory additional papers for non BSW students

Sl. No.	Code No.	Paper Title	L	T	P	Credits
1	NSW-1	Social Science Perspectives for Social Work Practice	-	-	-	-
2	NSW-2	Term Project	-	-	-	-

1. A bridge course will be conducted for a period of 5 days covering the required course input. There are no credits allotted to this course and no written examination too. However, attendance of 75% is compulsory.

2. Paper code: NSW2 : **Term project:**

The term project is a team-exercise consisting 3 to 5 students. The team is expected to select a theme relevant to current social issues in consultation with the supervisor and make an exhaustive survey of literature on the chosen theme including empirical studies made on the same.

Further, the group shall also collect the experiences or opinions of people on the issues and make a detailed presentation. Flexibility is accorded in planning and executing the term project. Creative and analytical approaches are to be carried out under the direct supervision of a faculty supervisor.

The report of the term project has to be submitted before the end of theory examination of the first semester. The term project is offered only for the non-BSW students. However, students with BSW background are also encouraged to opt for the term project, as an innovative approach in social work, if they desire so.

### **DISTRIBUTION OF CREDITS**

<b>Sl. No.</b>	<b>Course Type</b>	<b>Credits</b>
<b>1</b>	<b>HARD CORE (HC)</b>	<b>52</b>
<b>2</b>	<b>SOFT CORE (SC)</b>	<b>20</b>
<b>3</b>	<b>OPEN ELECTIVE (OE)</b>	<b>04</b>
	<b>TOTAL</b>	<b>76</b>



**Semester- wise Distribution of Course Content and Credits**

**I Semester**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L:T:P</b>	<b>Credits</b>
1.	SWA HC-1	Social Work - History and Ideologies	2:1:0	3
2.	SWA HC-2	Work with Individuals and Families	2:1:0	3
3.	SWA HC-3	Work with Groups	2:1:0	3
4.	SWA HC-4	Work with Communities	2:1:0	3
5.	SWA HC-5	Human Growth and Development	2:1:0	3
6.	SWA HC-6	Social Work Practicum – I	0:1:2	3
		<b>Total</b>		<b>18</b>

## II Semester

<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L:T:P</b>	<b>Credits</b>
1.	SWB HC-7	Management of Developmental and Welfare Services	2:1:0	3
2.	SWB HC-8	Social Work Research and Statistics	2:1:0	3
3.	SWB HC-9	Social Work Practicum – II ( Social Work Camp and Summer Placement)	0:0:3	3
4.	SWB HC-10	Social Work Practicum - III	0:1:2	3
5.	SWB SC-1	Communication and Counselling / Gandhian Approach to Welfare and Development	3:1:0	4
6.	SWB SC-2	Personal and Professional Growth/ Population and Environment	2:1:0	3
			<b>Total</b>	<b>19</b>

### III Semester

Sl. No.	Course Code	Course Title	L:T:P	Credits
1.	SWC HC-11	Human Resource Management	2:1:0	3
2.	SWC HC-12	Social Work Practicum – IV	0:1:2	3
3.	SWC SC-3	Social Work with Tribal and Rural communities/Organizational Behavior and Organizational Development	2:1:0	3
4.	SWC SC-4	Preventive and Social Medicine and Medical Social Work /Rehabilitation and After Care Services	2:1:0	3
5.	SWC SC-5	Social Policy, Planning and Development/ Legal System in India	2:1:0	3
6.	SWC OE	Gerontological Social Work / Social Work Practice with Children	4:0:0	4
			<b>Total</b>	<b>19</b>

#### IV Semester

Sl. No.	Course Code	Course Title	L:T:P	Credits
1	SWD HC-13	Employee Relations and Legislation	2:1:0	3
2	SWD HC-14	Mental Health and Psychiatric Social Work	2:1:0	3
3	SWD HC-15	Major Project	0:2:4	6
4	SWD HC-16	Social Work Practicum – V	0:1:2	3
5	SWD HC-17	Social Work Practicum – VI ( Block Placement)	0:0:2	2
6	SWD SC-6	Human Resource Development and Employee Wellness/Case Studies	3:1:0	4
			<b>Total</b>	<b>21</b>

**Note:** In a Semester for only one Soft Core Course, there can be two choices.

#### **Objectives of the Course (Master of Social Work):**

1. To provide education and training in social work to those desirous of making a career in social work practice.
2. To provide opportunities through intensive field practicum to work with variety of people in their development and provide service to those who are in need of it.
3. To provide inter-disciplinary collaboration for better understanding of human problems, services and issues related to human development.
4. To link theory with practice in every sphere of human service.
5. To develop requisite knowledge, skills and values in working with people.
6. To promote among learners a sense of responsibility and commitment to work with different sections of people and especially of the vulnerable sections of the society
7. To promote opportunities and to create awareness for personal growth
8. To acquire knowledge and skills in undertaking practice-based research and to administer human service organizations

**Name of the Course:**

The course shall be called ' **Master of Social Work**' (MSW).

**Duration of the Course:**

The Course of study **for MSW Degree** shall extend over a period of four semesters spreading over two academic years.

**Regulations:**

**ELIGIBILITY FOR ADMISSION TO MSW COURSE**

Candidates who have passed BSW/ BA/ B.Sc. / B.Com. / BBM/ B.C.A / LLB of the University of Mysore or any other university recognized as equivalent there to are eligible for admission to MSW course. Candidates will be selected for admission as per the general guidelines issued from the University of Mysore from time to time. The Department/University shall conduct entrance examination for admission to the course.

The examination is of two hour duration and the question paper comprises of 100 objective type questions - 20% questions from general knowledge and current social issues, 60% from science & social sciences, and another 20% questions will be from reasoning and numerical ability. Merit will be assessed on the basis of performance in the entrance examination and performance in the undergraduate examination on equal weightage.

### **PATTERN OF QUESTION PAPER**

#### **Pattern 3**

(The Question paper comprising of 3 parts: A,B and C as follows)

#### **PART – A**

There are 8 questions and a candidate has to answer any 5 questions. Each question carries 2 marks. This part covers all units of the syllabus.

#### **PART – B**

There are 8 questions and a candidate has to answer any 5 questions. Each question carries 5 marks. This part covers all units of the syllabus.

#### **PART –C**

There is a single question such as case study (may contain sub questions) covering entire syllabus carrying 15 marks. No choice.

### **ASSESSMENT OF SOCIAL WORK PRACTICUM**

A viva-voce examination shall be conducted for each candidate in all semesters. The performance of the candidate shall be assessed by a committee consisting of three members as follows.

1. Chairperson of the Department
2. One Senior Member of the Faculty
3. One External Examiner

### **SOCIAL WORK PRACTICUM**

The practicum with different learning opportunities is designed to provide scope to develop and enhance professional practice skills. Learning is aided through observation, analysis of social realities and experience of participation in designing and providing social work intervention.

The tasks are organized to help the learner acquire beginning skills, practice those already acquired, and master them from simple to complex. The learner is gradually encouraged to become an independent worker during the course of study.

## Objectives

The objectives are met by providing a variety of experiences to learners to:

1.
  - i. Develop the ability to observe and analyze social realities. Understand the characteristics of social systems and their dynamics. Appreciate society's response to people's needs, problems and social issues.
  - ii. Develop critical understanding of the application of legislation, legal process, and social policy.
2.
  - i. Develop the ability to examine the process of programme management and participate in the effort at various levels.
  - ii. Develop the ability to recognize the need for newer programs, initiate and Participate in them.
  - iii. Use Human Rights tools, understanding of gender justice, and need for equity in all intervention.
  - iv. Develop an understanding of organizational structure, resource management, and day-to-day administration for human service programmes - developmental and welfare programmes
  - v. Develop the capacity to integrate knowledge and practice-theory by participating in intervention.
3.
  - i. Clarify and imbibe values which sustain positive attitude and professional ethics.
  - ii. Develop the capacity for self-direction, growth and change through self awareness.
4.
  - i. Enhance writing skills to document practice appropriately. Recordings to be viewed as an expression of interest, motivation and involvement in practice and as evidence of enrichment in the process of professional growth.

To meet these outcomes, several opportunities with specific objectives are designed. The different sets of opportunities with details of content and related tasks are listed separately.

**Paper code: NSW -1**

**Paper Title: SOCIAL SCIENCE PERSPECTIVES FOR SOCIAL WORK PRACTICE**

## **INTRODUCTION**

This course provides the learners basic understanding of relevant concepts from social sciences to help the learners to study and understand social phenomenon. Further, it helps the learner develop skills for social analysis and understand developmental processes.

## **OBJECTIVES**

- a. Understand the concepts to examine social phenomenon.
- b. Develop skills to analyse Indian society and change.
- c. Understand change and conflict.
- d. Understand the system for economic order.
- e. Develop skills for social analysis.
- f. Understand the development and its impact.

## **Course Content**

### **UNIT I**

Sociology and its relationship to other disciplines: Meaning, scope and significance - Its relationship with other social sciences such as History, Economics, Politics, Psychology, Anthropology and Social work.

Society and Culture: Society as a system of relationship - Social Structure: Meaning, status and roles - Culture: Meaning and contents-Tradition, customs, values, norms, folklore and mores.

Indian Society: Composition of Indian Society: the concept of unity amidst diversity - Social classification in India: Tribal, rural and urban divisions - Social stratification in India: Meaning, caste, class divisions.

Socialization: Meaning, process of socialisation - The development of self - Agencies of socialisation.

### **UNIT II**

Social Groups, Social Institutions and Social Control - Meaning and types: Primary and Secondary groups, in-groups and out-groups, reference groups - Types of social institutions: Marriage, Family, Religion, State and Law.

Meaning and Functions: Social Control exercised through the social institutions

Social Change: Meaning, characteristics and factors inducing change with reference to India.



Social Movements in India: Meaning, factors essential for a Movement - Dominant social movements in India - Social reform movement and contributions of social reforms - Peasant movement - Trade Union movement - Social movements and social change in India.

### **UNIT III**

Development - A Human Right Perspective: Social Ideals of Indian Constitution - Fundamental Rights - Human Rights.

Socio-economic order and comparative economic system: Capitalism, Socialism and Mixed economy, their features, merits and demerits - Marxian political economy.

Social Analysis: Significance of social analysis: A brief analysis of socioeconomic, political and cultural systems - Inter-linkages in the Indian context.

### **UNIT IV**

Under-development and its causes and Contemporary Development Dynamics: A historical overview with reference to developing countries of Asia, Africa and Latin America - North-south relations, world trades, Multinational corporations and their influences on Third World economics - Trends and counter trends (Paradoxes) in the global, political, economic, military, ecological and socio-cultural spheres.

Theories of Economic Development, Globalisation and its impact on Developing Countries: Stages of growth theory - Structural internationalist theory Privatization, liberalization and structural adjustment programmes - Role of international financial institutions.

### **REFERENCES**

1. Acuff, F. Gene; Allen, Donald E. and Taylor Lloyd, A. 1973 From Man to Society, Hinsdale, Illinois, The Dryden Press.
2. Agrawal, A. N. and Lal Kundan 1989 Economics and Development and Planning, Delhi, New Vikas Publishing House Private Limited
3. Augushine, John S. (Ed.) 1989 Strategies for Third World Development, New Delhi: Sage Publications.
4. Basu, Durga Das. 1983 Introduction to the Constitution of India, New Delhi, Prentice-Hall of India Private Ltd.
5. Bert N. Adams. 1975 A Sociological Interpretation, Chicago: Rang McNally College.

6. Bharadwaj, A. N. 1979 Problems of SC/ ST in India, New Delhi: Light and Life Publication.
7. Bhushan, Vidya and Sachdev, D.R. 1999 An Introduction to Sociology, Allhabad, Kitab Mahal
8. Broom, Leonard, Charles M. Bonjean, Dorothy, H. Broom. 1990 Sociology, Wadsworth Publication Co. Belmont.
9. Chakraborty, Bimal 1996 The United Nations and Third World, New Delhi: Tata McGraw Hill Publishing Company Limited.
10. Descrochers, John. 1 77 Methods of Social Analysis, Bangalore: Centre for Social Action.
11. Deshpande, Srinivasan Narain. 1978 Society Economy of Polity in India, Mumbai: University of Mumbai.
12. Elsenhans, Hartmut. 1991 Development and Under Development: The History, Economics and Politics of North South Relations, New Delhi: Sage Publications.
13. Ely Chinoy. 1967 Society - An Introduction to Sociology, New York: Random House.
14. Haralambos, Michael. 1980 Sociology, Delhi: Oxford University Press.
15. Jain, P. C. 1991 Social Movements among Tribals, New Delhi, Rawat Publication.
16. Kapadia, K. M. 1966 Marriage and Family in India, London: Oxford University Press.
17. Kingsley, David. 1969 Human Society, New York.
18. Kolenda, Pauline. 1987 Regional differences in Family Structure in India, Jaipur: Rawat Publication.
19. Maudelbaum, David M. 1970 Society in India, Vol. I and II, University of California Press.
20. Nagardra, S. P. 1994 Development and Change, New Delhi: Concert Publishing Company.
21. Nana Poku Lloyd Pettiford (Ed.) 1998 Rebuilds up the Third World, London: Macmillan Press Limited.

22. Narang, B. S., and Dhawan, R. C. 1983  
Introduction to Social Sciences, Delhi: C.B.S. Publication.
23. Panday Rajendra. 1986  
Reality, New Delhi: Criterion Publication.
24. Pandey, A. K. 1997  
Tribal Society in India, New Delhi: Manak Publishing Ltd.
25. Rao, D. Bhaskar, 1998  
World Summit for Social Development, New Delhi: Discovery Publications.
26. Rao, V. Lakshmana 1994  
Ashish  
Essays on Indian Economy, New Delhi: Publishing House.
27. Reddy, D. V. 1994  
Development and New International Economic Order, New Delhi: Deep and Deep Publications.
28. Ross, Aileen D. 1961  
The Hindu Family in its Urban Setting, Delhi: Oxford University Press.
29. Rugman, Alan 2000  
The End of Globalization, London: Random House.
30. Sharma, S. L. (Ed.) 1986  
Development: Socio-Cultural Dimensions, Jaipur: Rawat Publications.
31. Sharma, K. L. (Ed.) 1999  
Caste and Race in India, Mumbai: Popular Prakashan.
32. Sharma, R. K. 1997  
Indian Society - Institution and Change, New Delhi: Atlantic Publishers.
33. Singh, K. S. 1985  
Tribal Society in India, New Delhi: Manohar Publishing House.
34. Srinivas, M. N. 1996  
Village, Caste, Gender and Method (Essay in Indian Social Anthropology), Delhi: Oxford University Press.
35. Steveus Smart M., Laura S. Smart. 1976  
Families Developing Relationships, New York: Macmillan Publishing Co.
36. Tandon, B. B., and Tandon, K. K. 1997.  
Indian Economy, New Delhi: Tata McGraw-Hill Publishing Company Limited

### **Journals/ Magazines**

Sociological Bulletin (Journal of the Indian Sociological Society).

Contribution to Indian Sociology.

Social Change, Issues and Perspectives (Journal of the Council for Social Development).

Economic and Political Weekly, EPW Research Foundations, Mumbai.

### **Paper code: NSW 2**

### **TERM PROJECT**

The term project is a team-exercise consisting 3 to 5 students. The team is expected to select a theme relevant to current social issues in consultation with the supervisor and make an exhaustive survey of literature on the chosen theme including empirical studies made on the same.

Further, the group shall also collect the experiences or opinions of people on the issues and make a detailed presentation.

Flexibility is accorded in planning and executing the term project. Creative and analytical approaches are to be carried out under the direct supervision of a faculty supervisor.

The report of the term project has to be submitted before the end of theory examination of that semester to the Department of Social Work, University of Mysore, Mysore through the supervisor and Chairman/Principal of the college.

The term project is offered only for the non-BSW students. However, students with BSW background are also encouraged to opt for the term project, as an innovative approach in social work, is they desire so.

Evaluation of the term project will be done along with the viva-voce examination by the viva-voce committee, constituted for the assessment of social work practicum or similar committee may be constituted, if required.

Odd semester

Paper code: SWAHC- 1

**Paper Title: SOCIAL WORK - HISTORY AND IDEOLOGIES**

## **INTRODUCTION**

This course aims at introducing the learners to a critical inquiry into the history and ideologies of social change and professional social work.

## **OBJECTIVES**

- a. Understand the history of evolution of social work profession, both in India and the West.
- b. Develop insights into the origin and development of ideologies, approaches to social change.
- c. Understand rationale, goals, ideals and ethics for social change.
- d. Understand the perceptions of people and social problems, the status of benefactors and their motives.
- e. Develop skills to understand contemporary reality in its historical context.
- f. Understand self as a part of own environment and explore own assumptions, ideals, values to develop sensitivity to marginalization of vulnerable groups.

## **Course Content:**

### **UNIT I**

Indian History of Social Work Profession: Introduction - Beginning of social work education - Welfare versus developmental orientation in social work - Professionalization of social work values, education, knowledge and professional associations - Goals, values, functions/roles and process of social work - Interface between professional and voluntary social work, social work ethics.

### **UNIT II**

Indian History of Ideologies for Social Change -Ancient period: Vedic, Vedantic and non-Vedic Ideologies, Spirituality - Medieval period: Zoroastrianism and Islam in India - Mysticism of Bhakti and Sufi movements and Sikhism.

Modern period: Christianity in India - Hindu reform movements - Dalit movements - Gandhian ideology and Sarvodaya movement - Nationalism - Ideology of the Indian Constitution - Ideology of voluntary organisations and voluntary action.

### **UNIT III**

Contemporary Ideologies for Social Change: Neoliberalism and Globalisation - Post modernism - Multiculturalism - Ideology of action groups and social movements - Ideology of non-governmental organisations.  
Role of state in providing social welfare services.

## UNIT IV

Western History of Ideologies for Social Change: Organized and scientific charity - Beginning of social work education - Clinical social work - Ecological social work - Attributes of a profession.

Western History of Social Work Profession - Medieval period: Judeo-Christian-ideologies - Secular humanism and Protestantism - Modern period: Rationalism and Welfarism - Liberalism and democracy - Utilitarianism and Social Darwinism - Socialism and human rights - Emerging ideologies of professional social work.

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#### Journals/ Magazines

Economic and Political Weekly, The Indian Journal of Social Work, Lokayan Bulletin and Vikalp.



Odd semester

Paper code: SWAHC- 2

**Paper Title: WORK WITH INDIVIDUALS AND FAMILIES**

## **INTRODUCTION**

This course aims to develop simple to complex skills of working with individuals and families in various situations like crisis, preventive, facilitative and developmental.

## **OBJECTIVES**

- a. Understand casework as a method of social work, and appreciate its place in social work practice.
- b. Understand the values and principles of working with individuals and families.
- c. Develop the ability to critically analyse problems of individuals and families and factors affecting them.
- d. Enhance understanding of the basic concepts, tools and techniques in working with individuals and families, in problem-solving and in developmental work.
- e. Develop appropriate skills and attitudes to work with individuals and families.

## **Course Content**

### **UNIT I**

Social case work: Definitions, scope, historical development - Influence of psychoanalysis on casework - Introduction of casework as a method of social work - Concepts of adjustment and maladjustment - Philosophical assumptions and casework values.

Principles of casework: Individualization, acceptance, non-judgmental attitude, participation, relationship, effective communication of feeling, client self-determination, and confidentiality.

Components of social casework: The person, the problem, the place and the process.  
Process in casework: Study, assessment, intervention, evaluation, follow-up, and termination.

### **UNIT II**

Types of problems faced by Individuals and families; individual differences and needs - Family assessment in casework practice.

Theories and approaches: Psycho-social approach, Functional approach, Problem-solving approach, Crisis Theory, Family intervention, Behavioural modification, Transactional analysis and Holistic approach.

### UNIT III

Tools for Help: Case work tools: Interview, home visit, observation, listening, communication skills, rapport building.

Records: Nature, purpose and principles of recording.

Techniques of casework: Supportive, resource enhancement and counseling.

Self as a professional: Professional self - Conflicts and dilemmas in working with individuals and families.

### UNIT IV

Application of Method: Primary and secondary settings - Application of methods in family, women, and child welfare settings, marriage counselling centres, schools settings, medical and psychiatric settings, correctional institutions, and industry.

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Odd semester

Paper code: SWAHC -3

**Paper Title: WORK WITH GROUPS**

## **INTRODUCTION**

This course aims at developing the understanding of Group Work as a method, developing skills for intervention, and gaining knowledge of the scope of this method in various settings.

## **OBJECTIVES**

- a. Develop awareness about the specific characteristics of Group Work and its contributions as a method of social work intervention,
- b. Gain knowledge about group formation and the use of a variety of group approaches.
- c. Develop understanding of concepts, dynamics and small group theory in relation to all types of groups, e.g. family, staff, committee, long-term client groups.
- d. Identify the various situations and settings where the method could be used in the context of social realities of the country.

## **Course Content**

### **UNIT I**

Introduction and history of Group Work: Understanding of groups - Characteristics and significance of group - Definition of Social Group Work - Characteristics of Social Group Work - Purpose of Social Group Work; Historical evolution of group work with special emphasis on the Indian Context.

Type of Groups: Types and approaches based on objectives and purpose - Type of membership - Time duration - Social group work in different settings and analysis of group processes.

Values and Principles in group work and Characteristics of Group formation: Values in social group work- Principles in group work - Assumptions underlying social group work - Factors of group formation - Formulation of goals - Identification of problems for work.

Pre-group and Initial Phase: Planning model - Characteristics of pre group phase - Group structures - Facilitation skills and role of worker in pre-group and initial phase.

## UNIT II

Group Processes and Group Dynamics: Importance of group processes - Typical patterns - Processes in different type of groups - Worker's skills in identifying and understanding processes - Bond, sub-groups, role.

Leadership - Isolation - Decision making - Conflict - Communication - Relationships.

## UNIT III

Middle Phase and Use of Program: Characteristics of middle phase - Group structures - Group dynamics - Facilitation skills - Role of group workers - - Comparison across phases - Concept and principles - Program planning - Skills in program planning

Facilitation: Knowledge of skills and techniques for effective work with groups/problem solving.

Recordings in Group work: Importance of recording in social group work - Principles of recording - Recording structure - Types of recording.

## UNIT IV

Evaluation in Groups and Termination Phase : Importance of evaluation - Types of evaluation - Methods of evaluation - Need for termination - Types of termination - Characteristics of termination phase - Worker's skills.

Application of Group Work: Application in health settings, school settings, family welfare settings, industrial settings, women and child welfare settings.

## REFERENCES

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Odd semester

Paper code:SWAHC-4

**Paper Title: WORK WITH COMMUNITIES**

## **INTRODUCTION**

Community organization / development, as a method of social work practice, is seen as a means to facilitate communities towards self-directed change. It takes as its basis the inequalities in society manifested through processes of marginalization, discrimination or disempowerment of groups, which have resulted in the loss of control over resources, be they tangible or intangible. The strategies of Community Organisation practice being addressed as part of the course cover a range spanning different ideologies, from those being people-initiated, and those that are initiated by the elite. Community organization is seen as a means as well as an end, where collective processes are to sustain the community's capacity to bring about change.

## **OBJECTIVES**

- a. Understand the critical elements of community organisation practice.
- b. Enhance critical understanding of the models and strategies for community organisation practice.
- c. Make the micro-macro connections between the range of complex issues in practice.
- d. Develop attitudes conducive to participatory activities for civil society.

## **Course Content**

### **UNIT I**

Community: Concept, characteristics, types and functions.

Understanding of community organisation practice: Definition of community organisation, values and principles of Community Organisations, ethics of community organisation practice.

Community Organisation Practice: Community work within social work, Understanding Human Rights in community organisation practice.

Historical development of community organisation practice.

Power: Concept of power - The range of perspectives - Dimensions of power relevant to community organization.

Empowerment: Concept of Empowerment - Barriers to, process and cycle of empowerment.

Gender and Empowerment: Gender sensitive community organization practice

## UNIT II

Models and Strategies of Community Organization - Locality Development Model - Social Planning Model - Social Action Model - Select methods of public interest mobilization, litigation, protests and demonstrations, Dealing with authorities, Public Relations, Planning, Monitoring and Evaluation - Roles in different models attributes and attitude.

## UNIT III

Community Organization as a Method: Relevance of community organisation as a method across different spheres of social work intervention and relook at own attitudes.

Skills of Community Organization Practitioner: Problem analysis, resource mobilization, conflict resolution, organizing meetings, writing and documentation, networking, training.

## UNIT IV

Strategy and Roles: Unionization as a strategy - Advocacy in community organization.

Current debates in Community Organisation Practice: Emerging issues - Impact of macro policies.

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25. Zaltman, G. and Duncan,  
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### **Journals**

Community Development Journal: An International Forum, UK, Oxford University Press.

Development and Change, Hague Blackwell Publisher.

**Paper code: SWAHC-5**

**Paper Title: HUMAN GROWTH AND DEVELOPMENT**

## **INTRODUCTION**

The course aims to introduce the learners to the development of the individual across the life span, in a system and an ecological perspective. It also provides an understanding of human development and behaviour, in contextual influences, including individuals in disadvantaged or special contexts. The theoretical inputs are to enhance the understanding of people's growth, health, and development at various stages as bio-psycho-socio-spiritual being over the life span.

## **OBJECTIVES**

- a. Develop an overall understanding of the principles of growth; their relevance and application to behaviour at various phases in the life span.
- b. Understand the twin roles of individual's heritage and environmental influences in growth and development.
- c. Understand interactional nature of growth and behaviour at various stages in the life span: infancy, childhood, adolescence, youth, adulthood and old age, and impact of cultural aspects.
- d. Develop sensitivity towards needs, developmental tasks and health status along with need for developmental programmes for the same.
- e. Apply the information of growth, development and health in social work practice in general and individuals, groups and communities in particular.

## **Course Content**

### **UNIT I**

Life Span: Beginning of life - Human reproductive system; Fertilization and Foetal development - Delivery and pre-natal and post-natal care and their importance in development.

Principles of growth and development - Methods of studying human behaviour, - Role of heredity and environment - Social customs traditions, values in parenting and child rearing practices, deprivation and development during stages of life span. Understanding of the Indian concept of life span stages.

### **UNIT II**

Developmental periods: Infancy, babyhood, childhood, puberty, adolescence -. Growth, hazards, lifestyle effects

Adulthood - Growth, personal and social adjustment, health, sexuality, vocational and marital adjustment.

Aging - Characteristics, hobbies, adjustment, physical and mental health, death, dying and bereavement.

Special focus is on psychosocial development, moral development, and personality development vis-a-vis the influence of the contexts of development., (The contexts here refers to gender, family, significant others, neighbourhood: peers, school, community, work place and other larger contexts like the society and culture. Emphasis is placed on the Indian context of development, variations from the

normal patterns of development and views on the stages)

### UNIT III

Theories of Human Development: A critical look at the theories of human development - Freud's psychosexual theory, Erikson's psychosocial theory, learning theories.

### UNIT IV

Basic human needs: Physical, psychological and intellectual needs, stress - Coping and social support.

Motivation, frustration and conflicts - Emotions and emotional behaviour.

Personality: Definition, nature, types and assessment of personality.

Intelligence: Concept, levels of intelligence, influence of heredity and environment, assessment of intelligence.

Relevance of Psychology to social work practice across the stages of development, period specific needs, tasks and challenges.

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Odd semester

Code: SWAHC-6

**Title: SOCIAL WORK PRACTICUM - I**

**Orientation** provides information regarding.

- i. the importance and place of the practicum in the educational programme.
- ii. the purpose, functions and ethics in professional practice.

In the first four weeks, the learners may make a local directory to include emergency numbers of Hospitals/ PHCs/ Police/ Panchayath Office and Network Agencies along with references to other developmental and welfare services in the location.

**Visits** - provide an exposure to and understanding of the services provided in responses to people's needs. (Agencies in health setting, education, community, institutional services, criminal justice system, civic administration, rehabilitation etc.)

**Structured experience laboratory** - is a classroom activity, which provides opportunities through the games/activities, to form the involvement of self in various practice skills. These laboratory experiences are designed in small groups to encourage participation, sharing of the experience and aid in examining learning and applications of skills. These sessions have a specific objective of experiencing self, and applying /using self in practice. (Relationship skills, Communication skills etc., will be focused)

**Concurrent practice learning of two-days a week** - on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester.

The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work.

## Even semester (II Semester)

Code: SWBHC -7

Paper Title: MANAGEMENT OF DEVELOPMENTAL AND WELFARE SERVICES

### INTRODUCTION

The course aims to develop management competencies to function in organizations, participate as a team member and understand the role of a social work programmes manager.

### OBJECTIVES

- a. Understand the overall environment and its impact on the nature, structure and development of organizations in corporate, public and voluntary sectors in the context of social work profession.
- b. Understand policies and procedures involved in establishing and maintaining human service organizations.
- c. Acquire skills to network and participate in the management of resources - human, material and environmental.
- d. Develop skills to participate in management of programmes, as a part of the inter-disciplinary team and initiate as well as develop new programmes.
- e. Develop ability to analyse the practices applied in specific settings.

### Course Content

#### UNIT I

Social Services: Need for welfare and developmental organisations, Factors determining social welfare programmes, Development and Welfare organizations' response to societal needs; role of state, voluntary and corporate sector.

Management services: Types of settings, organizational characteristics like origin, nature, size, structure, and design, organizational climate and impact of socio-political environment - Management process: Vision, Planning, Organizing, Directing, Staffing, Coordination, Reporting, Budgeting.

Establishment: Registration, different types of legislations, legal status, constitution, rules and procedure, goals - Financial resources: Organizational Budget, Sources of finance, Fund Raising, Records, Audit.

#### UNIT II

Physical: All activities related to acquiring, hiring and maintaining importable structure and infrastructure, maintenance of premises and daily upkeep.



Enhancing the involvement and the potential of people in organization's executive boards, committees; professionals and other staff-relationship, communication, team work, and facilitating team building, supervision, and participation in training.

### **UNIT III**

Programme Development: Programme management: long term, short term, and Documentation.

Project proposals based on felt-needs, nature of resources, eligibility criteria, records, evaluation and research.

Impact analysis - Qualitative and quantitative.

### **UNIT IV**

Public Relations: Public relations need and its promotion by all in the organisation. Representing the organization, networking, public, corporate and voluntary sector, resource building, accountability, transparency, use of media for publicity.

Change and its Management: Understand and manage change, innovation in a rapidly changing social environment: for policy programmes and structure.

Organizational understanding: Conflict, conflict resolution, creating positive climate.

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Paper Code: SWBHC-8

**Paper Title: SOCIAL WORK RESEARCH AND STATISTICS**

## **INTRODUCTION**

This course is to equip learners to utilize, and conduct research as service managers to improve services, evaluate, and develop new services and intervention methods: strategies and techniques and also, be an effective consumer of other researches.

## **OBJECTIVES**

- a. Develop an understanding of scientific approach to human inquiry in comparison to the native or common sense approach in various aspects, and its process.
- b. Understand major research strategies, meaning, scope and importance of social work research.
- c. Develop an ability to see the linkages between practice, research, theory and their role in enriching one another.
- d. Develop ability to conceptualize, formulate and conduct simple research projects/exercises (This would include a broad range of basic research skills such as conceptualization of a research strategy and problem; writing a research proposal; developing tools for collecting data; use of sampling, strategies; data collection, processing, presentation, analysis and interpretation; and writing research report etc).
- e. Make informed assessment and judicious use of research studies and findings.
- f. Develop skills for use of library and documentation services for research.

## **Course Content**

### **UNIT I**

Science - Meaning and assumptions, scientific approach in comparison to the native or common sense approach.

Scientific attitude; Scientific method; application of scientific method for the study of social phenomena.

Research: Definition and objectives, Social Work Research: Meaning, objectives, functions and limitations; Scope of social work research in India; Agencies sponsoring and conducting social work research, ethics in research.

Problem identification: Criteria for the selection of research problem; Problem formulation.

Concepts, constructs, variables, conceptual and operational definitions. Hypothesis: Meaning, importance, uses and requirements.

## **UNIT II**

Design of research: Definition and importance; types of research design; exploratory, descriptive, experimental, evaluative design, participatory research and action research.

Source and Types of Data: Primary and secondary, objective and subjective, qualitative and quantitative.

Sampling: Sample and population: Rationale and Characteristics of sampling; methods of sampling, general considerations in the determination of sample size.

Methods of collection of primary data:

Observation: Structured and unstructured; participant and non-participant. Questionnaire, interview schedule and interview guide. Pilot study and Pre-testing.

Scales: Need for scales, some prominent scaling procedures.

Case study: Meaning, uses, steps.

Secondary data: Official data, personal documents, problem in the use of secondary data

## **UNIT III**

Processing of data: Content, editing, coding data classification, manual and mechanical tabulation of data; frequency distribution, diagrammatic and graphic presentation - use of computers.

Issues related to Social Work Research: Interpretation of data, research reporting; contents of research report: foot-note, references, bibliography, preparation of abstract; the art of making book review.

## **UNIT IV**

Statistics: Definition, functions and importance

Measures of Central Tendency; Measures of Dispersion.

Chi-square, Correlation Coefficient, 't' distribution; Analysis of Variance and 'F' distribution.

SPSS package.

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Code : SWBHC-9

**Title: SOCIAL WORK PRACTICUM - II:**

**SOCIAL WORK CAMP:**

Rural/ Tribal camps with a duration of 7 - 10 days - provide opportunities to experience rural life, analyze rural dynamics, and observe the functioning of local self government and voluntary organisations. This experience aids peer participation in planning for activities for own group and those for local people. It also helps develop skills to carry out, evaluate, and report the experience.

**SUMMER PLACEMENT:**

Summer Placement - provides an opportunity to experience day-to-day work in a setting. The learner gets involved with direct practice with the client system and with the ongoing management operations of the setting. The time frame recommended for this experience is about three weeks, after the first year of the post-graduate programme. The learner may use the same setting for data collection of research project, if such an arrangement is part of the plan.

Code: SWBHC -10

**Title : SOCIAL WORK PRACTICUM - III**

Concurrent practice learning of two-days a week - on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester. The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work.

Even semester

Paper Code: SWBSC-1

**Paper title: COMMUNICATION AND COUNSELING**

**INTRODUCTION**

This paper relates the relevance of components of communication and counseling in social work practice.

**OBJECTIVES**

- a. Understand the meaning and importance of communication in day-to-day life.
- b. Focus on interpersonal communication of interviewing and allied aspects.
- c. Develop holistic understanding of counseling as a tool for help.
- d. Acquire knowledge of various approaches: their theoretical under-pinnings for goals, values, processes and techniques,
- e. Develop skills of application to real life situations.

**Course Content**

**UNIT I**

Communication: Meaning and importance of communication.

Process of communication: Key elements in the communication process - Communication, message, audience; channel of communication. Verbal and non-verbal communication.

Basics of Communication.

Education and communication for national development.

Interpersonal communication: Interviewing - Objectives, principles of interviewing; listening, qualities of effective communicator.

Seminars, conferences, lectures, group discussion, panel discussion, symposium, workshop, role playing, simulation exercises, written communication, report writing, letter writing, article/essay writing, games, brain storming, street play, field work exposure.



## **UNIT II**

Visual aids in communication: Poster making, use of notice boards, flip charts, charts, flash cards, photographs, pamphlets, slide shows.

Mass Communication: Television, exhibition, newspapers and magazines, advertisements, radio, film, VCD/ DVD, e-mail, internet.

Impact of mass communication on society, family, marriage and child development.

Communication Analysis and Planning: Planning and executing a communication campaign on an issue using various methods of communication.

## **UNIT III**

Counseling: Definition, nature and goals, areas of counseling; Historical background and origins of counseling, ethical nature of counseling, qualities of an effective counselor.

Counseling Situations: Developmental, preventive, facilitative, and crisis.

Counseling and Psychotherapy - Skills in counseling - Establishing the relationship.

Process of Counseling.

Approaches to Counseling: Approaches; Theoretical base, thrust, goals, key concepts, techniques - Approaches like person-centered, rational-emotive, behavioural approaches, gestalt, existential approaches, Egans three stage model, eclectic model.

Indigenous Approach: Indigenous approaches of help and self-help like yoga, reflection. Act of Prayashchit.

## **UNIT IV**

Couple and Family Counseling: Issues in such counseling, its process and stages.

Crisis Counseling

Group Counseling: Counseling for groups - Process, advantages and disadvantages of group counseling.

Practice of counseling in family counseling centres, family courts, counseling bureau - Premarital and marital counseling, vocational counseling centres, mental health centres, child guidance clinics, correctional institutions, deaddiction and rehabilitation centres, educational institutions.

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**Paper code: SWBSC -1**

**Paper Title: GANDHIAN APPROACH TO WELFARE AND DEVELOPMENT**

### **INTRODUCTION**

The course aims at sensitizing the learner to the Gandhian approach and to utilize some of the skills in practice.

### **OBJECTIVES**

- a. Develop an understanding of Gandhi's concept of society and his approach to social transformation.
- b. Develop knowledge of the specific programmes formulated by Gandhi for rural reconstruction and the development of the weaker sections of society, with the focus on strategies and skills.
- c. Develop the ability to identify similarities and differences between the Gandhian and professional social work approaches to social change, welfare and development.

### **Course Content**

#### **Unit I**

Gandhian thought: Salient features of Gandhian thought; Gandhian values; Concepts and methods; Concept of a healthy society; Sarvodaya.

## **Unit II**

Gandhian Approach: Economic and its organization: Ownership of property; Concept of trusteeship, distribution and economic equality; System of production, problems of mechanization, decentralization of production, rural- urban relationship

## **Unit III**

Social Organisation: Marriage and family, position of women, social stratification, caste and untouchability, education and its role; Basic education.

## **Unit IV**

Constructive programmes: Contents training of constructive workers, skills involved, nature of programmes; Bhoodan, Gramdan.

Gandhian and Vinobha's movements with special reference to Bhoodan and Gramdan

Gandhian and Professional Social Work Approach: Similarities and differences between Gandhian and professional approach to social development and welfare

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Even semester

Paper Code: SWSC-2

**Paper title: PERSONAL AND PROFESSIONAL GROWTH.**

## **INTRODUCTION**

The course aims at enhancing personal and professional effectiveness by developing a continuous awareness and deeper insight into one's being. It encourages value clarification, upholding of professional ethics, and ability to make effective choices for integration. It provides opportunities to understand stress, stressors and methods to handle stress experienced.

## **OBJECTIVES**

- a. Understand self as a being, as one in the process of becoming and experience self-awareness.
- b. Examine own values and attitudes and explore choices made to express self in own environment.
- c. Develop positive life skills and practice self-help methods for integration and for stress reduction.
- d. Understand and uphold professional values and ethics.

## **Course Content:**

### **UNIT I**

Self and Self Awareness: Understand self through a cognitive construct/paradigm (two/three models from among those available may be offered as workshops). Suggested approaches are: Rational Emotive Therapy, Gestalt Approach, Transactional Analysis, Reality Therapy, Yoga for Therapy, Meditation Techniques.

Explore self as being, and understand the process of becoming. (through observation)

Practice consciously measures to sustain and experience continuous awareness.

Observation and Reflection: Theory and techniques.

Communication Choices: Communication mode and patterns and effectiveness, Interpersonal communication, nature of choices made.

## UNIT II

Emotions and their Expression: Emotions, nature of expression.

Understand own pattern of communication, choices made to express emotions, modes used, examine need for change.

Communication: Informal and knowledge and skills of rapid reading, writing, creative writing, report writing and public speaking.

## UNIT III

Creativity and Self: Understand brain functions: Creativity, need and development

Life Style: Conscious life style - enhanced life skills: Communication, decision making, empathy, critical thinking, use of time and money, building and sustaining bonds-relational, collegial and personal.

Self defeating behaviour - nature and impact. Choices for change.

## UNIT IV

Values, Attitude and Professional Ethics: Values and attitudes - their role in life, Value conflict - its impact, value clarification.

Integration: Through Eastern and Western approaches experience the processes of integration. Approaches recommended are: Yoga as a science, meditation (tool for meditation - own choice).

Stress / Burn out - Self help Methods: Stress, Stressors, nature and impact of stress, its expression, and burnout.

Spirituality and Growth.

## REFERENCES:

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Paper code: SWBSC-2

**Paper Title: POPULATION AND ENVIRONMENT**

## **INTRODUCTION**

The content has two aspects to it. Population dynamics and its relatedness to the environment, natural resources, utilization and their preservation.

## **OBJECTIVES:**

- a. Understand characteristics, determinants of population growth.
- b. Examine population policy, plan and initiatives.
- c. Understand inter-relatedness of human life, living organisms and environment.
- d. Examine utilization and management of resources.
- e. Develop skills to participate in activities related to the two areas.

## **Course Content**

### **UNIT I**

Characteristics of population: Population, determinants of growth, global concerns - Characteristics of Indian Population - Distribution by age, sex, literacy and occupation - Fertility trends - Birth and death ratio.

Population Policy, World Action Plan, Population Policy of India- Implementation; Initiatives - Government and NGO.

### **UNIT II**

Family Planning: Objectives, scope, methods, implementation, mechanisms and progress.

Concept and Scope of Population education, family life education, sex education, and family planning education.

Population and Environment: Interrelatedness of human life, living organisms; Environment and natural resource - Environment, lifestyle, degradation. Environment management, maintaining, improving, enhancing - Current issues of Environment.

### **UNIT III**

Natural Resources and Diversity: Utilisation and management - Forest, land, water, air, energy sources - Pollution - Sources, treatment, prevention - Soil, water, air, noise - Waste matter - disposal, recycling, renewal, problems, issues - Programmes for forest, land and water management.

### **UNIT IV**

Environment Protection Laws and Role of Social Worker: Acts related to environmental protection - Forest conservation- Water pollution - Standards and tolerance levels - Unplanned urbanization- Environmental movements in India - Role of NGOs in Environmental issues - Government agencies in environmental protection - Social work initiatives at different levels.

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## **odd semester (III Semester)**

Odd Semester

**Paper code: SWCHC-11**

**Paper Title: HUMAN RESOURCE MANAGEMENT**

### **INTRODUCTION**

The main objective of this course is to prepare young graduates for management and administrative positions in various industrial, business, governmental/non-governmental organisations and service sector organisations.

### **OBJECTIVES**

- a. Develop managerial skills in different functional areas of management with practical focus on HRM.
- b. Develop the competence to evolve the problem-solving approaches by applying conceptual and behavioural skills.
- c. Develop interpersonal skills/ competence and leadership qualities to work in a group with team building approach.
- d. Develop sound theoretical base in various concepts and theories to enable the student to develop a broad perspective of the management field.
- e. Distinguish the strategic approach to Human Resources from the traditional functional approach.
- f. Understand the relationship of HR strategy with overall corporate strategy.

### **Course Content**

#### **UNIT I**

Human Resource Management: Concept, scope, philosophy and objectives; Evolution; Approaches, Structure and Functions; Line and staff relations of HRM; HRM Model. Hierarchy, formal and informal structure, Organization chart/reporting structure.

Human Resource Planning: Concept and objectives; Human resource inventory; Human resource planning process; job analysis; job description; job specification; job design; career planning and career paths; job rotation.

#### **UNIT II**

Talent Acquisition: Goals; policies, sources and methods. Selection: Concept, process. Talent Acquisition Tests, Theories and issues in psychological testing, Intelligence testing - theoretical background, Aptitude Testing, Personality Assessment, MBTI. Placement, Induction and socializing the new employee. Talent retention: Concept, importance and methods.

### UNIT III

Compensation Management: Factors influencing compensation plans and policies; Job evaluation - Fixation of salary, components of salary. Pay for performance - Incentive Schemes, principles and types, Employee Stock Option Plan, compensation survey / review

### UNIT IV

Strategic Human Resource Management (SHRM): Business strategy and organizational capability, SHRM: aligning HR with Corporate strategy, Strategic HR planning and Development, Change Management and restructuring and SHRM, Corporate Ethics, Values and SHRM, Competencies of HR professional in a SHRM scenario.

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4. Chatteljee, Bhaskar 1999 The Executive Guide to Human Resource Management, New Delhi, Excel Books.
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| 13. Rudrabasavaraj, M. N. 1984          | Human Factors in Administration, Bombay: Himalaya Publishing House.                               |
| 14. Rudrabasavaraj, M. N. 1986          | Cases in Human Resource Management, Bombay: Himalaya Publishing House.                            |
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**Odd semester**

**Code: SWCHC-12**

**Title: SOCIAL WORK PRACTICUM - IV**

Workshops: Skills Development - help learners acquire specific skills for situations encountered during practice and acquire skills for intervention. These may be for problems/ concerns, issues or situations like work with alcoholics, HIV/AIDS affected persons, adolescents for life skills development, youth for leadership development and couples for marital relationship and enrichment work with elderly. These workshops are to enhance skills/ develop new skills for practice in specific situation, specific problems and issues.

Concurrent practice learning of two-days a week -on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester. The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of

the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work

Odd semester

**Paper code : SWCSC-3**

**Paper Title : SOCIAL WORK WITH TRIBAL AND RURAL COMMUNITIES.**

## **INTRODUCTION**

This course aims at introducing the learner the programmes of tribal and rural development, and the importance of social work practice with tribal and rural communities.

## **OBJECTIVES**

- a. Develop an understanding of tribal and rural communities.
- b. Understand the characteristics and problems of tribal and rural communities.
- c. Acquire knowledge about the contribution of Governmental and Non-governmental Organisations to tribal and rural development.
- d. Develop an understanding of the functions of Panchayath Raj Institutions with particular reference to Karnataka.
- e. Gain knowledge about the application of social work in tribal and rural development programmes.

## **Course Content**

### **UNIT I**

Tribe in relation to caste and nation - Nature and Characteristics of Primitive Cultures- Tribes in India and their ecological distribution.

Emerging Trends in Tribal Social Institutions - Family and Kinship Systems, Jati Structure, Economic Structure, Political organisations.

Characteristics of Tribal Society - Economic, Social, Political and Cultural Problems of Tribal Life.

## UNIT II

Government Programmes since Independence and their Impact on Tribal Societies - Programmes of Voluntary Agencies and their Impact on Tribal Societies.

Analysis and Assessment of Tribal Community Problems - Special Problems of the Tribals in a particular area.

Social Work Practice in Tribal Development: Community organisation as a method of intervention, Participatory Rural Appraisal (PRA), Logical Framework Approach/Analysis (LFA), techniques of intervention and its scope in tribal community development.

## UNIT III

Rural Society and Poverty - Historical perspective - Dynamics in the village society - Caste/class relationships - Control and Power, Conflict and Integration. Poverty in the rural context - Its nature and manifestations. Analysis of Basic Problems - Issues faced by the rural poor such as indebtedness, Bonded labour, Low wages, Unemployment, Underemployment, and other forms of exploitations.

## UNIT IV

Current Rural Development Programmes in India: Council for the Advancement of People's Action and Rural Technology (CAPART) and other Rural Development Statutory Bodies.

Panchayath Raj System in Karnataka and its role in rural and tribal development.

Role of social worker in tribal and rural development programmes. **REFERENCES:**

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2. Bhalla, Alok and Bumke, Peter J. (Eds) 1992 Images of Rural India in the 2nd Century, New Delhi; Sterling Publishers Pvt. Ltd.
3. Bharadwaj, A. N. 1979 Problems of Scheduled Castes and Scheduled Tribes in India, New Delhi: Light and Life Publishers.
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21. Swaminathan, M. S. 1982 Science and Integrated Rural. Development, New Delhi: Concept Publishing company.

**Paper code SWCSC-3**

**Paper Title: ORGANIZATIONAL BEHAVIOUR AND ORGANIZATIONAL DEVELOPMENT**

**INTRODUCTION**

The course aims to provide an understanding of human behavior at work so that the learner may acquire the skills required to analyze problems and develop a problem-solving approach.

**OBJECTIVES:**

- a. To impart knowledge about individual, group and organizational dynamics and their consequences,
- b. To make clear the concepts and approaches that help in developing models or systems that support human ingenuity.
- c. To acquaint the students with the knowledge of theories and practices that govern human behavior at work,
- d. To help the learner understand the value and worth of human resources in an organization.
- e. To enable the students to become aware of their communication skills and sensitize them to their potential to become successful managers.
- f. To gain self-confidence and healthy self-respect while retaining respect for other's rights.
- g. To understand the application of Transactional Analysis in several areas of employee management.



## **Course content**

### **UNIT I**

Conceptual Framework: Organization Behavior: Definition, concept, approaches and scope, historical background of Organization Behavior.

Introduction to Enneagram, personality types according to Enneagram. Emotional Intelligence; Attitude, Values, Personality; Job satisfaction, Employee Morale : Meaning, influences and outcomes - Measuring job satisfaction.

Assertiveness Training: Benefits of assertiveness - components of assertive behavior, measuring assertiveness, handling fear, handling anger, handling depression, developing assertive behavior skills, assertiveness on the job, assertiveness in interpersonal relations.

### **UNIT II**

Transactional Analysis ( TA), TA and self awareness, Winners and Losers, Structural analysis, Life positions, transactions, games and strokes, Life scripts, TA applications in motivation, Leadership and Teamwork, TA in counseling.

Motivation: Concept and theories, techniques of motivation, role of reinforcement and punishment, motivation and organization reward system, awards, employee empowerment and engagement.

### **UNIT III**

Leadership: Meaning, roles, skills, and styles, leadership theories, types of leadership, powerful persuasion strategies.

Group dynamics: Concept, types of groups, dynamics of group formation, decision making in groups.

Organization Development: Concept, emerging approaches and techniques, Foundations of OD, Organizational Diagnosis, OD interventions - An overview, individual and interpersonal interventions, team/group interventions, comprehensive interventions, organizational transformation, success and failure of OD, Planned Organizational change, feedback and OD.

### **UNIT IV**

Organizational Conflict: Concepts, causes and types, conflict-resolution strategies.

Organizational change: Concept, forces of change and resistance to change, managing organizational change and diversity, facilitating creative and divergent thinking, planned organizational change.

Stress and Burn Out: Concepts, causes, consequences and coping strategies.  
Managerial Ethics: Individual ethics, ethical dilemmas in management, Ethical practices of Indian Managers, Corporate ethics.

## REFERENCES

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3. Donald, Hislop, 2007                        Knowledge Management in Organisation- A Critical Introduction, Oxford University Press.
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Odd semester

**Paper code: SWCSC-4**

**Paper Title: PREVENTIVE AND SOCIAL MEDICINE AND MEDICAL SOCIAL WORK**

## **INTRODUCTION**

This course introduces the basic health issues and the application of social work in health setting both in hospital and community.

## **OBJECTIVES**

- a. Understand the concept and dimensions of health.
- b. Understand the issues related to the prevention, clinical features and treatment of major communicable and non-communicable diseases.
- c. Trace the historical development of medical social work in India and abroad.
- d. Understand the nature of medical social work services.
- e. Understand the tenets of National Health Policy of India and modernization of community based health care services. .
- f. Understand the health care services at different levels.

## **COURSE CONTENT**

### **UNIT I**

Concept of health : Physical, social, mental and spiritual dimensions of health - Positive health - Determinants of health - Health and development - Indicators of health. Concept of Prevention: Levels of prevention - Hygiene, public health, preventive medicine, community health, social medicine, community medicine. Health Care of the Community; Concept of health care - Levels and principles of health care.

## UNIT II

Communicable and Non-communicable Diseases: Leprosy, Tuberculosis, Sexually Transmitted Diseases (STDs), HIV/AIDS. Cancer, Hypertension, Accidents, Diabetes, Blindness, Neurological problems, Mental illnesses.

Maternal and Child Health Services - Immunization - Integrated Child Development Services (ICDS) Scheme - School health programmes.

## UNIT III

Medical Social Work: Meaning, Definition and Scope - Historical background and nature: Medical Social Work in India and Abroad - Team work and Multidisciplinary approach in health care; Organization and administration of medical social work departments in hospitals.

Patient as a person and Role of Social Worker: Understanding the patient as a person; Illness behaviour and treatment behaviour of the patient - Impact of illness on the patient and family.

Role of social worker with patients and their families - Rehabilitation.

## UNIT IV

National Health Policy of India, Directorate General of Health Services, Indian Council of Medical Research (ICMR), Health as a concurrent subject.

Health System in India - at the Centre, at the State level, at the district level, and village level. Health Education and Communication.

Voluntary Health Agencies in India - International health - World Health Organisation (WHO), UNICEF, UNDP, FAO, ILO, World Bank.

Non - governmental and other Agencies - Ford Foundation, CARE, International Red Cross, Indian Red Cross.

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2. Brody, Elaine M. and Contributors. 1974 A Social Work Guide for Long-Term Care Facilities, U. S. Dept. of Health, Education and Welfare, Public Health Service, Maryland: National Institute of Mental Health.
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18. UNICEF Health and Basic Services, New Delhi, UNICEF South Central Asia Regional Office.

**Paper code: SWCSC-4**

**Paper Title: REHABILITATION AND AFTER CARE SERVICES**

## **INTRODUCTION**

Rehabilitation of differently abled people is a noble and worthy endeavor, requiring the combined knowledge of the psycho-social theory and practical skills and techniques of social work. The current paper facilitates social work students to work with the specific group of clientele suffering from various types of disabilities and impart application of specific professional social work methods to cater to the needs of this population.

### **OBJECTIVES:**

- a. To understand the concept of handicap, rehabilitation and the scope for practice.
- b. To identify the specific client categories requiring the rehabilitation services, problem specificity and rehabilitation service interventions.
- c. To acquaint oneself with different rehabilitation settings, different therapeutic approaches to rehabilitation process.
- d. To acquire the social work skills adapted to facilitate the process of rehabilitation, the rights and legal provisions provided for differently abled people and assimilate the knowledge of social work practice to disability specific client service.

### **Course Content**

#### **UNIT I**

Rehabilitation: Definition and scope for social work interventions; definition of Impairment, Disability, Handicap; causes of Handicap - heredity, acquired, Major illnesses - physical, neurological and psychiatric Stress, vulnerability, coping and competence to deal with handicaps; Need for comprehensive rehabilitation - psycho-social rehabilitation

#### **UNIT II**

History, philosophy and principles of psycho-social rehabilitation; specific problem areas - physical handicap - vision, hearing, orthopedic, speech and language difficulties, mental retardation and others; neurological, psychiatric problems, disasters, alcohol and drug usage, terminal illnesses and any other.

Intervention in rehabilitation: Assessment, planning, intervention, evaluation, tools for assessment, follow-up services.

### UNIT III

Rehabilitation Settings: Hospital based, day-care, night-care, quarter-way home, half-way-home, group home, hostels, long-stay homes, vocational guidance centre,

sheltered workshop, occupational therapy centre, community based rehabilitation centre, home care, inclusive education and others

Approaches: Therapeutic community, behavior modifications, transactional analysis and eclectic approach

### UNIT IV

Practice of Social work methods in the process of rehabilitation: Case work, group work, community organisation, research, administration and social action.

Legal provisions for differently abled people - The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act 1995, Rehabilitation Council of India: Formation, scope and functions, governmental policies and programmes, initiatives from the non-governmental sectors.

International trends and national initiatives in the rehabilitation scenario.

### REFERENCES

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**Paper code: SWCSC-5**

**Paper Title: SOCIAL POLICY, PLANNING AND DEVELOPMENT**

## **INTRODUCTION**

The course introduces the learner as to how policy is a link between Constitutional Principles, Development Plans, Legislative and Executive Actions. The analysis of these processes is to enable utilization of the knowledge to improve social work practice.

Further, it provides a critical and analytical framework to understand key concepts, development processes and current issues, pertaining to different parts of the world, with specific reference to India. This course is expected to provide the social work students with a context for micro-level interventions.

## **OBJECTIVES**

- a. Gain knowledge of policy analysis and the policy formulation process.
- b. Acquire skills in critical analysis of social policies and development plans.
- c. Develop an understanding of social policy in the perspective of national goals as stated in the Constitution, particularly with reference to Fundamental Rights and the Directive Principles of State Policy.
- d. Critically understand the concept, content and process of social development.
- e. Develop the capacity to identify linkages among social needs, problems, development issues and policies.
- f. Locate strategies and skills necessary for social development and reinforce values of social justice, gender justice and equality.

## **Course Content**

### **UNIT I**

Social Policy and Constitution: Concept of social policy, sectoral policies and social services - Relationship between social policy and social development-- Values underlying social policy and planning based on the Constitutional provisions (i.e. the Directive Principles of State Policy and Fundamental Rights) and the Human Rights - Different models of social policy and their applicability to the Indian situation.

## UNIT II

Sectoral Social Policies in India: Evolution of social policy in India in a historical perspective-Different sectoral policies and their implementation, e.g. Policies concerning education, health, social welfare, women, children, welfare of backward classes, social security, housing, youth, population and family welfare, environment and ecology, urban and rural development, tribal development and poverty alleviation.

## UNIT III

Social Planning: Concept of social planning - Scope of social planning - the popular restricted view as planning for social services and the wider view as inclusive of all sectoral planning to achieve the goals of social development - Indian planning in a historical perspective - The Constitutional position of planning in India. Niti Ayog - Coordination between Centre and State, need for decentralization - Panchayath Raj - people participation.

## UNIT IV

Social Development: Concept of social development - Current debates of development - Approaches to development - Development indicators.

Social Development in India: The historical and social context of development in India - Demographic transitions - Rural development: Agrarian and land reforms; Green Revolution - Industrialization and urban development - Labour relations-Gender issues - Environmental issues (land, water, forest) - Education - Health.

## REFERENCES

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### **Recommended Journals / Periodicals**

Alternatives; Development and Change; Economic and Political Weekly.

**Paper code : SWCSC-5**

**Paper Title : LEGAL SYSTEM IN INDIA**

## **INTRODUCTION**

The course is to help learners understand the legal system and procedures in India. It supports understanding the processes in public interest litigation and develops skills for the same.

## **OBJECTIVES**

- a. Acquire information on the legal rights of people.
- b. Develop an understanding of the legal system and get acquainted with the process of the legal system with emphasis on functioning in India.
- c. Understand the role of the police, prosecution, judiciary and correction. d. Gain insight into the problems faced by the people belonging to different strata of society, in interacting with this system.
- e. Develop an understanding of the processes and problems of public interest litigation and legal aid to marginalized.

## **Course Content**

### **UNIT I**

Social Justice: Meaning and Concept; Social legislation: Meaning, definitions and concept. Social justice as an essential basis of social legislations; Social legislations in a welfare state with special reference to India.

Rights: Concept and definitions of Rights; types of Rights; Rights of women and children; Rights of Scheduled Castes and Scheduled Tribes; Rights of accused and offender under Constitution of India, Indian Penal Code and Criminal Procedure Code.

### **UNIT II**

Division of Law: Substantive Law and Procedural Law.

Legislations pertaining to Social Institutions: Marriage, divorce, maintenance of spouse, adoption.

Legislations for prevention of Crime and Deviance: Indian Penal Code (relevant chapters like of Offences against Public Tranquility, of Offences affecting the Public Health, Safety, Convenience, of Decency and Morals, of Offences relating to Religion, of Offences affecting the Human Body, of Offences relating to Marriage, of Cruelty by Husband or Relatives of Husband)

Legislations pertaining to women.

### **UNIT III**

Criminal Justice System in India:

Police: Structure, powers and functions and their role in maintaining peace and order in the society.

Prosecution: Meaning, structure, its role in criminal justice, trial participation.

Judiciary: Supreme Court, High Court - Constitution of Supreme Court and High Court: Powers and functions.

Sub-ordinate Courts - District Sessions Court, Magistrate Courts, and other subordinate courts.

### **UNIT IV**

Correction and Correctional Laws: Corrective measures as per Criminal Procedure Code, Probation of Offenders Act, Juvenile Justice (Care and Protection of Children) Act.

Legal Aid: Concept of legal-aid, history of legal-aid, persons needing legal-aid, legal-aid schemes.

Public Interest Litigation: Meaning, Concept, Process and Problems.

Right to Information Act- Provisions and implementation.

Role of Social Worker: Social Work intervention, need, methods.

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**Open Elective****Paper Code: SWOE****Paper Title: GERONTOLOGICAL SOCIAL WORK****INTRODUCTION**

Changing demographic profile in India has led to rise in the number of elderly as never before. Along with the enhanced longevity, a number of issues related to care and management of elderly have come into focus. Social work as a profession concerned with providing professional service to the needy, has recognized the need to address the concerns of the senior citizens. The paper envisages training the learners in professional social work practice with the elderly.

The paper focuses on senior citizens as target client group for social work intervention; the paper deals with the issues, concerns, problems and social work methods in facilitating healthy adaptation of the client group in the current Indian context.

**OBJECTIVES:**

- a. To get an overview of the perspectives on aging and scope for practice.
- b. To understand the various challenges related to aging, healthy aging and problems of the elderly in difficult situations.
- c. To identify agencies working with elderly, the different care settings and issues in working with elderly in different settings. To gain an insight into process of working with elderly.
- d. To train the learners in applying specific social work intervention measures in working with senior citizens, care givers and to have an understanding of
- e. National Policy on Older Persons, and the role of International and NGOs in improving the quality of life of the elderly.

**Course Content****UNIT I**

Gerontology - Definition and scope. Understanding the elderly - demographic, developmental, psychological, socio cultural, economic, and health perspectives. The issues pertaining to elderly- health, occupation, income, retirement planning, family support, gender issues, property Rights and any other

**UNIT II**

Developmental tasks in elderly: Issues in health care, changes in family structure, coping with aging process, challenges due to changing physiological, economic, safety, status in the family and other issues, Healthy aging, quality of life, coping with demise of the life partner, bereavement, resolving one's own death, and any other.

### UNIT III

Care settings for elderly: General hospitals, geriatric wards/ hospitals, home-based care, homes for the aged, nursing homes, day-care-centers, hobby centers, and facilities for homeless elderly, elder helpline, and senior citizen forum.

Tools for assessment of the problems of elderly, intervention and follow up services and evaluation.

### UNIT IV

Social work intervention measures for senior citizens through methods of social work: Case work, group work, community organisation, welfare administration, social work research, social action

Care giver issues - Needs, burden, coping and training; training for caregivers of institutions for the elderly

National Policy on Older Persons, Legal and governmental welfare benefits for senior citizens, Role of HelpAge India and other prominent Organisations working for elderly.

International scenario

### REFERENCES

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1. Indian Journal of Gerontology, C-207, Manu Marg, Tilak Nagar, Jaipur 302 004
2. R & D Journal of Helpage India . C-14, Qutab Institutional Area, New Delhi, 110016.

### **Open Elective**

**Paper code SWOE**

**Paper Title: SOCIAL WORK PRACTICE WITH CHILDREN**

### **INTRODUCTION**

Children are the future of human society. Profession of social work has to work with children in difficult circumstances while rendering services in varied settings. There is a need for social workers specially trained in working with the children and adolescents. Such trained social workers can render valuable services to children in need of professional help.

The current paper focuses on children as a special group for focused social work intervention through facilitating acquisition of knowledge about children from different perspectives, types of settings where the children can be helped and application of social work methods to render social work intervention to children.

### **OBJECTIVES**

- a. To understand children facing difficult circumstances and the impact of difficult circumstances on children's development.
- b. To gain an overview of agencies where children form the major client group, and appropriate evaluation of children's problems.
- c. To impart to the trainee, specific social work intervention methods in dealing with children as a client group; to understand the Rights of children in the legal, national and international context.

## **Course Content**

### **UNIT I**

Human reproductive system - beginning of life till beginning of adulthood. Understanding the children and adolescents from different perspectives - developmental, demographic, economic, psychological, sociological, environmental, familial, educational dimensions of child development. Issues in adolescence - self image, peer group, career choice, sexuality, education, vocation and other issues. Healthy child development, importance of supportive environment in upbringing of the children.

### **UNIT II**

Children in difficult circumstances - developmental delay, physical and intellectual handicaps; chronic illnesses, nutritional deficiencies, accidents, poverty, child labour, abandoned and orphaned children, adoption issues, children in institutions, psychological problems in children, self harm and suicides in children, addiction related problems in children, children brought up by single parent due to death, divorce and other related issues, problems in formal schooling, children living in difficult situations - children in streets, slums, war zones, migration, children in conflict with law, truancy, drug abuse, running away from homes, neglected children, child abuse, child trafficking, child marriage and any other. Special focus on adolescent issues as applicable.

### **UNIT III**

Children in difficulties - Helping agencies, Settings and issues - paediatric hospitals, nursing homes, child care centres, child guidance clinics, residential care services for children - residential schools, orphanages, homes for children in conflict with law, agencies dealing with differently abled children, any other. Assessment, intervention, follow up and evaluation of children and adolescents facing difficulties.

### **UNIT IV**

Social Work Intervention Programmes - Case work, group work, community organisation methods in helping children, school mental health programmes, home visits, school visits, life skills training, family life education for adolescents, creative use of play therapy, art, dance, drama and other mediums for helping children, child

help lines, child care centres, adoption services, special rehabilitation services for rescued children and any other.

Legislations pertaining to children, legal protection, International, National and non-governmental organisations working with children, Rights of the children.

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Women and Child Development  
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Varma, R.M, 1993                                      New Delhi, Prayas Juvenile Aid Centre,.
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### **Even semester (IV Semester)**

#### **Paper code SWDHC-13**

#### **Paper Title: EMPLOYEE RELATIONS AND LEGISLATION**

#### **INTRODUCTION**

The purpose is to provide an in-depth knowledge about the relationship between employer, employee and the state, to bring out the importance of cordial employee relations for organizational productivity and gain an understanding of the mechanism of inter-personal relations, collective bargaining and productivity improvement functions in the organisation through involvement of all groups.

#### **OBJECTIVES**

- a. Develop the skills of interpersonal relationship as per organisational requirement.
- b. Understand the trends and dynamics between the partners in the organisation.
- c. Enhance the knowledge on organisational performance, role and responsibility.
- d. Develop the knowledge on various statutory / legal aspects influencing the organizations.
- e. To stimulate thinking on rationale behind the Laws and their enforcement.

## **Course Content**

### **UNIT I**

Employee relations, History of industrialization in India - Issues related to employees in organized and unorganized sector.

Concept, Definition, Philosophy and Principles of employee relations. Employee relations with special reference to Occupation - Safety - Health and Environment (OSHE) Education.

Analysis of the terms 'industry' and 'industrial dispute', industrial discipline - misconduct, disciplinary proceedings.

Domestic Enquiry: Contents and Process, Principles of Natural Justice, Tribunal; Discharge/Dismissal.

### **UNIT II**

Trade Unions: Trade Unionism in India, emergence, history and growth, Trade Union as an organization - Various Trade Unions in India, Trade Union policies, Role of Trade Unions in India, Employers' Associations - Objectives, structure and activities. Contemporary issues in employee relations.

### **UNIT III**

Employee Legislations: - The Payment of Bonus Act, 1965, Employees Provident Fund (and Misc. Provisions) Act 1952, Workmen's Compensation Act 1923, Employees State Insurance Act 1948, Payment of Gratuity Act, 1972, Child Labour (Prohibition and Regulation) Act, 1986.

Fundamentals of Labour laws, The Constitution of India: Preamble, Fundamental Rights including writs, Directive Principles of State Policy, The Factories Act 1948, The Contract Labour (Regulation and Abolition) Act 1970, The Minimum Wages Act 1948 and The Payment of Wages Act 1936; The Apprentices Act, 1961, The Maternity Benefit Act 1961.

### **UNIT IV**

The Trade Union Act 1926, The Industrial Employment (Standing Orders) Act 1946, The Industrial Dispute Act 1947, The Employment Exchanges (Compulsory Notification of Vacancies) Act 1958. Introduction to Right to Information Act, Intellectual Property Rights, Patent Law, Copyrights, Trademark Law.

Collective Bargaining: Definitions, characteristics, critical issues in collective bargaining, theories of collective bargaining, Hick's Analysis of Wages setting under collective bargaining, conflict-choice model of negotiation, Behavioral Theory of Labor Negotiation, Collective Bargaining in India, Collective bargaining in practice, levels of bargaining, coverage and duration of agreements, administration of agreements, negotiating a contract, the negotiation process, effective negotiation, negotiation and collective bargaining, post negotiation - Administration of the agreement.

Employee relations in knowledge based industry - Concepts of self-managed teams (SMT) - Changing employee/ employer and trade union relationship. Current rules of Taxation of Salaries.

Labor Welfare Officer - Duties and functions; Social Work in Industry.

## REFERENCES

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2. Arora, M, 2005                         Industrial Relations, New Delhi, Excell Books.
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5. Joseph, T.M. 2009                        Industrial Law, Mumbai, Himalaya Publications Pvt., Ltd.
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26. Vaid, K. N. 1970 Labour Welfare in India, New Delhi, Sri Ram Centre for Industrial Relations.
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**Paper code: SWDHC-14**

**Paper Title: MENTAL HEALTH AND PSYCHIATRIC SOCIAL WORK**

## **INTRODUCTION**

This course is to provide awareness about mental health and mental health problems and also application of social work in mental health settings.

## **OBJECTIVES**

- a. Understand the concepts 'mental health' and 'mental illness'.
- b. Understand the signs and symptoms, etiology, diagnosis and treatment of mental health problems.
- c. Understand different services for the care of mentally ill.
- d. Understand historical background of psychiatric social work in India and abroad. Understand the nature of psychiatric social work services and relevance of team work.
- e. Understand the nature of collaboration with voluntary organisations for the welfare of mentally ill.
- f. Identify the issues related to psychiatric social work department in hospitals and community mental health settings.

## **Course Content**

### **UNIT I**

Concept of mental health and mental illness - Mental health as a part of general health - Misconceptions about mental illnesses. General approaches to the mentally ill - International Classification of Mental Disorders.

Signs, symptoms, etiology, diagnosis, prognosis and management of the following:

- Neuroses
- Psychoses
- Psycho physiologic disorders
- Personality disorders
- Psychiatric disturbances in children and adolescents
- Organic psychotic conditions
- Mental retardation.

## **UNIT II**

Introduction to Psychiatric Social Work: Meaning and Scope - Historical background of psychiatric social work in India and abroad - Reasons for its development as a specialty. Application of social work methods and other related techniques used in the field - Multi-disciplinary approach and team work in mental health care - Problems of hospitalization - Impact of mental illness on the patient, family and community.

Practice of Social Work: Importance of home visit and visit to the place of work - Role of family in the treatment of mentally ill - Preparing the family and community for the return of the affected individual, follow-up.

## **UNIT III**

Care of mentally ill: Day-care centre, night-care centre, half-way-home, sheltered workshop, Occupational therapy units - Role of social worker and role of voluntary organisations.

Role of voluntary organisations, governmental-agencies and paraprofessionals in the welfare of mentally ill.

Role of social worker in mental health centers, departments of psychiatry in general hospitals, child guidance clinics, community mental health units, correctional institutions, industries, and family welfare centres.

Role of social worker with head injured, paraplegics and epileptics.

Role of social worker in the management of substance abuse - Educational avenues in psychiatric social work - Research avenue in the field of mental health for social workers.

## **UNIT IV**

Organisation of psychiatric social work department - Functions; and collaboration with other departments.

Community mental health and social work, NMHP, Innovations like Satellite clinics, district mental health programme etc.

Rehabilitation and Acts: Occupational therapy - Principles and practice - Psychosocial rehabilitation.

Mental Health Act, 1987.

The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995.

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A Short Textbook of Psychiatry, Third Edition, New Delhi, Jaypee Brothers.
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Social Work with the Mentally  
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Clinics with Discuss Notes, Chicago;

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25. Yelloly, Margaret. 1980

Social Work Theory and  
Psychoanalysis, New York: Van  
Nostrand Reinhold Company.

26. National Mental Health Programme for India

**Code SWDHC -15**

**Title: MAJOR PROJECT**

Students are given broad guidelines for undertaking empirical evidence-based project in the fourth semester. In case of group project work, the group will be formed by the college or the university department by adopting random method of selection. The project shall comprise of selection of the topic, methodological details, analysis, interpretation and deductions made. The department will prepare a set of guidelines for presenting the report.

Evaluation of the Project will be done along with the viva-voce examination by the viva-voce committee constituted for the assessment of social work practicum.

Even semester

Code: **SW DHC-6**

Title : **SOCIAL WORK PRACTICUM - V**

Concurrent practice learning of two-days a week - on going learning of practice is an opportunity to develop intervention skills in reality situations. This entails learning social work practice for two, or two and a half days or its equivalent, each week of the semester. The learners may be placed in agencies or in communities to initiate and participate in direct service delivery. Practice learning is a vital component of the educational opportunity to be provided to the learner. The teaching-learning process must be designed to help the learner to move on the mastering strategies, skills and techniques to practice social work.

Even semester

Code: **SWDHC-17**

**Title: SOCIAL WORK PRACTICUM - VI: (BLOCK PLACEMENT)**

Block Placement - enables learners to integrate learning and generate newer learning by participating in the intervention process over a period of 6 weeks continuously, in a specific agency. Usually, block field work is provided at the end of the two-year programme. There shall be a professionally qualified worker in the setting willing to plan orientation and provide consultation, when needed.

**Paper code: SWDSC-6**

**Paper Title: HUMAN RESOURCE DEVELOPMENT AND EMPLOYEE WELLNESS**

## **INTRODUCTION**

The purpose of this course is to provide practical exposure and knowledge in behavioural science to develop skills not only to understand and analyse problems but also to develop a problem-solving approach to issues.

## **OBJECTIVES**

- a. To develop multi facets of the personality and to build self confidence.
- b. To develop a spirit of continuous learning and innovation.
- c. To strengthen the competency base of individuals, teams and organization and also familiar with the organizational culture.
- d. Understand and further the organization culture.
- e. To appreciate the importance of bottom-line focus to the Human Resource function and trend toward HR Accountability.
- f. To understand the various approaches to and techniques of measuring HR issues.
- g. To create awareness of different types of information systems in an organization so as to enable the use of computer resources efficiently, for effective decision- making.

## **Course Content**

### **UNIT I**

**Human Resource Development (HRD):** Concept, origin and needs for HRD; Overview of HRD as a Total system; Approaches to HRD; human capital approach; social psychology approach and poverty alleviation approach; HRD and its dimensions, Competency Mapping.

## UNIT II

**HRD Interventions:** Performance Measurement Systems - Fundamental issues. Feedback sessions. Organizational goal setting process, Key Result Area (KRA) and Key Performance Indicator (KPI), Coaching, Mentoring, career planning, career development, reward system, quality of work life. HRIS: - Computers and computer based Information Systems. Measuring HR : Changing role of HR, HR as a strategic partner, the need for measuring HR. Approaches to measuring HR: - Competitive Benchmarking, HR Accounting, HR Auditing, HR Effectiveness Index, HR Key Indicators, HR MBO (Management by Objectives).

Instructional Technology: Learning and HRD; Building Learning Organization: measuring learning - the intellectual capital, architecting a learning organization, Organizational Learning, models and curriculum; factors and principles of learning; group and individual learning; HRD trends; behavioural sciences; transactional analysis; Concepts of continuous learning, behavior modeling and self-directed learning; evaluating the HRD effort; data gathering; analysis and feedback; HRD experience in Indian organizations; future of HRD - Organization culture and development.

## UNIT III

**Talent Development:** Concept and importance; Training Need Analysis, process of training, designing and evaluating training and development programs. Use of information technology, Types and Methods of Training: Training within industry (TWI), External; on the job and off the job; Training methods; lecture, incident process, role play, structured and unstructured discussion, in-basket exercise, simulation, vestibule, training, management games, case study, programmed instruction, team development, and sensitivity training; review of training programs.

## UNIT IV

**Employee Wellness:** Concept, philosophy, principles and scope; Importance and relevance of wellness programs, Role of Welfare Officer as per the Factories Act 1948. Relevance - with reference to Accidents, Absenteeism, Alcoholism, Domestic Violence: Preventive and remedial measures.

Employee Counseling. Role of Counselor in Organizations. Corporate Social Responsibility (CSR): CSR as a business strategy.

Environmental management systems ISO 14001, ISO 26000: Social responsibility guidance standard, environmental impact assessment.





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**Code: SWDSC-6**

**Title: CASE STUDIES**

Every Candidate is expected to take up five cases, study them in depth and present the intervention, if any. Case refers to a unit of study - an individual, an institution, a community or an incident. The candidate has to work under the guidance of faculty member and submit the report on or before the date prescribed.

The university or the college concerned can develop guidelines for undertaking case studies. However, the students are encouraged to start his/her work on case studies from the beginning of the course.

Evaluation of the case study will be done along with the viva-voce examination by the viva-voce committee constituted for the assessment of social work practicum or similar committee may be constituted, if required.

**JSS MAHAVIDYAPEETHA**



**JSS College of Arts, Commerce & Science (Autonomous)**  
Ooty Road, Mysuru-25

**PG Department of Physics**

(Autonomous under University of Mysore, Re-accredited by NAAC with 'A' Grade  
Recognised by UGC as "College with Potential for Excellence")

**M.Sc. Physics**  
Course Structure and Syllabus

*Under*  
**Choice Based Credit Scheme (CBCS)**  
&  
**Continuous Assessment Grading Pattern (CAGP)**  
*2022-23 (With PO, PSO and Co's)*



JSS MAHAVIDYAPEETHA

**JSS College of Arts, Commerce & Science (Autonomous), Ooty Road, Mysuru-25**  
**PG Department of Physics**

**Details of Courses offered and associated credits**

Paper Code	Paper	HC/SC/EL/OE	Credits			
			L	T	P	Total
<b>I Semester</b>						
PHA 120	Classical Mechanics	HC 1	3	-	-	03
PHA 130	Mathematical Methods of Physics 1	HC 2	3	-	-	03
PHA 140	Mathematical Methods of Physics 2	HC 3	3	-	-	03
PHA 150	Classical Electrodynamics & Plasma Physics	HC 4	3	-	-	03
PHA 160	Computer Lab CL-A	HC 5	-	-	2	02
PHA 220	Electronics Lab	SC 1	-	-	4	04
						18
<b>II Semester</b>						
PHB 070	Continuum Mechanics and Relativity	HC 6	3	-	-	03
PHB 080	Thermal Physics	HC 7	3	-	-	03
PHB 090	Quantum Mechanics 1	HC 8	3	-	-	03
PHB 100	Spectroscopy and Fourier Optics	HC 9	3	-	-	03
PHB 110	Computer Lab CL-B	HC 10	-	-	2	02
PHB 210	Optics Lab	SC 2	-	-	4	04
						18
<b>III Semester</b>						
PHC 050	Quantum Mechanics 2	HC 11	3	-	-	03
PHC 060	Condensed Matter Physics	HC 12	3	-	-	03
PHC 070	Nuclear and Particle Physics	HC 13	3	-	-	03
PHC 080/090	Condensed Matter Physics Lab / Nuclear and Particle Physics Lab	HC 14	-	-	4	04
<b>Students are permitted to choose any one of the following (special paper) and corresponding practical coupled to the special paper</b>						
PHC 240	Solid State Physics 1	SC 3	3	-	-	03
PHC 250	Solid State Physics Lab 1	SC 4	-	-	2	02
PHC 260	Nuclear Physics 1	SC 3	3	-	-	03
PHC 270	Nuclear Physics Lab 1	SC 4	-	-	2	02
PHY 306	Theoretical Physics 1	SC 3	3	-	-	03
PHY 315	Theoretical Physics Lab 1	SC 4	-	-	2	02
<b>Students from other departments can register for any one of the following</b>						
PHY-321/322	Modern Physics/Energy Science	OE	3	1	-	04
						22

<b>IV Semester</b>						
PHD 090/080	Nuclear and Particle Physics Lab/ Condensed Matter Physics Lab	HC 15	-	-	4	04
<b>A student has to register for one particular discipline in confirmation with the corresponding SC (special paper) opted in III semester</b>						
PHD 250	Solid State Physics 2	SC 5	3	-	-	03
PHD 260	Solid State Physics 3	SC 6	3	-	-	03
PHD 240	Solid State Physics Lab 2	SC 7	-	-	2	02
PHD 300	Nuclear Physics 2	SC 5	3	-	-	03
PHD 310	Nuclear Physics 3	SC 6	3	-	-	03
PHD 320	Nuclear Physics Lab 2	SC 7	-	-	2	02
PHY-405	Theoretical Physics 2	SC 5	3	-	-	03
PHY-406	Theoretical Physics 3	SC 6	3	-	-	03
PHY-425	Theoretical Physics Lab 2	SC 7	-	-	2	02
<b>Students are permitted to choose any one of the following (Elective papers 1)</b>						
PHD 270	Accelerator Physics	SC 8	2	-	-	02
PHY-408	Liquid Crystals		2	-	-	02
PHY-409	Atmospheric Physics		2	-	-	02
PHY-410	Numerical Methods		2	-	-	02
			18			
<b>Students are permitted to choose any one of the following (Elective papers 2)</b>						
PHY-411	Nuclear Spectroscopy Methods	SC 9	3	1	-	04
PHY-412	Modern Optics					
PHD 280	Electronics					
PHY-414	Minor Project					
						04
						18
		<b>Semester</b>	<b>HC</b>	<b>SC</b>	<b>OE</b>	<b>Total</b>
		I Semester	14	4		18
		II Semester	14	4		18
		III Semester	13	5	04	22
		IV Semester	04	14		18
		<b>Total</b>	<b>45</b>	<b>27</b>	<b>04</b>	<b>76</b>

HC: Hard Core; SC: Soft Core; OE: Open Elective; EL: Elective; EC: Extra Credit;

### **Scheme of Assessment**

1. First Theory and Practical Internal Assessment tests (for C1) will be conducted after 8<sup>th</sup> week of the semester comprising 50% of the syllabus.
2. Second Theory and Practical Internal Assessment tests (for C2) will be conducted in the 16<sup>th</sup> week of the semester comprising remaining 50% of the syllabus.
3. The Theory C1 and C2 Internal Assessment tests evaluation will be an aggregate of written test, assignments, seminar by the corresponding Course teacher/teachers.
4. Practical Internal Assessment tests C1 and C2 will be assessed based on the performance of the student in the given Lab experiment, Record writing and viva by the corresponding Course teacher/teachers.
5. A student will be eligible for C3 semester end examination, if he/she has scored a minimum of 30% which is the sum total of C1 test and C2 test.
6. C3 semester end examination for theory Courses (papers) will be conducted in 18<sup>th</sup> week of the Semester. Three sets of question papers will be set by both internal and external Examiners, who were chosen from the panel of examiners approved by the Board of Studies for each Course. The Board of Examination convened well before the C3 semester end examination will scrutinise and approve the question papers sets and submit the same to Controller of Examination.. From each of the sets, one question paper is randomly chosen by Chief Controller of Examination.
7. C3 semester end Laboratory examination for practical Courses will be conducted conveniently before or after C3 semester end examination for theory Courses. The Laboratory examination will be conducted by both internal and external examiners.
8. Overall grade will be based on marks scored in C1, C2 and C3 examination

The details of the allotment of marks for evaluation of the theory and practical question papers of C1, C2 and C3 examinations were also prepared on the recommendations and approval of Board of Studies. The pattern of evaluation is provided below:

#### **Theory Examination : C1+C2+C3=100 Marks**

Theory	Unit 1	Unit 2	Unit 3	Problems from the three units	Average Score	Assignment	Seminar	Total Marks
<b>C1</b>	<b>10</b>	<b>10</b>	<b>10</b>	-	<b>10</b>	<b>5</b>	-	<b>15</b>
<b>C2</b>	<b>10</b>	<b>10</b>	<b>10</b>	-	<b>10</b>	-	<b>5</b>	<b>15</b>
<b>C3</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>16</b>	<b>--</b>	-	-	<b>70</b>

#### **Practical Examination: C1+C2+C3=100 Marks**

Practical	Experiment	Record	Viva	Total Marks
<b>C1</b>	<b>7</b>	<b>5</b>	<b>3</b>	<b>15</b>
<b>C2</b>	<b>7</b>	<b>5</b>	<b>3</b>	<b>15</b>
<b>C3</b>	<b>50</b>	-	<b>20</b>	<b>70</b>

### **Programme Outcomes:**

- PO1. Identify, formulate and analyze complex problems using first principles.
- PO2. A research oriented learning to develop analytical problem-solving approaches.
- PO3. Awareness of ethical issues and regulatory considerations.
- PO4. Understand the basic concepts, fundamental principles and the scientific Theories.
- PO5. Acquire skills in handling scientific instruments, planning and performing in laboratory experiments.
- PO6. Think creatively in explaining solutions to the problems.
- PO7. Realize developments in science subject and interdisciplinary approach.
- PO8. Develop scientific outlook towards all aspects of life.
- PO9. Effective influence, which inspires in new scientific theories and inventions.
- PO10. To Imbibe ethical, moral and social values in personal and social life and develop Positive attitude that leads to successful life.

### **PROGRAMME SPECIFIC OUTCOMES:**

- PSO1. Acquire substantial knowledge in Physics, basic knowledge in Mathematics and computer science
- PSO2. Specialisation in Solid State Physics/Nuclear Physics provides special expertise.
- PSO4. Provide hands-on research experience in a specific field of Physics, through the supervised project.
- PSO5. Familiarise with contemporary research within various fields of Physics.
- PSO6. Provides the candidate knowledge with general competence and analytical skills needed in research, education, industry, consultancy and public administration.
- PSO7. Develop interdisciplinary approach.
- PSO8. Critically assess and evaluate research methods and results.
- PSO9. Understands the role of Physics in society and ethical problems.
- PSO10. To avail Global research opportunities.

## Syllabus for the 4-Semester M.Sc., (Physics) Choice Based Credit Scheme (CBCS)

### PHA 120: Classical Mechanics

#### Course Outcome:

- Students who have completed this course should be able to
- C01. Solve the Newton equations for simple configurations
  - C02. Use conservation to solve dynamics problems.
  - C03. Represent the equations of motion for complicated mechanical systems
  - C04. Derive and solve the equations of motions for systems subject to the Principle of Least Action
  - C05. Calculate conserved quantities from symmetries
  - C06. Acquire a deep knowledge of the Lagrangean and Hamiltonian formalism
  - C07. Understand theory of small oscillations

**Mechanics of a system of particles:** Conservation of linear and angular momenta in the absence of (net) external forces and torques using centre of mass. The energy equation and the total potential energy of a system of particles using scalar potential (**Goldstein H**).

**The Lagrangean method:** Constraints and their classifications. Generalized coordinates. Virtual displacement, D'Alembert's principle and Lagrangean equations of the second kind. Examples of (1) single particle in Cartesian, spherical polar and cylindrical polar coordinate systems, (2) Atwood's machine, (3) a bead sliding on a rotating wire in a force-free space and (4) Simple pendulum. Derivation of Lagrange equations from Hamilton principle (**Goldstein H**).

**Central forces:** Reduction of two particle equations of motion to the equivalent one-body problem, reduced mass of the system. Conservation theorems (First integrals of the motion). Equations of motion for the orbit, classification of orbits, conditions for closed orbits. The Kepler problem (inverse-square law of force) (**Aruldas G, Goldstein H, Srinivasa Rao K.N**). **[16 hours]**

**Hamilton's equations:** Generalised momenta. Hamilton's equations. Examples - simple harmonic oscillator, charged particle moving in an electromagnetic field. Hamiltonian for a free particle in different coordinates. Cyclic coordinates. Physical significance of the Hamiltonian function. Derivation of Hamilton's equations from a variational principle (**Goldstein H**).

**Canonical transformations:** Definition, Generating functions (Four basic types). Examples of Canonical transformations. The harmonic Oscillator. Infinitesimal contact transformation. Poisson brackets; properties of Poisson brackets, angular momentum and Poisson bracket relations. Equation of motion in the Poisson bracket notation. The Hamilton-Jacobi equation; the example of the harmonic oscillator treated by the Hamilton-Jacobi method (**Goldstein H**). **[16 hours]**

**Mechanics of rigid bodies:** Degrees of freedom of a free rigid body. Angular momentum and kinetic energy of rigid body. Moment of inertia tensor, principal moments of inertia, products of inertia, the inertia tensor. Euler equations of motion for a rigid body. Torque free motion of a rigid body. Precession of earth's axis of rotation, Euler angles, angular velocity of a rigid body (**Goldstein H**).

**Small oscillations of mechanical system:** Introduction, types of equilibria, Quadratic forms of kinetic and potential energies of a system in equilibrium. General theory of small oscillations, secular equation and eigenvalue equation. Small oscillations in normal coordinates and normal modes, examples of two coupled oscillators. Vibrations of a linear triatomic molecule (**Goldstein H**). **[16 hours]**

**Total work load**

**48 hours**

#### References:

1. Goldstein H., Poole C. and Safko J., Classical mechanics, 3rd Edn., Pearson Education, New Delhi. 2002
2. Upadhaya J.C., Classical mechanics, Himalaya Publishing House, Mumbai. 2006.
3. Srinivasa Rao K.N., Classical mechanics, Universities Press, Hyderabad. 2003.
4. Takwale R.G. and Puranik S., Introduction to classical mechanics, Tata McGraw, New Delhi, 1991.
5. Landau L.D. and Lifshitz E.M., Classical mechanics, 4th Edn., Pergamon Press, 1985.
6. Aruldas G., Classical Mechanics, PHI Learning Private Limited, New Delhi

## PHA 130: Mathematical Methods of Physics 1

### Course Outcome:

Upon completion of the course students should be

- CO1. Familiar with mathematical methods for solving advanced problems in physics.
- CO2. Familiar with Tensors, algebra of tensors and Tensor Calculus and its applications in applied sciences and engineering;
- CO3. Able to solve abstract mathematical problems, recognize real-world problems and to formulate mathematical models for such problems.
- CO4. Familiar with Hermite and Laguerre polynomials solutions
- CO5. Familiar with generating function of the polynomials
- CO6. Able to Use Legendre polynomials, associated Legendre polynomials in Physics
- CO7. Able to Use Bessel functions, Spherical harmonics in Physics

**Curvilinear coordinates and Tensors:** Curvilinear coordinates in the Euclidean 3-space, Orthogonal curvilinear coordinates. Differential vector operators; Grad, divergence, curl and Laplacian in arbitrary curvilinear coordinates. Circular cylindrical coordinates, spherical polar coordinates (**Arfken & Weber**).

**Tensors:** Tensors of rank  $r$  as a  $r$ -linear form in base vectors. Transformation rules for base vectors and tensor components. Tensor algebra, contraction, Raising and lowering of indices, Associated tensors, quotient rule. Mention of pseudo tensor, dual tensor and non-cartesian tensor. Metric tensor, Covariant and contravariant components of the metric tensor, Christoffel symbols. Tensor derivative operators, Covariant differentiation. The contracted Christoffel symbol (**Arfken & Weber**). **[16 hours]**

**Differential equations, Hermite function and Laguerre functions:** Differential equations: Partial differential equations, Separation of variables - Helmholtz equations in Cartesian, circular cylindrical coordinates Spherical polar coordinates. Regular and irregular singular points of a second order ordinary differential equation. Series solution-Frobenius power series method, Examples of Harmonic oscillator and Bessel's equation. Linear dependence and independence of solutions-Wronskian. Non-homogeneous equations-Green's function, examples (**Arfken & Weber**).

**Hermite functions:** Hermite's differential equation and its Solution, Hermite polynomials, Generating functions, Recurrence relations, Rodrigues representation, Orthogonality (**Arfken & Weber**).

**Laguerre functions:** Laguerre differential equation and its solution, Laguerre polynomials, Generating function, Recurrence relations, Rodrigues representation, Orthogonality. Associated Laguerre functions: Definition, Generating function, Recurrence relations and Orthogonality (**Arfken & Weber**). **[16 hours]**

**Special functions:** Sturm - Liouville theory - Self adjoint ODE's, Hermitian operators, completeness of eigenfunction, Green's function—eigenfunction expansion (**Arfken & Weber**).

**Bessel functions:** Bessel functions of the first kind  $J_\nu(x)$ , Bessel differential equation, generating function for  $J_\nu(x)$ , Integrals for  $J_0(x)$  and  $J_\nu(x)$ , recurrence formulae for  $J_\nu(x)$ , orthogonal properties of Bessel polynomials (**Arfken & Weber**).

**Legendre functions:** Legendre differential equation, Legendre polynomials, generating functions, recurrence formulae, Rodrigues representation, Orthogonality. Associated Legendre polynomials; The differential equation, Orthogonality relation (**Arfken & Weber**).

**Spherical harmonics:** Definition and Orthogonality (**Arfken & Weber**).

**[16 hours]**

**Total work load**

**48 hours**

### References:

1. Arfken G.B. and Weber H.J., Mathematical methods for physicists, 6th Edn., Academic Press, New York (Prism Books, Bangalore, India), 1995.
2. Harris E.G., Introduction to modern theoretical physics, Vol. 1, John Wiley, New York, 1975.
3. Srinivasa Rao K.N., The rotation and Lorentz groups and their representations for physicists, Wiley Eastern, New Delhi, 2003.
4. Gupta B.D., Mathematical physics, 4th Edn, 2011.
5. Bali N. P., Engineering Mathematics, Laxmi Publications, New Delhi
6. Dass H. K., Higher Engineering Mathematics, S. Chand, New Delhi
7. Chattopadhyay P. K., Mathematical Physics, New Age International.



## PHA 140: Mathematical Methods of Physics 2

### Course Outcome:

Upon completion of the course students should be able to

- C01. Explain the concepts of Linear vector space.
- C02. Express conditions for transformations.
- C03. Explain matrix representation of a linear transformation, Matrix representations
- C04. Explain concepts of eigenvalues and eigenvectors of a matrix.
- C05. Use matrices and determinants to solve sets of simultaneous linear equations
- C06. Understand the concepts of inner product, orthogonality and orthonormality
- C07. Recognize real-world problems and formulation of mathematical models of such problems.
- C08. Understand linear representations of groups and Rotation groups and applications in Physics
- C09. Apply Fourier transforms and Integral equations in Physics

**Linear vector space:** Linear vector space - Definition. Linear dependence and independence of vectors. Dimension. Basis. Change of basis. Subspace. Isomorphism of vector spaces. Linear operators. Matrix representative of a linear operator in a given basis. Effect of change of basis. Invariant subspace. Eigenvalues and eigenvectors. Characteristic equation. The Schur canonical form. Diagonalization of a normal matrix. Schur's theorem (**Arfken & Weber**). [16 hours]

**Linear representations of groups:** Groups of regular matrices; the general linear groups  $GL(n, C)$  and  $GL(n, R)$ . The special linear groups  $SL(n, C)$  and  $SL(n, R)$ . The unitary groups  $U(n)$  and  $SU(n)$ . The orthogonal groups  $O(n, C)$ ,  $O(n, R)$ ,  $SO(n, C)$  and  $SO(n, R)$ . Homogeneous Lorentz group (**Arfken & Weber**).

**Rotation group:** The matrix exponential function-Definition and properties. Rotation matrix in terms of axis and angle. Eigenvalues of a rotation matrix. Euler resolution of a rotation. Definition of a representation. Equivalence. Reducible and irreducible representations. Schur's lemma. Construction of the  $D^{1/2}$  and  $D^1$  representation of  $SO(3)$  by exponentiation. Mention of the  $D^1$  irreps  $SO(3)$  (**Srinivasa Rao K.N.**). [16 hours]

**Fourier transforms and Integral equations:** General properties, completeness, use of Fourier series. Applications of Fourier series (**Arfken & Weber**).

**Integral transforms;** Development of Fourier Integral, Fourier transform - inversion theorem, Fourier transform of derivatives, convolution theorem. Momentum representation (**Arfken & Weber**).

**Integral equations:** Definitions, transformation of a differential equation into an integral equation, Integral transforms, generating functions, Abel's equation, Neumann series, separable kernels, Numerical solution, non-homogeneous integral equations (**Arfken & Weber**). [16 hours]

**Total work load**

**48 hours**

### References:

1. Shankar R., Principles of quantum mechanics, 2nd Edn., Plenum Press, New York, 1984.
2. Srinivasa Rao K.N., The rotation and Lorentz groups and their representations for Physicists, Wiley Eastern, New Delhi, 1988.
3. Arfken G.B. and Weber H.J., Mathematical methods for Physicists, 5th. Edn., Academic Press, New York, 2001.
4. Gupta B.D., Mathematical Physics, 4th Edn. (Page no. 8.48-8.83, 8.16-8.48) 2011
5. Bali N. P., Engineering Mathematics, Laxmi Publications, New Delhi
6. Dass H. K., Higher Engineering Mathematics, S. Chand Publications, New Delhi
7. Charlie Harper, Introduction to Mathematical Physics, PHI Publications, 2008.

## PHA 150: Classical Electrodynamics, Plasma Physics and Optics

### Course Outcome:

Students who have completed this course should

- CO1. Have theoretical foundations of electromagnetic phenomena.
- CO2. Be able to solve the Maxwell equations for simple configurations.
- CO3. Formulate and solve electromagnetic problems with the help of electrodynamic potentials and super potentials
- CO4. make a detailed account for gauge transformations and their use
- CO5. Learn the techniques of deriving and evaluating formulae for the electromagnetic fields from general charge and current distributions
- CO6. calculate the electromagnetic radiation from radiating systems, formulate and solve electrodynamic problems, covariant form in 4 dimensional space-time
- CO7. Formulate self-consistent models for the interaction between matter and em fields,
- CO8. Covariant formulation of electrodynamics, Lagrange formalism
- CO8. Apply the concept of Special theory of relativity for relativistic electrodynamics

**Electric multipole moments:** The electric dipole and multipole moments of a system of charges. Multipole expansion of the scalar potential of an arbitrary charge distribution **(Griffiths D.J.)**.

**Potential formulation:** Maxwell equations in terms of electromagnetic potentials. Gauge transformations. The Lorentz, Coulomb and radiation gauges **(Griffiths D.J.)**.

**Fields of moving charges and radiation:** The retarded potentials. The Lienard-Wiechert potentials. Fields due to an arbitrarily moving point charge; the special case of a charge moving with constant velocity **(Griffiths D.J.)**.

**Radiating systems:** Radiation from an oscillating dipole. Power radiated by a point charges - Larmor formula. Lienard's generalisation of Larmor formula. Energy loss in bremsstrahlung and linear accelerators. Radiation reaction - Abraham-Lorentz formula **(Griffiths D.J)** **[16 hours]**

**Relativistic electrodynamics:** Charge and fields as observed in different frames. Covariant formulation of electrodynamics; Electromagnetic field tensor, Transformation of fields, Field due to a point charge in uniform motion. Lagrangian formulation of the motion of charged particle in an electromagnetic field **(Griffiths D.J)**.

**Plasma Physics:** Quasineutrality of a plasma, plasma behaviour in magnetic fields, Plasma as a conducting fluid. Magnetohydrodynamics; magnetic confinement, Pinch effect, instabilities, Plasma waves. **(Laud B. B.)** **[16 hours]**

**Electromagnetic waves:** Monochromatic plane waves - velocity, phase and polarization. Propagation of plane electromagnetic waves in (1) conducting media and (2) ionised gases. Reflection and refraction of electromagnetic waves; Fresnel formulae for parallel and perpendicular components. Brewster's law. Normal and anomalous dispersion; Clausius-Mossotti relation **(Born M. and Wolf E)**.

**Interference:** General theory of interference of two monochromatic waves. Two beam and Multiple beam interference with a plane-parallel plate. Fabry-Perot interferometer; etalon construction, resolving power and its application. Interference filters **(Born M. and Wolf E)**.

**Diffraction:** Integral theorem of Helmholtz and Kirchhoff. Fresnel-Kirchhoff diffraction formula; conditions for Fraunhofer and Fresnel diffraction. Fraunhofer diffraction due to a circular aperture. **(Born M. and Wolf E)** **[16 hours]**  
**48 hours**

### Total work load

### References:

1. Griffiths D.J., Introduction to Electrodynamics, 5th Edn., Prentice-Hall of India, New Delhi, 2006.
2. Jackson J.D., Classical Electrodynamics, 2nd Edn., Wiley-Eastern Ltd, India, 1998.
3. Born M. and Wolf E., Principles of Optics, 6th Edn., Pergamon Press, Oxford, 1980.
4. Matveev A.N., Optics, Mir Publishers, Moscow, 1988.
5. Laud B.B., Electromagnetics, Wiley Eastern Limited, India, 2000.
6. Hecht E., Optics, Addison-Wesley, 2002.
7. Lipson S.G., Lipson H. & Tannhauser D.S., Optical physics, Cambridge University Press, USA, 1995.
8. Ajoy Ghatak, Optics, Tata McGraw - Hill, New Delhi
9. Gupta A. B. Modern Optics, Books and Allied (P) Ltd, Kolkata
10. Sen S.N., Plasma Physics, Pragathi Prakasan

### **PHA 160: Computer Lab CL-A**

#### **Course Outcome:**

Students who have completed this course should

- C01. Learn scientific typesetting with LaTeX program.
- C02. Plot the functions and data with Gnuplot program,
- C03. Solve problems with Octave program
  - Linux operating system basics (4 sessions) :  
Login procedure; creating, deleting directories; copy, delete, renaming files; absolute and relative paths; Permissions—setting, changing; Using text editor.
  - Scientific text processing with LATEX.  
Typeset text using text effects, special symbols, lists, table, mathematics and including figures in documents.
  - Using the plotting program GNUPLOT (2 sessions) :  
Plotting commands; To plot data from an experiment and applying least-squares fit to the data points. Including a plot in a LATEX file.
  - Using the mathematics package OCTAVE (2 sessions), To compute functions, matrices, eigenvalues, inverse, roots.

**Total work load:** 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

### **PHA 220: Electronics Lab**

#### **Course Outcome:**

Students who have completed this course should

- C01. Maintain digital and analog devices and circuits.
- C02. Analyze components associated with digital and analog electronic systems.
- C03. Demonstrate proficiency in the use of electronic equipment and devices.
- C04. Assist in the design, operation, and troubleshooting of electronic systems.
- C05. Analyse electronics devices and circuits using computer simulations.
- C06. Realise electronic circuits using electronic devices and mathematical concepts.
- C07. Accept professional and ethical responsibilities of the engineering technology

Any ten of the following experiments:

1. Regulated power supply.
2. Active filters : low pass (single pole).
3. Active filters : high pass (double pole).
4. Voltage follower.
5. Colpitts' oscillator.
6. Opamp as an integrator and differentiator.
7. Opamp as a summing and log amplifier.
8. Opamp as an inverting and non-inverting amplifier.
9. Coder and encoder.
10. Half adder and full adder.
11. Boolean algebra-Logic gates.
12. Opamp astable multivibrator.

**Total work load:** 2 day(s) per week × 4 hours × 16 weeks = **128 hours**

## PHB 070: Continuum Mechanics and Relativity

### Course Outcome:

- After the completion of the course, student will be familiar with
- CO1. Internal response of materials to external loading
  - CO2. Development of physical intuition for the behaviour of solids and fluids
  - CO3. Unique connections between solid and fluid mechanics.
  - CO4. The non-existence ether through Michelson-Morley experiments
  - CO5. Minkowski space-time
  - CO6. The true nature of Newtonian mechanics and Lorentz Transformations
  - CO7. The concept of constant relative motion of different bodies in different frames
  - CO8. The calculation of proper time, dilated time, proper length and contracted length
  - CO9. Principles of the special theory of relativity, Covariant form of Newton laws
  - CO10. Einstein field equations, their underlying mathematical structure and solutions
  - CO11. Lagrangean formulation of General Relativity.
  - CO12. Derivation of testable physical consequences of General Relativity

**Continuum mechanics of solid media:** Small deformations of an elastic solid; the strain tensor. The stress tensor. Equations of equilibrium. The symmetry of the stress tensor. The generalised Hooke's law for a homogeneous elastic medium; the elastic modulus tensor. Navier equations of motion for a homogeneous isotropic medium. **(Landau L.D. and Lifshitz)**

**Fluid mechanics:** Equation of continuity. Flow of a viscous fluid; Navier-Stokes equation and its solution for the case of flow through a cylindrical pipe. The Poiseuille formula **(Landau L.D. and Lifshitz)**. **[16 hours]**

**Minkowski space-time:** Real coordinates in Minkowski space-time. Definition of 4-tensors. The Minkowski scalar product and the Minkowski metric  $\eta_{ij} = \text{diag}(1, -1, -1, -1)$ . Orthogonality of 4-vectors. Raising and lowering of 4-tensor indices. Time like, null and space like vectors and world-lines. The light-cone at an event **(Griffiths)**.

**Relativistic mechanics of a material particle:** The proper-time interval  $d\tau$  along the world - line of a material particle. The instantaneous (inertial) rest-frame of a material particle; Components of 4-velocity, 4-acceleration and 4-momentum vector, statement of second law of Newton. Determination of the fourth component  $F_4$  of the 4-force along the world-line of the particle. Motion of a particle under the conservative 3-force field and the energy integral. The rest energy and the relativistic kinetic energy of a particle. **[16 hours]**

**Einstein's equations:** The Principle of Equivalence and general covariance. Inertial mass, gravitational mass, Eötvös experiment. Gravitation as space-time curvature. Einstein Gravitational field equations and its Newtonian limits.

**The Schwarzschild metric:** Heuristic derivation of the Schwarzschild line element. Motion of particles and light rays in the Schwarzschild field. Explanation of the (1) perihelion advance of planet Mercury, (2) gravitational red shift and (3) gravitational bending of light. A brief discussion of the Schwarzschild singularity and the Schwarzschild black hole. **[16 hours]**

**Total work load**

**48 hours**

### References:

1. Landau L.D. and Lifshitz E.M., Fluid Mechanics, Pergamon Press, 1987.
2. Landau L.D. and Lifshitz E.M., Theory of Elasticity, Pergamon Press, 1987.
3. Synge J.L., Relativity: The Special Theory, North-Holland, 1972.
4. Landau L.D. and Lifshitz E.M., The Classical Theory of Fields, 4th Edn., (Sections 1 to 6, 16 to 18, 23 to 25, 26 to 35), Pergamon Press, Oxford, 1985.
5. Wald R.M., General relativity, The University of Chicago Press, Chicago, 1984.
6. Schutz B.F., A first course in general relativity, Cambridge University Press, Cambridge, 1985.
7. Bergman P., Introduction to theory of relativity, Prentice-Hall of India, 1969.
8. Rindler R., Relativity: Special, general and cosmological, Oxford University Press, 2006.
9. Narlikar J. V., An introduction to Cosmology, Cambridge Publications
10. Somnath Datta, Introduction to Special theory of Relativity, Allied Publishers, India, 1998
11. Griffiths D. J. Introduction to Electrodynamics, Pearson Publications, 2013.

## PHB 080: Thermal Physics

### Course Outcome:

After the completion of the course, Student will be familiar with

- C01. Basic concepts of Thermodynamics
- C02. Formulation of the first law of thermodynamics for a closed systems
- C03. Mode of heat transfer, the amount of heat energy transferred and conservation of mass and energy equations.
- C04. Second law of thermodynamics; thermal efficiency & coefficient of performance.
- C05. concept of ensemble, phase space & conservation of phase-space density(Liouville's theorem)
- C06. Solution to statistical mechanics problems for simple non-interacting systems,
- C07. Phase transitions, Statistical equilibrium,. Entropy and probability
- C010. Microcanonical ensemble, Partition function, Gibbs paradox, canonical ensemble
- C011. Quantum statistical mechanics. Symmetry of wave functions.
- C012. Quantum distribution functions (BE and FD), Applications of Quantum Statistics

**Thermodynamics Preliminaries:** Zeroth law of thermodynamics, vander Walls equation of state second law of thermodynamics (**Huang K., Laud B.B, Satya Prakash**).

**Entropy:** Change in entropy for reversible an irreversible process, entropy and second law of thermodynamics, thermodynamic functions and Maxwell's relations  $TdS$  equations, heat capacities equations, third law of thermodynamics. Irreversible thermodynamics Onsager's reciprocal relation (**Huang K., Laud B.B, Satya Prakash**).

**Phase equilibria;** Equilibrium conditions. Classification of phase transitions; phase diagrams; Clausius-Clapeyron equation, applications. Thermoelectric phenomenon, Peltier effect, Seebeck effect, Thompson effect. Systems far from equilibrium (**Huang K., Laud B.B, Satya Prakash**). **[16 hours]**

**Classical Statistical Mechanics:** Probability, phase space, division of phase space, ensembles, density distribution in phase space, ergodic hypotheses, Liouville theorem. Statistical equilibrium, postulate of equal *a priori* probability, general expression for probability, Stirlings formula, the most probable distribution, Maxwell Boltzmann distribution law, law of equipartition of energy. Entropy and probability. Microcanonical ensemble, connection between statistical and thermodynamic quantities, Partition function of system of particles, Gibbs paradox, canonical ensemble, perfect monoatomic gas in canonical ensemble, grand canonical ensemble. Vibrational partition function of diatomic molecules (Einstein relations), Rotational partition function of diatomic molecule (**Huang K., Laud B.B, Satya Prakash**). **[16 hours]**

**Quantum Statistical Mechanics:** The postulates of quantum statistical mechanics. Symmetry of wave functions. The Liouville theorem in quantum statistical mechanics; condition for statistical equilibrium; Ensembles in quantum mechanics; the quantum distribution functions (BE and FD), the Boltzmann limit of Boson and Fermion gases, the derivation of the corresponding distribution functions.

**Applications of Quantum Statistics:** Equation of state of an ideal Fermi gas (derivation not expected), Application of Fermi-Dirac statistics to the theory of free electrons in metals, degeneracy. Application of Bose statistics to the photon gas, derivation of Planck's law, comments on the rest mass of photons. Thermodynamics of Black body radiation. Bose-Einstein condensation (**Huang, Laud, Satya Prakash**). **[16 hours]**

**Total work load**

**48 hours**

### References:

1. Agarwal B.K. and Eisner M., Statistical mechanics, New Age International Publishers, 2000.
2. Roy S.K., Thermal physics and statistical mechanics, New Age International Pub., 2000.
3. Huang K., Statistical mechanics, Wiley-Eastern, 1975.
4. Laud B.B., Fundamentals of statistical mechanics, New Age International Pub., 2000.
5. Schroeder D.V., An introduction to thermal physics, Pearson Education New Delhi, 2008.
6. Salinas S.R.A., Introduction to statistical physics, Springer, 2004.
7. Mark W Zemansky Heat and Thermodynamics, McGraw - Hill
8. Gupta A. B and Roy H. B., Thermal Physics Books and Allied (P) Ltd, Kolkata
9. Satya Prakash, Statistical Mechanics, Kedarnath Ramnath, 2017.
10. Mike Glazer, J.S. Wark, Statistical Mechanics: A Survival Guide, Oxford Publications, 2001.

## PHB 090: Quantum Mechanics 1

### Course Outcome:

After the completion of the course Student will be familiar with

- CO1. The Basic concepts and mathematical foundations of quantum mechanics
- CO2. Solutions to the Schrödinger equation for simple potentials.
- CO3. The effect of symmetries in quantum mechanics
- CO4. The significance of wave function, normalization, uncertainty Principle
- CO5. The Physical significance of eigen functions and eigen vectors
- CO6. Formalism; Hilbert space, Dirac notation, concepts of Dynamical variables and operators
- CO7. General Uncertainty relation. Matrix representation of wave functions & operators.
- CO8. The Schrödinger equation and time evolution of a system.
- CO9. The Schrödinger picture and Heisenberg picture
- CO10. Schrodinger equation in three dimensions, Hydrogen atom.

**The wave function and uncertainty Principle:** Wave particle duality, interpretation of the wave function, wave functions for particles having definite momentum, wave packet, Gaussian wave packet. Heisenberg uncertainty principle.

Time independent Schrodinger equation, conservation of probability, expectation values and operators, the Ehrenfest theorem, Time dependent Schrodinger equation, stationary states. Energy quantisation. Properties of energy eigenfunction, general solutions of time dependent Schrodinger equation for a time independent potential. Schrodinger equation in momentum space **(Bransden & Joachain)**. **[16 hours]**

**Formalism:** Hilbert space. The state of a system, Dirac notation. Dynamical variables and operators – Hermitian operators, adjoint operator, projection operators. Inverse and unitary operators. Expansion in eigenfunctions - eigenvalue and eigenfunction of an operator. Commutator algebra. General Uncertainty relation. Unitary transformation, Representation in discrete basis; Matrix representation of wave functions and operators. Change of representation and Unitary transformations. Matrix representation of eigenvalue problem. Representation in continuous bases. The Schrödinger equation and time evolution of a system. The Schrödinger picture and Heisenberg picture.

**Schrodinger equation in one dimension:** The free particle, the potential step, potential barrier, infinite square well, finite square well, the linear harmonic oscillator (Algebraic and Analytic method), the periodic potential **[Bransden and Joachain, Nouredine Zettili]**. **[16 hours]**

**Angular Momentum:** Orbital angular momentum; Orbital angular momentum and spatial rotations, eigenvalues and eigenfunctions of  $L^2$  and  $L_z$ . Particle on a sphere and the rigid rotator. General angular momentum. The spectrum of  $J^2$  and  $J_z$ . Matrix representation of angular momentum operators, spin angular momentum, spin one-half, total angular momentum. Addition of angular momenta - CG Coefficients.

**Schrodinger equation in three dimensions:** Separation of the Schrodinger equation in Cartesian coordinates - the free particle. Central potential. Separation of the Schrodinger equation in spherical polar coordinates; the Hydrogenic atom and its solutions **(Bransden & Joachain)**. **[16 hours]**

**Total work load**

**48 hours**

### References:

1. Nouredine Zettili, Quantum Mechanics, WILEY Publications, U K 2009
2. Griffiths D.J., Introduction to quantum mechanics, Prentice-Hall, USA, 1994.
3. Bransden & Joachain, 2004, II edition, Pearson Low Price Edition
4. Sakurai J.J. and Tuan S.F. (Editor), Modern quantum mechanics, AddisonWesley, India, 1999.
5. Shankar R., Principles of quantum mechanics, 2nd Edn., Plenum Press, New York, 1984.
6. Schiff L.I., Quantum mechanics, 3rd. Edn., McGraw-Hill, Kogakusha Ltd., New Delhi, 1968.
7. Aruldas G., Quantum Mechanics, PHI, New Delhi
8. Mathews P. M. and Venkatesan K., Quantum mechanics, Tata - McGraw-Hill, New Delhi
9. Verma H. C., Quantum Physics, Surya Publications, Ghaziabad
10. Merzbacher E., Quantum Mechanics, III edition, Wiley publication.

## PHB 100: Spectroscopy and Fourier Optics

### Course Outcome:

- After completing this course, the student will be able to
- CO1. Explain the applications of spectroscopic methods for qualitative & quantitative analysis.
  - CO2. Compare and contrast atomic and molecular spectra.
  - CO3. Understand the molecular absorption & scatter from particulate matter in atomic absorption spectroscopy
  - CO4. Recognise the effect of changing the slit width on qualitative & quantitative analysis.
  - CO5. Explain the selection rule for infrared-active transitions
  - CO6. design a non-dispersive infrared spectrophotometer
  - CO7. Understand the Fourier Transform infrared spectroscopy
  - CO8. understand Raman spectroscopy
  - CO9. Elements of Nonlinear Optics

**Atomic spectroscopy:** vector model of atom- orbital magnetic moment, Larmor precession, electron spin, coupling of orbital and spin angular momenta. Spectroscopic terms and their notations, spin-orbit interaction, quantum mechanical relativistic correction. Fine structure of hydrogen, Lamb shift. L-S and J-J coupling. Lande interval rule, selection rules.

Zeeman effect, Examples 1)  $3/2^2D - 1/2^2P$  2)  $5/2^2D - 3/2^2P$  3)  $3P - 2S$ .

Anomalous Zeeman effect, Lande-g factor, Paschen-Back effect – spin-orbit correction. Stark effect – weak field effects and strong field effects. Hyperfine structure of spectral lines. Nuclear spin and hyperfine splitting, intensity ratio and determination of nuclear spin. Breadth of spectral lines, natural breadth. Doppler Effect and external effect (**Rajkumar**). [16 hours]

**Nuclear magnetic resonance:** Quantum mechanical expression for the resonance condition. Relaxation Mechanisms; Expression for spin lattice relaxation. Chemical shift; spin-spin interaction, example of ethyl alcohol. Fourier transform technique in NMR. FTNMR spectrometer and experimental procedure. NMR in medicine.

**Microwave spectroscopy:** The classification of molecules. The rotational spectra of rigid diatomic rotator, the spectra of non-rigid diatomic rotator, example of HF. Microwave oven.

**Infrared spectroscopy:** The Born-Oppenheimer approximation. Vibrational energy of diatomic molecule. Anharmonic oscillator. Diatomic vibrating rotator, example of the CO molecule. The vibrations of polyatomic molecules; skeletal and group frequencies. Experimental technique in FTIR.

**Raman spectroscopy:** The quantum theory of Raman effect. Pure rotational Raman spectra of linear molecules and symmetric top molecules. Vibrational Raman spectra. Rotational fine structure. Instrumentation technique in Raman spectroscopy (**Banwell C.N. & McCash E.M and Aruldas**). [16 hours]

**Fourier optics:** Spatial frequency filter; effect of a thin lens on an incident field distribution. Lens as a Fourier transforming element. Application to phase contrast microscopy. (**Hecht**)

**Propagation of light in an anisotropic medium:** Structure of a plane electromagnetic wave in an anisotropic medium. Dielectric tensor. Fresnel's formulae for the light propagation in crystals. Ellipsoid of wave normals and ray normals. Normal surface and ray surface. Optical classification of crystals. Light propagation in uniaxial and biaxial crystals. Refraction in crystals. (**Born M. and Wolf E.**)

**Elements of Nonlinear Optics:** Second harmonic generation, optical rectification and phase matching; third harmonic generation (**Lipson, Srivatsava**). [16 hours]

### Total work load

48 hours

### References:

1. Tralli N. and Pomilla P.R., Atomic theory, McGraw-Hill, New York, 1999.
2. Banwell C.N. and McCash E.M., Fundamentals of Molecular Spectroscopy, 4th Edn., Tata McGraw-Hill, New Delhi, 1995.
3. Mahan B.H., University Chemistry, 3rd Edn. (Chapters 3, 10, 11 and 12), Narosa, New Delhi, 1975.
4. Hecht E., Optics, Addison-Wesley, 2002.
5. Lipson S.G., Lipson H. and Tannhauser D.S., Optical physics, Cambridge University Press, USA, 1995.
6. Rajkumar, Atomic and molecular spectra: Laser, Kedarnath Ramanath Publications, Meerut.
7. Born M. and Wolf E., Principles of optics, 6th Edn., Pergamon Press, Oxford, 1980
8. Srivatsava, P K Optics, CBS Publisher & Distributors I Edition, 2011

## PHB 110: Computer Lab CL-B

### Course Outcome:

After completing this course the student will

- CO1. Learn Computer Programming,
- CO2. Have Hands on experience with C programming language and its syntax,
- CO3. Apply C techniques for physics problem solving and data analysis.
- CO4. Learn PERL scripting language

### Programming in C

- Check whether given number is odd or even.
- Find the largest and smallest number in the input set.
- Compute the Fibonacci sequence.
- Check whether the input number is prime or not.
- Compute the roots of a quadratic equation.
- Generate Pascal's triangle.
- To add two  $m \times n$  matrices.
- To find the sum and average of a data stored in a file.
- Linear least-squares fitting to data in a file.
- To find the trajectory of a projectile shot with an initial velocity at an angle. Also, find the maximum height travelled and distance travelled. Write the trajectory data to a file specified and plot using Gnuplot.

### Programming in Perl

- Searching for a pattern in a string.
- Counting the number of characters, words and lines in a given file.
- Sorting strings.
- Check whether the input number is prime or not.
- Compute the roots of a quadratic equation.
- Linear least squares fitting to data in a file.

Total work load : 1 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **64 hours**

## PHB 220: Optics Lab

### Course Outcome:

After completing this course the student will

- CO1. Have hands on experience of experiments using spectrometer
- CO2. Use the principles of superposition to explain interference, diffraction and polarisation
- CO3. Describe the operation of optical devices, including, polarisers and interferometers.
- CO4. Solve problems in optics by selecting the appropriate equations & performing numerical or analytical calculations.
- CO5. Follow instructions to perform experiments & document their results, using correct procedures and protocols.
- CO6. Analyse, interpret and communicate results from laboratory experiments, orally or in a written laboratory report.

Any ten of the following experiments:

1. Verification of the Brewster law of polarisation.
2. Verification of Fresnel laws of reflection from a plane dielectric surface.
3. Determination of the inversion temperature of the copper-iron thermocouple.
4. Birefringence of mica by using the Babinet compensator.
5. Birefringence of mica by using the quarter-wave plate.
6. Experiments with the Michelson interferometer.
7. Determination of the refractive index of air by Jamin interferometer.
8. Determination of the size of lycopodium spores by the method of diffraction haloes.
9. Determination of wavelength by using the Fabry-Perot etalon.
10. Dispersion of the birefringence of quartz.
11. The Franck-Hertz experiment.
12. Experiments with the laser.
13. Determination of the Stokes vector of a partially polarised light beam
14. Determination of the modes of vibration of a fixed-free bar.

Total work load : 2 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **128 hours**



## PHC 050: Quantum Mechanics 2

### Course Outcome:

- After completing this course the student will be able to
- CO1. Understand the effect of symmetries in quantum mechanics
  - CO2. Understand the significance of wave function, normalization, uncertainty principle, Physical significance of eigenfunctions and eigenvectors
  - CO3. Time-independent perturbation theory: Non degenerate Perturbation Theory
  - CO4. Degenerate Perturbation Theory; Fine Structure of Hydrogen, Zeeman Effect.
  - CO5. The Variational Principle: Theory, the Ground State of Helium.
  - CO6. WKB Approximation: The Classical Region, Tunneling; connection formulae,  $\alpha$ -decay
  - CO7. The time-dependent perturbation theory
  - CO8. Adiabatic approximation and scattering phenomena
  - CO9. Have a basic understanding of relativistic effects in quantum mechanics.
  - CO10. Mathematical foundations of quantum mechanics & Schrödinger equation for simple cases.
  - CO11. Relativistic quantum mechanics using Klein-Gordon equation & Dirac equation

**The time-independent perturbation theory:** Non degenerate Perturbation Theory; first and second order perturbation, Perturbed Harmonic Oscillator. Degenerate Perturbation Theory; Fine Structure of Hydrogen, The Zeeman Effect.

**The Variational Principle:** Theory, the Ground State of Helium.

**WKB Approximation:** Classical Region, Tunneling; connection formulae,  $\alpha$ -particle decay **(Griffiths).[16 hours]**

**Time-dependent perturbation theory:** Time dependent perturbation theory; general features, constant and periodic perturbations. Two-Level Systems; Emission and Absorption of Radiations, Spontaneous Emission, Fermi golden rule, Rabi Oscillations.

**Adiabatic approximation** - The Adiabatic Theorem, Berry's Phase. Sudden approximation.

**Scattering:** Introduction, scattering cross section, scattering by a spherically symmetric potential. Partial Wave Analysis, phase shifts. Optical theorem, Lippmann- Schwinger equation. Born Approximation, Rutherford scattering **(Griffiths D J).** **[16 hours]**

**Relativistic quantum mechanics:** Klein-Gordon equation: free particle, stationary state solutions, continuity equation. The Dirac equation; free-particle, stationary state solutions, continuity equation. Covariant formulation; Covariant form of Dirac equation, Lorentz invariance of the Dirac equation, Plane wave solutions of the Dirac equation -non-relativistic limit. Spin and helicity operators. Normalization of the solutions. Brief discussion of the hydrogen atom according to Dirac theory, Non-relativistic limit of Dirac equation. Negative energy states - Hole theory **(Sakurai J J).** **[16 hours]**

**Total work load**

**48 hours**

### References:

1. Bransden and Joachain, II edition, Pearson Low Price Edition
2. Sakurai J.J. and Tuan S.F. (Editor), Modern Quantum Mechanics, Addison Wesley, India, 1999.
3. Shankar R., Principles of Quantum Mechanics, 2nd Edn., Plenum Press, New York, 1984.
4. Schiff L.I., Quantum mechanics, 3rd. Edn., McGraw-Hill, Kogakusha Ltd., New Delhi, 1968.
5. Griffiths D.J., Introduction to Quantum mechanics, Prentice-Hall, USA, 1994.
6. Sakurai J.J., Advanced quantum mechanics, Addison-Wesley, Harlow, England, 1999.
7. Griffiths D., Introduction to Elementary particles, John Wiley and Sons, New York, 1987.
8. Gasiorowicz S., Elementary Particle Physics, John-Wiley, New York, 1966.
9. Muirhead H., The Physics of Elementary Particles, Pergamon Press, London, 1965.

## PHC 060: Condensed Matter Physics

### Course Outcome:

- After completing this course, the student will be able to
- C01. Understand the principles of Condensed Matter Physics, Mathematical descriptions of physical phenomena.
  - C02. Understand the principles of crystal structure of elements Instrumentation for crystal studies
  - C03. Evaluation of crystals data and their suitability for single crystal structure analysis.
  - C04. Crystal growth techniques
  - C05. Liquid crystals; Classification and structures
  - C06. Understand the Structural, Magnetic, Electrical and Semiconductor Properties
  - C07. Theoretical and practical experience in the Condensed Matter Physics

**X-ray crystallography:** Crystalline state. Reference axes, equation of a plane, Miller indices. External symmetry of crystals; symmetry operations. Two and three dimensional point groups. Lattices; two dimensional lattices, choice of unit cell. **(Buerger, p12-20, 23-45).**

Three-dimensional lattices; crystal systems and Bravais lattices. Screw and glide operations. Space groups; Examples of space groups. Diffraction of X rays by crystals; Laue equations. Reciprocal lattice. **[Sherwood, p272-288].** Bragg equation. Equivalence of Laue and Bragg equations. Significance of structure of solid for applications **(Ladd and Palmer, p55-66, p114-121).**

**Atomic scattering factor** (qualitative).

**Electron and neutron diffraction:** Basic principles. Differences between electron, neutron and X-ray diffractions, applications (qualitative). **(Vainshtein, p 336 - 357).**

**Crystal growth techniques:** General methods of crystal growth. Czochralski, Kyropoulos, Stockbarger-Bridgman. Zone refining techniques **(Rose et al p 146 - 154). [16 hours]**

**Disordered materials:** Amorphous solids. Aperiodic materials.

**Liquid crystals:** Introduction, Classification and their applications. Morphology. The smectic (A-H), nematic and cholesteric phases. Birefringence, texture and X-ray studies. Orientational order and its determination for nematic liquid crystals **(DeGennes P.G. and Prost J, Gray and Goodby)**

**Crystal lattice dynamics:** Vibration of an infinite one-dimensional monoatomic lattice, First Brillouin Zone. Group velocity. Finite lattice and boundary conditions. Vibrations of a linear diatomic lattice; optical and acoustical branches, dispersion relations. **(Wahab, p288-305).**

**Magnetic properties of solids:** Diamagnetism and its origin. Expression for diamagnetic susceptibility. Paramagnetism; Quantum theory of paramagnetism, Brillouin function. Ferromagnetism; Curie-Weiss law, Spontaneous magnetisation and its variation with temperature. Ferromagnetic domains. Antiferromagnetism. Two sub-lattice model. Susceptibility below and above Neel's temperature. **(Dekker, p446-490). [16 hours]**

**Superconductivity:** Experimental facts. Type I and type II superconductors. Phenomenological theory. London equations. Meissner effect. High frequency behaviour. Thermodynamics of superconductors; Entropy and Specific heat. Qualitative ideas of the theory of superconductivity. **(Kittel, p333-364).**

**Semiconductors:** Elemental and compound Semiconductors [Streetman, p61-95]. Crystal structure and bonding. Expressions for carrier concentrations. Fermi energy, electrical conductivity and energy gap in intrinsic semiconductors. Extrinsic Semiconductors; impurity states and ionization energy of donors. Carrier concentrations and their temperature variation **(Mckelvey, p256-277). [16 hours]**

**Total work load**

**48 hours**

### References:

1. Stout G.H. and Jensen L.H., X-ray structure determination, MacMillan, USA, 1989.
2. Ladd M.F.C. and Palmer R.A., Structure determination by X-ray crystallography, Plenum Press, USA, 2003.
3. Buerger M.J., Elementary crystallography, Academic Press, London.
4. Dekker A.J., Solid state physics, Prentice Hall, 1985.
5. Kittel C., Introduction to solid state physics, 7th Edn., John Wiley, New York, 1996.
6. Mckelvey J.P., Solid state and semiconductor physics, 2nd Edn., Harper and Row, USA, 1966.
7. Streetman B.G., Solid state electronic devices, 2nd Edn., Prentice-Hall of India, New Delhi, 1983.
8. DeGennes P.G. and Prost J., The physics of liquid crystals, 2nd Edn., Clarendon Press, Oxford, 1998.
9. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.
10. Azaroff L.V., Introduction to solids, McGraw-Hill Inc, USA, 1960.

11. Sherwood D., Crystals, X-rays and proteins, Longman, UK, 1976.
12. Rose R.M., Shepard L.A. and Wulff J., The structure and properties of materials Vol. 4, Electronic properties, Wiley Eastern, 1965.
13. Vainshtein B.K., Modern crystallography, Vol. I, Springer-Verlag, Germany, 1981.
14. Pillai S.O., Solid state physics, New Age International Publications, 2002.

### PHC 070: Nuclear and Particle Physics

#### Course Outcome:

After completing this course the student will be able to

- C01. Understand the relation between the standard model and QCD.
- C02. Understanding strong interactions with many-body physics.
- C03. Quantitatively estimates for nuclear phenomena
- C04. Understand the Standard Model
- C05. Familiarise with theoretical and experiments used in particle physics.
- C06. Stabilise the nucleus, nuclear forces, interactions and models,.
- C07. Critically assess a range of applications of nuclear technology.
- C08. Develop Theoretical & practical experience in the scattering experiments & gamma-ray spectroscopy.

**Properties of the Nucleus:** Nuclear radius; determination by mirror nuclei, Mesic X-rays and electron scattering methods. Nuclear moments; spin, magnetic dipole moment. Relation between  $J$  and  $\mu$  on the basis of single particle model. Determination of nuclear magnetic moment by Molecular beam experiment. Electric quadrupole moment – reduced Electric quadrupole moment .

**Nuclear Models:** Liquid drop model; Weissacker's formula and its application to (1) stability of isobars and (2) fission process. Shell model; Infinite square well potential, Magic numbers. Fermi gas model; well depth, level density and nuclear evaporation.

**Nuclear reactions:** Q-values, threshold energy. Reactions induced by proton, deuteron and particles. Photodisintegration **(Krane & Taya)**. **[16 hours]**

**Nuclear decay modes:** Beta decay; Beta ray spectrum, Pauli neutrino hypothesis, mass of the neutrino from beta ray spectral shape, Fermi theory of beta decay, Kurie plot, ft- values and forbidden transitions. Methods of excitation of nuclei; Nuclear isomerism, Mossbauer effect (qualitative only), Auger effect.

**Interaction of nuclear radiation with matter:** Energy loss due to ionization for proton -like charged particles, Bethe-Bloch formula, Range energy relations. Ionisation and Radiation loss of fast electrons (Bremsstrahlung - qualitative only). Interaction of gamma and X-rays with matter. Detectors; Brief description of NaI (TI) gamma ray spectrometer. Boron trifluoride counter.

**Nuclear reactors:** Condition for controlled chain reactions, slowing down of neutrons, logarithmic decrement in energy. Homogeneous spherical reactor; critical size, effect of reflectors. Breeder reactor(Qualitative discussion) **(Krane & Taya)**. **[16 hours]**

**Nuclear forces and elementary particles:** General features of nuclear force; spin dependence, charge independence, exchange character, saturation other features. Meson theory of nuclear forces; Yukawa's theory. Properties of pi mesons; charge, mass, spin, isospin and parity, decay modes, meson resonances.

**Particle interactions and families:** Conservation laws; classification of fundamental forces and elementary particles. Associated particle production, Gellmann-Nishijima scheme, strange particles. CP violations in Kaon decay. Symmetries; Eight-fold way symmetry, quarks and gluons. Elementary ideas of the Standard model **(Griffiths D J)**. **[16 hours]**

**Total work load**

**48 hours**

#### References

1. Taya D.C., Nuclear Physics, Himalaya Publishing House, New Delhi, 2012 (Unit 1. Chapter Page 6-14. Page 30- 35, 40-49. Chapter 9. Page 355-369. Chapter 10. Page 401-411.)
2. Krane K.S., Introductory nuclear physics, Wiley, New York, 1987. (Unit 1. Chapter 16 page 605-610.)
3. Ghoshal S.N., Nuclear physics, S.Chand and Company, Delhi, 1994. (Unit 2: Chapter 5 page 137-155, Chapter 6 page 187-204, 222, 262, Chapter 13, page 647-651, chapter 15, page 717-721.)
4. Wong S.S.M., Introductory nuclear physics, Prentice Hall of India, Delhi, 1998.
5. Khanna M.P., Introduction to particle physics, Prentice Hall of India, Delhi, 2008.
6. Kapoor S.S. and Ramamoorthy V., Nuclear radiation detectors, Wiley Eastern, Bangalore, 2007

**PHC 240: Solid State Physics 1****Course Outcome:**

- After completing this course the student will
- C01. Understand the Dielectrics properties of Solids;
  - C02. Understand Physics of Ferroelectric Properties of Solids
  - C03. Quantitatively estimate the Magnetic properties of solids
  - C04. Compute the magnetic relaxation time
  - C05. Understand BCS theory of Superconductors
  - C06. Understand the fundamentals of nanomaterials
  - C07. Understand the elastic properties of solids

**Dielectric properties of solids:** Macroscopic description of static dielectric constant, the static electronic and ionic polarisabilities of molecules, orientation polarization. Local electric field at an atom; Lorentz field, field of dipoles inside cavity. The static dielectric constant of solids; Clausius- Mossotti relation. Complex dielectric constant. Polarization catastrophe. Dielectric losses and Debye relaxation time. Classical theory of electronic polarization and optical absorption.

**Ferroelectricity:** Basic properties and classification of ferroelectric materials. The dipole theory of ferroelectricity, objections against the dipole theory. Ionic displacements and behavior of Barium titanate above the Curie temperature. Theory of spontaneous polarization of Barium titanate. Thermodynamics of ferroelectric transitions. Landau theory of phase transitions, Dielectric constant near the Curie point. Ferroelectric domain **(Dekker and Kittel)**. **[16 hours]**

**Magnetic properties:** Definition of magnetization and susceptibility. Hund's rule; calculation of L, S and J for 3d and 4f shells. Setting up of Hamiltonian for an atom in an external magnetic field; explanation of diamagnetism, Van Vleck Paramagnetism and quantum theory of paramagnetism **(Ashcroft & Mermin)**. Interpretation of the Weiss field in terms of exchange integral **(Dekker p473-474)**. Calculation of the singlet triplet splitting, spin Hamiltonian and Heisenberg model **(Ashcroft and Mermin)**.

**Zero-temperature properties:** Ground state of the Heisenberg ferromagnet. First excitation of one dimensional ferromagnetism at zero-temperature; spin waves, anti-ferromagnetism. Low-temperature behaviour of ferromagnets; Bloch's  $T^{3/2}$  law **(Ashcroft and Mermin, Kittel)**.

**Magnetic resonance:** Phenomenological description, Relaxation mechanisms, Derivation of Casimir Durpe relation. Nuclear Magnetic moments, condition for resonance absorption, setting up of Bloch's equations, solutions for steady state and weak RF field. Expression for power absorption, change of inductance near resonance. Dipolar line width in a rigid lattice **(Dekker p498-512)**. **[16 hours]**

**Band theory of solids:** Statement and proof of Bloch theorem; periodic potentials in solids. Reciprocal lattice, periodic boundary conditions, density of states. Construction of Brillouin zones for a square lattice. Nearly free electron model and solution at the boundary. Energy gap using nearly free electron model. Tightly bound electron approximation, application to SC, BCC and FCC lattices **(Dekker)**.

**Superconductivity:** BCS theory; Cooper pairs, Energy gap, Meissner effect. Flux quantization. Theory for DC and AC bias; Josephson tunnelling, Josephson junction. High  $T_c$  superconductors **(Ibach and Luth)**.

**Elastic constants of crystals:** Elastic strains and stresses. Elastic compliance and stiffness constants, applications to cubic crystals and isotropic solids. Elastic waves and experimental determination of elastic constants **(Kittel, R S Krishnan, R J Asero)** **[16 hours]**

**Total work load**

**48 hours**

**References:**

1. Dekker A.J., Solid state physics, Prentice Hall, 1985.
2. Kittel C., Introduction to solid state physics, 7th Edn., John Wiley, New York, 1996.
3. Ashcroft N.W. and Mermin N.D., Solid State Physics, Saunders College Publishing, 1996.
4. Ibach H. and Luth H., Solid State Physics Narosa, New Delhi, 1996.
5. Pillai S.O., Solid state physics, New Age International Publications, 2002.
6. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.
7. R S Krishnan, Progress in Crystal Physics, Vol 1, Central Art Presst, Chennai
8. R J Asero, Mechanics of Solids and Mateials, Uni. Of Caifornia,

## PHC 260: Nuclear Physics 1

### Course Outcome:

- After completing this course the student will
- C01. Conceptualise the Nuclear Detectors, Nuclear Pulse techniques and Nuclear models
  - C02. Develop Theoretical and practical experience in the scattering experiments and gamma-ray spectroscopy.
  - C03. Learn High-energy nuclear physics, the behaviour of nuclear matter under extreme conditions.
  - C04. Learn Low-energy nuclear physics, structure & dynamics of nuclei, nuclear reactions and their probabilities;
  - C05. Understand development of sensors, detectors, and larger complex Nuclear instruments

**Nuclear detectors:** Scintillation processes in inorganic crystals (NaI(Tl)). Semiconductor detector -Diffused junction, Surface barrier and Lithium drifted detectors. Relation between applied voltage and depletion layer thickness in junction detectors, Hyper pure germanium detectors, Cerenkov detectors.

**Nuclear pulse techniques:** Preamplifier circuits; charge sensitive and voltage sensitive preamplifiers. Linear pulse amplifiers; Linearity, stability, pulse shaping, pulse stretching. Operational amplifiers; analog to digital converters. Scalars, Schmidt trigger as a pulse discriminator, Single channel analyser; Integral and differential discriminators. Multichannel Analysers, memory devices and online data processing. [16 hours]

**Shell model:** Motion in a mean potential, Square well and simple harmonic oscillator potential well, spin orbit interaction and Magic numbers. Extreme single particle model, Ground state properties of nuclei based on shell model. Nordheim's Rules.

**Collective model:** Evidences for collective motion. Nuclear rotational motion; Rotational energy spectrum and nuclear wave functions for even-even nuclei. Odd- A nuclei energy spectrum and wave function.

**Nilsson model:** Nilsson diagrams.

**Many body self-consistent models:** Hartree-Fock model. **(Hans H.S)** [16 hours]

**Timing spectroscopy:** Coincidence and anti-coincidence circuits. Delay circuits. Time to amplitude conversion; start-stop and overlap converters.

**Gamma ray spectroscopy:** Life time measurements. Gamma-gamma, beta-gamma angular correlation studies. Angular distribution of gamma rays from oriented nuclei. Polarization of gamma rays. [16 hours]

**Total work load** 48 hours

### References:

1. Mermier P. and Sheldon E., Physics of the nuclei and particles, Vol. 1 and 2, Academic Press, New York 1970.
2. Segre E., Nuclei and particles, Benjamin Inc, New York, 1977.
3. Arya A.P., Fundamentals of nuclear physics, Allyn and Bacon, USA, 1968.
4. Blatt J.M. and Weisskopf V.F., Theoretical nuclear physics, Wiley and Sons, New York, 1991.
5. Siegbahn K., The alpha, beta and gamma ray spectroscopy: Vol. 1 and 2, North Holland, Amsterdam, 1965.
6. Price J.W., Nuclear radiation detectors, McGraw Hill, New York, 1965.
7. Kapoor S.S. and Ramamoorthy V., Nuclear radiation detectors, Wiley Eastern, Bangalore, 1993.
8. Kowalski E., Nuclear electronics, Springer Verlag, Berlin, 1970.
9. Leo W.R., Techniques for nuclear and particle physics experiments, Springer Verlag, 1992.
10. Roy R.R. and Nigam B.P., Nuclear physics, New Age International, New Delhi, 1986.
11. Hans H.S., Nuclear physics—Experimental and theoretical, New Age International Publishers, 2001.
12. Tayal D.C., Nuclear Physics, Himalaya Publishing House, New Delhi, 2012

## PHY-306: Theoretical Physics 1

### Course Outcome:

- After completing this course the student will
- C01. Tackle a wide range of topics using powerful analytical tools including formal methods in classical and quantum physics
  - C02. Clearly communicate information & conclusions in written and verbal form of the ideas in Theoretical Physics
  - C03. Evaluate complex problems & formulate solutions, indentifying the role of theory, hypothesis and experiment in the scientific method
  - C04. Apply computation to solve the problems in theoretical physics
  - C05. Plan, carry out and report theoretical physics based investigation
  - C06. Apply classical and quantum theoretical techniques in research

**General theory of relativity:** Tensor Calculus and Riemannian geometry: Covariant Differentiation, Parallel Transport, Geodesies, The Curvature Tensor.

**Riemannian geometry:** Riemannian space, The determinant of  $g_{\mu\nu}$ . Metrical Densities, The Connection of a Riemannian Space: Christoffel Symbols, Geodesies in a Riemannian Space, The Curvature of a Riemannian Space: The Riemann Tensor. **[16 hours]**

**Gravitational field:** The Principle of Equivalence, The Field Equations of General Relativity, Metrics with Spherical Symmetry, The Schwarzschild Solution. Geodesies in the Schwarzschild Space, Advance of the Perihelion of a Planet, The Deflection of Light Rays, Red Shift of Spectral Lines, The Schwarzschild Sphere. Gravitational Collapse. Black Holes. **[16 hours]**

**Quantum field theory-1:** Classical and quantum fields: Particles and fields, Discrete and continuous mechanical systems, Classical scalar fields, Maxwell fields Quantum Theory of Radiation: Creation, annihilation, and number operators, Quantized radiation field, Fock states, Emission and absorption of photons by atoms, Rayleigh scattering, Thomson scattering, and the Raman effect. **[16 hours]**

**Total work load**

**48 hours**

### References:

1. Papapetrou A., Lectures on general relativity, D. Reidel Publishing Company, USA, 1974.
2. Dirac P.A.M., The general theory of relativity, John Wiley and Sons, New York, 1975.
3. Adler R., Bazin M. and Schiffer M., Introduction to general relativity, McGraw-Hill Kogakusha, Ltd. New Delhi, 1965.
4. Hartle J.B., Gravity: An introduction to Einstein's general relativity, Benjamin-Cummings Pub. Co., USA, 2002.
5. Sakurai J.J., Advanced quantum mechanics, Addison-Wesley, Harlow, England, First ISE Reprint, 1999.
6. Griffiths D., Introduction to elementary particles, John Wiley and Sons, New York, 1987.
7. Gasiorowicz S., Elementary particle physics, John-Wiley, New York, 1966.
8. Muirhead H., The physics of elementary particles, Pergamon Press, London, 1965.

## Open Elective Papers

Paper to be offered to Non-Physics Postgraduate students

### PHY-321: Modern Physics

#### Course Outcome:

After completing this course the student will

- CO1. Apply basic principles and laws of electricity and magnetism
- CO2. Solve Problems involving the fundamental principles of physics
- CO3. Apply Mathematical techniques for quantitative solutions to problems
- CO4. Understand the fundamentals of Condensed Matter, Nuclear and Quantum Physics

**Nuclear physics:** A brief overview of nuclear physics. Nuclear reactions, a brief description of nuclear models. Interactions of X-rays and  $\gamma$ -rays with matter, slowing down and absorption of neutrons. Fundamental particles, classification of fundamental particles, fundamental forces, conservation laws in particle physics, a brief outline of the quark model.

**Nuclear power:** Nuclear fission, fission chain reaction, self sustaining reaction, uncontrolled reaction, nuclear bomb. Nuclear reactors, different types of reactors and reactors in India. Nuclear waste management. Nuclear fusion, fusion reactions in the atmosphere. Radiation effects; dosage calculation. Nuclear energy; applications and disadvantages. **[16 hours]**

**Condensed matter physics:** Amorphous and crystalline state of matter. Crystal systems. Liquid crystals. X-ray diffraction; Bragg equation. Structure of NaCl. FTIR; Experiment analysis. NMR; Experiment and analysis. Electrical conductivity of metals and semiconductor. Magnetic materials; para,ferro, ferri and anti-magnetism. Dielectrics—para, ferro, pyro and piezo properties. Symmetry in physics. **[16 hours]**

**Quantum physics:** Qualitative discussion. Molecules, atoms, nucleus, nucleons, quarks and gluons. Particle physics (qualitative). Stern-Gerlach experiment and consequences. Uncertainty relation. Hydrogen atom. Positron annihilation. Laser trapping and cooling. Ion traps. Electromagnetic, strong, weak and Gravitational forces. Big Bang theory, String theory. LHC experiment, consequences. Higgs Boson. **[16 hours]**

**Tutorial**

**[32 hours]**

#### References:

1. Ghoshal S.N., Atomic and nuclear physics, Vol.2., S. Chand and Company, Delhi, 1994.
2. Evans R.D., Atomic nucleus, Tata Mc Grow Hill, New Delhi, 1976.
3. Penrose R., Road to Reality, Vintage Books, 2007.
4. Ladd M.F.C. and Palmer R.A., Structure determination by X-ray crystallography, Plenum Press, USA, 2003.
5. De Gennes P.G. and Prost J., The physics of liquid crystals, 2nd Edn., Clarendon Press, Oxford, 1998.
6. Myer R., Kennard E.H. and Lauritsern T., Introduction to modern physics, 5th Edn., McGraw- Hill, New York, 1955.
7. Halliday D., Resnick R. and Merryl J., Fundamentals of physics, Extended 3rd Edn., John Wiley, New York, 1988.

## PHY-322: Energy Science

### Course Outcome:

After completing this course the student will

- CO1. Learn the need for renewable energy in the growing world
- CO2. Understand the conservation of renewable energy resources
- CO3. Understand the proper utilisation of renewable energy resources
- CO4. Understand the physics of renewable energy resources
- CO5. Learn the technology behind the biogas and biomass production

**Renewable energy resources:** Forms of Energy, Basics of Thermodynamics: Heat capacity, Heat transfer mechanism, entropy, First and second law of thermodynamics Carnot Cycle, Rankin cycle. Fossil fuels, time scale of fossil fuels. Solar energy: Sun as the source of energy and its energy transport to the earth, Extraterrestrial and terrestrial solar radiations, Measurement techniques of solar radiations using Pyranometer and Pyrheliometer. **[16 hours]**

**Materials and solar cell technology :** Single, poly and amorphous silicon, GaAs, CdS, fabrication of single and polycrystalline silicon solar cells, amorphous silicon solar cells, photovoltaic systems and technical problems. Wind Energy Origin and classification of winds, Aerodynamics of windmill: Maximum power and Forces on the Blades and thrust on turbines; Wind data collection and field estimation of wind energy, Site selection, Basic components of wind mill, Types of wind mill, Wind energy farm, Hybrid wind energy systems: The present Indian Scenario. **[16 hours]**

**Biomass energy and biogas technology:** Nature of Biomass as a fuel, Biomass energy conversion processes, Direct combustion: heat of combustion, combustion with improved Chulha and cyclone furnace; Dry chemical conversion processes: pyrolysis, gasification, types of gasification. Importance of biogas technology, anaerobic decomposition of biodegradable materials, Factors affecting Bio-digestion, Types of biogas plants, Applications of biogas. **[16 hours]**

### Tutorial

**[32 hours]**

### References:

1. Peter A., Advances in energy systems and technology, Academic Press, USA, 1986.
2. Neville C.R., Solar energy conversion: The solar cell, Elsevier North-Holland, 1978.
3. Dixon A.E. and Leslie J.D., Solar energy conversion, Pergamon Press, New York, 1979.
4. Ravindranath N.H., Biomass, energy and environment, Oxford University Press, 1995.
5. Cushion E., Whiteman A. and Dieterle G., World Bank Report, 2009.

## PHC 080: Condensed Matter Physics Lab

### Course Outcome:

After completing this course the student will

- CO1. Independently collect single crystal XRD data and evaluate the crystal structure,
- CO2. Analyse Diffraction data and their suitability for single crystal structure.
- CO3. Independently work on raw diffraction data and Solve and refine crystal data
- CO4. Understand the properties of Condensed Materials such as Structural, Magnetic, Electrical and Semiconducting Properties
- CO5. Acquire theoretical and practical experience in the Condensed Matter Physics

Any eight of the following experiments:

1. Determination of the paramagnetic susceptibility of the given salt by Quincke's method
2. Study of mercury spectrum by superimposing it on brass spectrum
3. Sodium spectrum analysis by using Edser-Butler fringes
4. Temperature coefficient of resistance of a thermistor
5. Analysis of the powder X-ray photograph of a simple cubic crystal
6. Thermionic work function of a metal (Richardson-Dushman formula)
7. Energy gap of a semiconductor
8. Frank Hertz experiment
9. Measurement of magneto resistance of semiconductors
10. Stefan's Constant of Radiation



11. Thermal Conductivity of Poor Conductor
12. Di-electric constant of a Non polar liquid
13. Dipole moment of an organic Molecule
14. High Resistance by Leakage

Total work load : 2 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **128 hours**

### **PHC 090: Nuclear and Particle Physics Lab**

#### **Course Outcome:**

After completing this course the student will

- CO1. Be familiar with theoretical concepts & experimental techniques of Nuclear & particle physics,
- CO2. Be able to make quantitative estimates of phenomena in elementary particles
- CO3. Understand stability of the nucleus, nuclear forces, interactions & models, Critically assess a range of applications of nuclear technology.
- CO4. Acquire Theoretical & practical experience in the scattering experiments and gamma-ray spectroscopy.
- CO5. Be able to realise the Nuclear Electronic circuits

Any eight of the following experiments:

1. Half-life of Indium-116 measurement.
2. Energy Resolution of a NaI(Tl) scintillation spectrometer.
3. Compton scattering—determination of the rest energy of an electron.
4. Beta absorption coefficient measurement.
5. Dekatron as a counter of signals.
6. Gamma-ray absorption coefficient measurement.
7. End-point energy of Beta particles by half thickness measurement.
8. Common Source amplifier.
9. Astable multivibrator using timer IC 555.
10. Dead time of the G.M. counter.

Total work load : 2 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **128 hours**

**Reference:** 1. Varier K. M., Antony Joseph and Pradyumman P. P., Advanced experimental techniques in Modern Physics, Pragati Prakashan, 2011

### **PHC 250: Solid State Physics Lab 1**

*For those who have opted for Solid State Physics Specialisation*

#### **Course Outcome:**

After completing this course the student will

- CO1. Be able to make quantitative estimates for phenomena in solid state physics.
- CO2. Describe thermal & vibrational properties of solids,
- CO3. Compute band structures using the tight-binding approximation
- CO4. Compute trajectories in real and reciprocal space, Characterize magnetism
- CO5. Characterize intrinsic and doped semiconductors
- CO6. Describe superconductivity
- CO7. Understand the mechanism and working of semiconductor devices.

Any five of the following experiments:

1. Optical rotatory dispersion of a uniaxial crystal.
2. Birefringence of quartz using spectrometer.
3. Paramagnetic susceptibility by Gouy balance method.
4. Fermi energy of copper.
5. Cell parameter(s) from an X-ray powder diffractogram.
6. Verification of Langmuir-Child's law.
7. Curie temperature of a ferroelectric material.
8. Dielectric constant and its temperature variation.
9. Determination of the polarisabilities of the molecules of an uniaxial crystal using spectrometer.
10. Determination of Stefan's constant using Photo Cell
11. Calibration of Si Diode

12. Measurement of Electrical and Thermal Conductivity of Copper
13. Verification of Curie-Weiss law
14. BH Curve in a ferromagnetic Material

Total work load : 1 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **64 hours**

### **PHC 270: Nuclear Physics Lab 1**

For those who have opted for *Nuclear Physics Specialisation*

#### **Course Outcome:**

After completing this course the student will

- CO1. Be familiar with Nuclear Detectors, Pulse techniques, nuclear models, timing spectroscopy and nuclear technology.
- CO2. Be familiar with Theoretical & practical experience in the scattering experiments and gamma-ray spectroscopy.
- CO3. Learn Instrumentation, development of sensors, detectors, & larger complex instruments.
- CO4. Familiarise in Fundamentals of reactor theory and nuclear decay mechanisms
- CO5. Learn Accelerator physics, research and development for the next generation of particle accelerators.

Any five of the following experiments:

1. Cockroft-Walton voltage multiplier.
2. Coincidence circuit.
3. Linear amplifier.
4. Transistorised binary circuit.
5. Pulse shaping circuits.
6. Linear Gate.
7. Randomicity of radioactive decay.
8. Nomogram method : Measurement of endpoint energy of beta rays.
9. Study of linearity of the NaI(Tl) gamma ray spectrometer.
10. Determination of the energy of an unknown gamma ray source.

Total work load : 1 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **64 hours**

### **PHY-315: Theoretical Physics Lab 1**

For those who have opted for *Theoretical Physics Specialisation*

#### **Course Outcome:**

After completing this course the student will

- CO1. Tackle a wide range of topics using powerful analytical tools including formal methods in classical and quantum physics
- CO2. Clearly communicate information and conclusions in written and verbal formats on ideas in Theoretical Physics
- CO3. Evaluate complex problems and formulate solutions, indentifying the role of theory, hypothesis and experiment in the scientific method
- CO4. Apply computation to solve the problems in theoretical physics
- CO5. Plan, carry out and report theoretical physics based investigation
- CO6. Apply classical and quantum theoretical techniques in research

Any five of the following experiments:

1. Calculation of Christoffel symbols.
2. Geodesics and curvature calculations.
3. Exterior Schwarzschild metric calculations.
4. Robertson-Walker metric calculations.
5. Lagrangian and Hamiltonian, Euler Lagrange equations for Schroedinger field.
6. Lagrangian for Maxwell's field and The field equations.
7. Symmetries of the Lagrangian and Constants of motion.
8. Operator algebra-BCH formula.
9. Relativistic kinematics-1: Relations between center of momentum and laboratory frames.
10. Relativistic kinematics-2: Non-relativistic limit of relativistic kinematics.

Total work load : 1 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **64 hours**

## PHD 250: Solid State Physics 2

### Course Outcome:

After completing this course the student will

- CO1. Gain an overall idea about X-ray diffraction method Solid State Physics
- CO2. Get the understanding about X-ray diffraction (XRD) by Crystals.
- CO3. Understand the Physical phenomena and significance of XRD
- CO4. Be able to make quantitative estimates for structural phenomena of solids.
- CO5. Describe thermal and vibrational properties of solids
- CO6. Understand the concepts of Dislocations, Imperfections and Defects in Solids
- CO7. Appreciate the Luminescent effects and colour centres in ionic crystals

**X-ray diffraction by crystals:** The reciprocal lattice. Ewald sphere and construction. Scattering by an electron and atom; Atomic scattering factor. Anomalous scattering. Fourier analysis and inversion of Fourier series; Physical significance. Geometrical structure factor of the unit cell. Absent reflections and space groups. **(Sherwood, P290 – 358).**

**Experimental techniques:** Brief introduction to Laue, Powder and single crystal methods. Use of Synchrotron radiation for structure studies. Weissenberg and precession methods. Cell parameter and space group determination. Molecular weight determination. **(Stout and Jensen, p 90–211). [16hours]**

**Structure analysis:** Low angle scattering. Reduction of intensities to structure amplitudes. Various corrections. Absolute scale factor and temperature factor from statistical methods. Statistical method for finding the presence of center of symmetry Fourier analysis of electron density. Patterson synthesis. Harker sections and lines. Heavy atom methods. Direct methods for phase determination. The inequality relations. Difference Patterson synthesis and error Fourier synthesis. Figure of merit. Cyclic Fourier refinement, Difference Fourier synthesis. Refinement of structures: The least squares method. Accuracy of the parameters. Bond lengths and angles. **(Sherwood, Ladd and Palmer)**

**SAXS;** Particle Size study of Fibre structure **[16 hours]**

**Imperfections in solids:** Different types of imperfections. Schottky and Frenkel defects; expression for energy for the formation of Frenkel and Schottky defects. Diffusion in metals; Kirkendall effect. Ionic conductivity in pure and doped halides. Photoconductivity **(Kittel).**

**Dislocations:** Burger's Vector. Expression for strain in edge and screw dislocations **(Wahab and Kittel).**

**Synthesis and Device fabrication of Nanomaterials:** Nanomaterials. Bottom-Up approach; Sol-gel synthesis, hydrothermal growth, thin-film growth, physical vapor deposition, chemical vapor deposition. Top- Down Approach; Ball milling, Microfabrication, Lithography, Ion-beam lithography **(Ramachandra rao and Shubra singh, p129-142).**

**Luminescence:** Excitation and Emission. Franck-Condon principle. Decay mechanisms; Temperature dependent and independent decays. Thermoluminescence and glow curve. Gudden-Pohl effect **(Dekker). [16 hours]**

**Total work load**

**48 hours**

### References:

1. Stout G.H. and Jensen L.H., X-ray structure determination, MacMillan, USA, 1989.
2. Ladd M.F.C. and Palmer R.A., Structure determination by X-ray crystallography, Plenum Press, USA, 2003.
3. Sherwood D., Crystals, X-rays and proteins, Longman, London, 1976.
4. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.
5. Azaroff L.V., Introduction to solids, McGraw-Hill Inc, USA, 1960.
6. Weertman J. and Weertmann J.R., Elementary dislocation theory, McMillan, USA, 1964.
7. Pillai S.O., Solid state physics, New Age International Publications, 2002.

## PHD 260: Solid State Physics 3

### Course Outcome:

After completing this course the student will

- CO1. Have overall idea about properties of Solids.
- CO2. Be provided with the understanding about free electron theory of metals
- CO3. Understand the properties of impurity semiconductors.
- CO4. Learn Semiconductor phenomena; Hall effect, Magneto-resistance phenomenon
- CO5. Be able to make quantitative estimates of semiconducting phenomena of solids.
- CO6. Describe the effect of excess carriers in semiconducting solids
- CO7. Understand the mechanism and working of semiconductor devices.

**Free electron theory of metals:** Boltzmann transport equation, Sommerfeld's theory of electrical conductivity, mean free path in metals, dependence of resistivity on temperature and impurities. Matthiessens rule. Electron-phonon collisions. Electrical conductivity of metals at high frequencies. Plasma frequency. Transparency of alkali metals to UV radiation. Anomalous skin effect. Plasmons. Field enhanced emission, Schottky effect. Hall effect and magnetoresistance in metals. Cyclotron frequency (**Kittel & Pillai**). Thermal conductivity of insulators; Umklapp processes (**Dekker, p275-292**). **[16 hours]**

**Impurity semiconductors:** A brief discussion on Elemental and Compound Semiconductors and their properties. Carrier concentrations; effect of temperature and impurity density. Electrical neutrality condition. Fermi energy; Variation with temperature and impurity density, when the Boltzmann approximation is valid, Effect of impurity density at very low temperatures. Mobility of current carriers; effect of temperature and impurity. Electrical conductivity; effect of temperature, impurity density and the energy band gap.

**Hall effect in semiconductors;** Expression for Hall co-efficient,

**Magneto-resistance phenomenon** (qualitative) (**M A Wahab**).

**Cyclotron resonance;**Cyclotron resonance in Si and Ge semiconductors. Effective mass tensor. Variation of cyclotron resonance frequency with orientation of the crystal in the magnetic field (**Mckelvey, p270-300**).

**[16 hours]**

**Excess carriers in semiconductors:** Generation and recombination rates. Continuity equations; Einstein equations, Expression for the diffusion length of electrons and holes (**Mckelvey, p320-335**).

High field transport in semiconductors; electron temperature. Gunn effect, Expression for drift velocity. Superlattice Phenomenon (**Roy, p29-39**).

**Semiconductor devices:** The pn junction; space charge region, effect of the applied field on barrier potential, barrier thickness and contact field. Transition capacitance. Current density for excess carriers. Characteristics and applications of phototransistors, JFET, SCR and UJT (**Mckelvey, p390-441**). **[16 hours]**

**Total work load**

**48 hours**

### References:

1. Dekker A.J., Solid state physics, Prentice Hall, 1985.
2. Mckelvey J.P., Solid state and semiconductor physics, 2nd Edn., Harper and Row, USA, 1966.
3. Roy D.K., Physics of semiconductor devices, University Press, Hyderabad, 1992.
4. Schur M., Physics of semiconductor devices, Prentice-Hall of India, New Delhi, 1999.
5. Wilson J. and Hawkes J.F.B., Optoelectronics—An introduction, 2nd Edn., Prentice-Hall of India, New Delhi, 1996.
6. Streetman B.G., Solid state electronic devices, 2nd Edn., Prentice-Hall of India, New Delhi, 1983.
7. Omar M.A., Elementary solid state physics, Addison Wesley, New Delhi, 2000.
8. Wahab M.A., Solid state physics, Narosa Publishing House, New Delhi, 1999.
9. Pillai S. O. Solid State Physics, ew Age International Publications, New Delhi.

## PHD 300: Nuclear Physics 2

### Course Outcome:

After completing this course the student will

- C01.** Understand the phenomenon of nuclear fission and its application in energy production.
- C02.** Gain an overview on the neutron physics and nuclear reactor theory.
- C03.** Develop the understanding of quantum theory beta decay.
- C04.** Learn about the multipole transition involving gamma decay and internal conversion.

**Nuclear fission:** Nuclear fission, Mass-energy distribution of fission fragments. Statistical model of fission.

**Reactor theory-1:** Neutron and its interaction with matter-collision kinematics, differential elastic scattering cross sections, isotropic scattering, the criticality condition for a reactor. Neutron transport equation using elementary diffusion theory. One group critical equation, critical size on the basis of Fermi age theory.

[16 hours]

**Reactor theory-2:** Reactors; One group theory, spherical and cylindrical homogeneous reactor. Effective multiplication factor. Reflector reactors: effects of reflector. One group method of a homogeneous reactor with reflector. reflector savings. Infinite multiplication factor, critical size and critical mass. Heterogeneous reactor system; calculation of thermal utilization factor. Fast Breeder reactor, Evaluation of Buckling using one group model.

[16 hours]

**Beta decay:** Classification of beta interactions. Matrix elements. Fermi and Gamow-Teller selection rules for allowed beta decay. The non conservation of parity in beta decay. Wu et al experiment. The universal Fermi interaction.

**Gamma decay:** Electromagnetic interactions with nuclei. Multipole transitions. Transition probabilities in nuclear matter. Weisskopf's estimates. Structure effects. Selection rules. Internal conversion Photo disintegration of deuteron and radiative capture of neutron by proton.

[16 hours]

**Total work load**

**48 hours**

### References:

1. Glasstone S.& Edlund M.C., Elements of nuclear reactor theory, D. Van Nostrand Co., USA, 9<sup>th</sup> Print, 1963.
2. Garg S., Ahmed F. and Kothari I.S., Physics of nuclear reactors, Tata McGraw-Hill, New Delhi, 1986.
3. Roy R.R. and Nigam B.P., Nuclear physics, New Age International, New Delhi, 1986.
4. Hans H.S., Nuclear physics—Experimental and theoretical, New Age International Publishers, 2001.
5. Ghoshal S.N., Nuclear physics, Vol. 2., S.Chand and Company, Delhi, 1994. Chapter 15, page 714-730.

## PHD 310: Nuclear Physics 3

### Course Outcome:

After completing this course the student will

- CO1. Know about the two particle nuclear bound system like deuteron.
- CO2. Learn the theory of nucleon-nucleon scattering processes.
- CO3. Get an understanding of plane wave theory of nuclear reactions.
- CO4. Acquire knowledge on optical model and heavy ion physics.

**Two particle systems:** Deuteron; Schrodinger equation for a two nucleon system, Theory of the ground state of the deuteron under central and non central forces, Excited states of the deuteron. Rarita-Schwinger relations. Deuteron magnetic and Quadrupole moments.

**Nucleon-nucleon scattering processes:** Theory of s-wave scattering of neutrons by free protons and experimental results. Wigner's formula for n-p scattering. Theory of scattering of slow neutrons by bound protons (Ortho and Para hydrogen) and experimental results. Effective range theory for n-p scattering. S wave theory of proton-proton scattering. Mott's modification of Rutherford's formula. Pion-nucleon scattering experimental results,  $(3/2, 3/2)$  resonance. **[16 hours]**

**Nuclear reactions-1:** Plane wave theory of direct reactions. Born approximation (Plane wave); Butler's theory. Cross section for nuclear scattering and reactions. Shadow scattering, Breit-Wigner resonance formulae.

**Nuclear reactions-2:** Bohr's independence hypothesis. The compound nucleus (CN) reactions, decay rates of CN, Statistical theory of nuclear reactions. Evaporation probability and cross sections for specific reactions. **[16 hours]**

**Optical model:** Giant resonances, Kapur-Pearls' dispersion formula for potential scattering. Direct reactions: Kinematics of stripping and pickup reactions. Theory of stripping and pickup reactions. Inverse reactions.

**Heavy ion physics:** Special features of heavy ion Physics. Remote heavy ion electromagnetic interactions. Coulomb excitations. Close encounters.

Heavy ion scattering. Grazing interactions. Particle transfer. Direct and head on collisions, compound nucleus and quasi molecule formation. **[16 hours]**

**Total work load**

**48 hours**

### References:

1. Roy R.R. and Nigam B.P., Nuclear physics—Theory and experiment, New Age International Ltd, New Delhi, 1986.
2. Hans H.S., Nuclear physics—Experimental and theoretical, New Age International Publishers 2001.
3. Sachtler G.R., Nuclear reactions, Addison Wesley, New York, 1983.
4. Mermier P. and Sheldon E., Physics of nuclei and particles, Vol. 2 Academic Press, USA, 1971.
5. Jackson D.F., Nuclear reactions, Chapman and Hall, London, 1975
6. Mermier P. and Sheldon E., Physics of nuclei and particles, Vol. 3 Academic Press, USA, 1971.

## PHY-405: Theoretical Physics 2

### Course Outcome:

- After completing this course the student will
- CO1. Tackle a wide range of topics using powerful analytical tools including formal methods in classical and quantum physics
  - CO2. Clearly communicate information and conclusions in written and verbal formats on ideas in Theoretical Physics
  - CO3. Evaluate complex problems and formulate solutions, identifying the role of theory, hypothesis and experiment in the scientific method
  - CO4. Apply computation to solve the problems in theoretical physics
  - CO5. Plan, carry out and report theoretical physics based investigation
  - CO6. Apply classical and quantum theoretical techniques in research

**Relativistic quantum mechanics:** Probability conservation in relativistic quantum mechanics, The Dirac equation, Conserved current, Representation independence, large and small components, approximate Hamiltonian for an electrostatic problem, free particle solutions, Relativistic covariance, Space inversion, Bilinear covariants and their properties, Klein's paradox, Hole theory and charge conjugation. **[16 hours]**

**Quantization of the Dirac field:** Second quantization, positron operators and positron spinors, Electromagnetic and Yukawa couplings. Weak interactions and parity nonconservation: Classification of interactions, parity and hyperon decay, Fermi theory of beta decay, the two-component neutrino. Pion decay and the CPT theorem. **[16 hours]**

**Covariant perturbation theory:** Natural units and dimensions, S-matrix expansion in the Interaction representation. Unitarity, First order processes: Matrix element for electron scattering. Cross section for Mott scattering. Helicity change and spin projection operator. Pair annihilation, pair creation, hyperon decay. S - matrix for two photon annihilation, electron propagator, Matrix element for Compton scattering, Feynman rules. Cross section for two photon annihilation. **[16 hours]**

**Total work load**

**48hours**

### References:

1. Sakurai J.J., Advanced quantum mechanics, Addison-Wesley, Harlow, England, First ISE Reprint, 1999.
2. Griffiths D., Introduction to elementary particles, John Wiley and Sons, New York, 1987.
3. Gasiorowicz S., Elementary particle physics, John-Wiley, New York, 1966.
4. Muirhead H., The physics of elementary particles, Pergamon Press, London, 1965.

**PHY-406: Theoretical Physics 3****Course Outcome:**

- After completing this course the student will
- CO1. Tackle a wide range of topics using powerful analytical tools including formal methods in classical and quantum physics
  - CO2. Clearly communicate information and conclusions in written and verbal formats on ideas in Theoretical Physics
  - CO3. Evaluate complex problems and formulate solutions, identifying the role of theory, hypothesis and experiment in the scientific method
  - CO4. Apply computation to solve the problems in theoretical physics
  - CO5. Plan, carry out and report theoretical physics based investigation
  - CO6. Apply classical and quantum theoretical techniques in research

**Angular momentum theory and applications:** Angular momentum: Transformations under rotations. Coupling of three and four angular momenta. Racah coefficients, Wigner 9j symbols, applications. Wigner-Eckart theorem. Projection theorem. j-j and L-S coupling. Angular momentum in nuclear reactions, Spherical tensors. Evaluation of matrix elements between coupled angular momentum states. Vector spherical harmonics. Gradient theorem (without proof). Multipole radiation. **[16 hours]**

**Spin density matrix:** Spin and helicity in a relativistic process. Effect of Lorentz and discrete transformations on helicity states. Wick and Wigner rotations, pure rotation, pure boost, parity, time reversal and charge conjugation. The spin density matrix ( $\rho$ ), general properties, multipole parameters, combined systems, Diagonalization of  $\rho$ . Oriented and non-oriented systems, Polarized and aligned systems, Spherical tensor basis and SU(N) basis. **[16 hours]**

**Relativistic density matrix:** Helicity multipole parameters and their transformation laws. Helicity amplitudes for elastic reactions and their symmetry properties. Polarization in scattering of spin  $\frac{1}{2}$  particles, Final state density matrix. Observables of a reaction, reactions involving polarized beam and polarized targets. **[16 hours]**

**Total work load**

**48 hours**

**References:**

1. Sakurai J.J. and Tuan S.F. (Editor), Modern quantum mechanics, AddisonWesley, India, 1999.
2. Leader E., Spin in particle physics, Cambridge University Press, London, 2001.
3. Rose M.E., Elementary theory of angular momentum, John Wiley and Sons, USA, 1957.
4. Blum K., Density matrix theory and applications, Plenum Press, New York, 1981.



## Elective Papers 1

### PHD 270: Accelerator Physics

#### Course Outcome:

After completing this course the student will

- CO1. Know about different types of ion sources and their working.
- CO2. Learn ion optics and focussing.
- CO3. Know about different particle accelerators.
- CO4. Get theory behind electron accelerator.

**Ion sources:** Brief introduction to ion sources for positive and negative ions. Ion production. Semi classical treatment of ionization, Townsend theory-comparison of theory and experiment for ion production. Examples of ion sources-properties of ion sources. Insulation at high voltages-Spark voltage. Paschen's law for gas breakdown.

**Ion optics and focussing:** Focussing properties of linear fields. Electrostatic and magnetic lenses. [16 hours]

**Particle accelerators:** Introduction, development of accelerators. Direct-voltage accelerators: Cockroft-Walton generator, Van de Graff generator, Tandem accelerators, Pelletron. Resonance accelerators: Cyclotron - fixed and variable energy, principles and longitudinal dynamics of the uniform field cyclotron. Linear accelerators.

[16 hours]

**Electron accelerators:** Betatron; Beam focusing and Betatron Oscillation. Microtron. Synchronous accelerators; Principle of phase stability, Mathematical theory for Principle of phase stability. Electron synchrotron. Proton synchrotron.

Alternating gradient machines; Alternating gradient principle, AG proton synchrotron.

[16 hours]

**Total work load**

**48 hours**

#### References:

1. Townsend P.D., Kelly J.C. and Hartley N.E.W., Ion implantation, sputtering and their applications, Academic Press, London, 1976.
2. Humphrey S. Jr., Principles of charged particle acceleration, John Wiley, 1986.
3. Arya A.P., Fundamentals of nuclear physics, Allyn and Bacon, USA, 1968.
4. Ghoshal S.N., Atomic and nuclear physics, Vol. 2, S.Chand and Company, Delhi, 1994.
5. Varier K.M., Joseph A. and Pradyumnan P.P., Advanced experimental techniques in modern physics, Pragathi Prakashan, Meerut, 2006.

### PHY-408: Liquid Crystals

#### Course Outcome:

After completing this course the student will

- CO1. Be familiar with the fundamentals of anisotropic fluids.
- CO2. Understand the principles of Long and short range order in nematics.
- CO3. Learn static distortion in nematics, defects and textures in nematics
- CO4. Know about Dynamical properties of liquid crystals and nematics.
- CO5. Study Optical properties of Cholesterics.

**Anisotropic fluids:** Main Types and properties: Introduction. The building blocks. Small organic molecules. Long helical rods. Associated structures. Nematics and Cholesterics. Nematics proper. Static pretransitional effects above  $T_{N-1}^i$ . The cholesterics. A distorted form of the nematic phase. Smectic. Smectic A. Smectic B. Smectic C. Other mesomorphic phases. Exotic smectics; long range order in a system of long rods. Lyotropic systems. Remarkable features of liquid crystals. Applications of liquid crystals. [De Gennes and Prost] [16 hours]

**Long and short range order in nematics:** Definition of an order parameter. Microscopic approach. Order parameter from optical method, from diamagnetic anisotropy. Mean field theory with S2 interaction (Maier-Saupe).

**Static distortion in nematics:** Long range distortions, distortion free energy. Magnetic field effects—Molecular diamagnetism, Magnetic coherence length.

**Defects and textures in nematics:** Observations. Black filaments. Schlieren structures. Types of defects (qualitative discussion only).

**Smectics:** Continuum description of smectics A and C, Mean field description of  $S_A$ -N transition.

[De Gennes and Prost]

[16 hours]

**Dynamical properties of nematics:** Experiments measuring the Leslie coefficients-Laminar flow under a strong orienting field, Attenuation of ultrasonic shear waves, Laminar flow in the absence of external fields. Convective instabilities under electric fields. Basic electrical parameters, Experimental observations at low frequencies, The Helfrich interpretation. Extension to higher frequencies (qualitative).

**Cholesterics:** Optical properties of an ideal helix—The planar texture, Bragg reflection, Transmission properties at arbitrary wavelengths (normal incidence), The Mauguin limit, Rotatory Power. Agents influencing the pitch—Physicochemical factors, External fields (qualitative). Textures in cholesterics. [De Gennes and Prost]

[16 hours]

**Total work load**

**48 hours**

**References:**

1. De Gennes P.G. and Prost J., The physics of liquid crystals, 2nd Edn., Clarendon Press, Oxford, 1998.
2. Chandrashekar S., Liquid crystals, Cambridge University Press, 1977.
3. Gray G.W., Molecular structure and the properties of liquid crystals, Academic Press, 1962.
4. Maier G., Sackmann E. and Grabmanier I.G., Applications of liquid crystals, Springer Verlag, 1975.
5. Gray G.W. and Goodby J.W., Smectic liquid crystals (Textures and structures), Leonard Hill, London, 1984.

### PHY-409: Atmospheric Physics

**Course Outcome:**

After completing this course the student will

- CO1. Understand the composition of atmosphere and its different layers.
- CO2. Get on the thermodynamics of the atmosphere.
- CO3. Learn on terrestrial radiations and its effects on atmosphere.
- CO4. Understand on aerosols, clouds and atmospheric radioactivity.
- CO5. Understand working of atmospheric electricity.

**Atmospheric composition:** Energy in the atmosphere, heating of the atmosphere, motions in the atmosphere. Variations in atmospheric composition, Structure on the basis of composition. Thermal structure of the atmosphere.

**Thermodynamics:** Entropy of dry air, vertical motion of saturated air, tephigram, potential energy of an air column.

**Dynamics:** Escape of hydrogen, photodissociation of oxygen, photo chemical processes. Equations of motion, the geostrophic approximation, cyclostrophic motion. [16 hours]

**Terrestrial and extra terrestrial radiation:** General features of direct, diffuse and global radiation-attenuation of direct solar radiation-Rayleigh and Mie scattering. Angstrom turbidity formula for all aerosols. Direct transmittance due to continuum attenuation, diffuse spectral irradiance due to Rayleigh and aerosol scattering.

**Aerosols:** Production and properties of aerosols. Aerosol optical depth, Beer's law - Sun Photometer. Optical filters.

**Clouds:** Microphysics of clouds, Macro characterization of clouds. Radiative transfer in clouds and aerosols.

[16 hours]

**Atmospheric radioactivity:** Background Radiation, Radioactivity in Atmosphere, Radon, Properties of radon, Origin of radon, Radon entry into the atmosphere: Diffusion, Advection and Convection. Health Effects: Dose.

**Atmospheric electricity:** The generation of an ion, The mobility of ions, Ion size, recombination of ions. Ions in an electric field, Ionizing agencies, radioactivity. The conductivity of the atmosphere and its origin, Measurement of conductivity of the atmosphere near the ground. Relationship between ions and conductivity. The current voltage characteristics in a gas under conditions of volume ionization. [16 hours]

**Total work load**

**48 hours**

**References:**

1. Salby M.L., Fundamentals of atmospheric physics, Academic Press, USA, 2006.
2. Houghton J., The physics of the atmosphere, Cambridge University Press, 2002.
3. Siddhartha K., Atmosphere, weather and climate, Kisalaya Publications, 2000.
4. Lutgens F.K. and Tarbuk E.K., The atmosphere: An introduction to meteorology, Prentice Hall USA, 1986.
5. Holton, J.R., Dynamic meteorology, 3rd edition, Academic Press, USA, 1992.
6. Keshvamurthy R.N. and Shankar Rao M., The physics of monsoons, Allied Publishers, 1992.
7. Iqbal M., An introduction to solar radiation, Academic Press, USA, 1983.
8. Wilkening M., Radon in the environment, Elsevier Science Publishers, The Netherlands, 1990.
9. Israel H., Atmospheric electricity-Vol II, Israel Program for Scientific Translations, Jerusalem. 1973.

**PHY-410: Numerical Methods**

**Course Outcome:**

After completing this course the student will

- CO1. Understand Computer arithmetic in solving the problems.
- CO2. Learn Iterative methods like Bisection method, Newton-Raphson method, Secant method.
- CO3. Solve Linear algebraic equations by numerical techniques like the Gauss elimination method.
- CO4. Learn numerical Interpolations, Least-squares approximation of functions.
- CO5. Learn different techniques of Numerical integration
- CO6. Solve Numerical solution of differential equations

**Computer arithmetic:** Integers; Floating point representation of numbers; Arithmetic operations with normalisation; Errors in representation; Commonly used number types and their limits like max. and min. integer, float, double precision, long, etc.

**Iterative methods:** Bisection method, Newton-Raphson method, Secant method, the method of successive approximations. Solution of a polynomial equation. **[16 hours]**

**Linear algebraic equations:** The Gauss elimination method, LU decomposition method, Gauss-Jordon method, An introduction to the solution of simultaneous non-linear equations.

**Interpolations:** Introduction, Newton interpolation formulae, extrapolation, Lagrange interpolation. spline interpolation.

**Least-squares approximation of functions:** Introduction, linear regression, algorithm for linear regression. Polynomial regression, fitting exponential and trigonometric functions. **[16 hours]**

**Numerical integration.** Trapezoidal method, Simpson rule. Errors in integration formulae (Romberg method). Algorithms for integration of a tabulated function. Algorithms for integrating a known function. Gaussian quadrature formulae.

**Numerical solution of differential equations:** Euler method, Runge - Kutta methods, Runge - Kutta 4th order formulae, predictor - corrector method. comparison of predictor-corrector and Runge- Kutta methods. **[16 hours]**

**Total work load**

**48 hours**

**References:**

1. Atkinson K.E., An introduction to numerical analysis, John Wiley and Sons, USA, 1988.
2. Press W.H., Flannery B.P., Teukolsky S.A. and Vetterling W.T., Numerical recipes in C, Cambridge University Press, UK, 1989.
3. Krishnamurthy E.V. and Sen S.K, Numerical algorithms, Affiliated East West Press Pvt. Ltd., India, 1993.
4. Rajaraman V., Computer oriented numerical methods, Prentice Hall of India Pvt. Ltd., India, 2001.

## Elective Papers 2

### PHY-411: Nuclear Spectroscopy Methods

#### Course Outcome:

After completing this course the student will

- CO1. Understand Ion implantation and backscattering spectroscopy
- CO2. Study Compton scattering
- CO3. Know about Positron annihilation spectroscopy
- CO4. Understand Experimental methods of positron annihilation spectroscopy

**Ion implantation and backscattering spectroscopy:** Ion implantation, Implantation technique, Ion beam diffusion, Thermal annealing and sputtering, Analysis techniques. Backscattering, Energy loss and straggling. Kinematics factor, differential scattering cross sections, depth scale, backscattering yield, instrumentation. Application to elemental and compound targets. Axial and planar half angles. Estimates of minimum yield. Lattice location of impurities, alignment procedures. Ion induced X-rays. Application of ion implantation. **[16 hours]**

**Compton scattering:** Compton scattering from free electrons. Effects of external potential. Klein-Nishina cross sections for polarized and unpolarized radiation. Compton profiles, momentum distributions and impulse Compton profiles. Calculation of Compton profiles for electron models. Relativistic profile corrections: experimentation. Discussion of methodology including sources, detectors and geometry. Data accumulation, analysis and multiple scattering corrections. Discussion of experimental results for some simple metals, ionic and covalent crystals. **[16 hours]**

**Positron annihilation spectroscopy:** The positron and its discovery, Positronium, its characteristics, formation. Spur model and Ore gap model of positronium formation. Quenching and enhancement. Theory of 2-gamma and 3-gamma annihilations. Positron and positronium states in solids: trapping of positrons. Two state trapping model.

**Experimental methods of positron annihilation spectroscopy:** Positron lifetime techniques (PLT), Angular Correlation of Annihilation Radiation (ACAR), Doppler broadening (DB) and Coincidence DB. Methods of data analysis: PLT and ACAR. Experimental results of some metals and defected materials. Interpretation of the experimental results. PAS in the study of polymers. Multiparameter techniques. A brief mention of slow positron beams. **[16 hours]**

**Tutorial**

**[32 hours]**

#### References:

1. Townsend P.D., Kelly J.C. and Hartley N.E.W., Ion implantation, sputtering and their applications, Academic Press, London, 1976.
2. Chu W.K., Mayer J.W. and Nicholate Mar A.O., Backscattering spectroscopy, Academic Press, New York, 1978.
3. Mayer J.W. and Rimini B. (Eds.), Ion beam handbook for material analysis, Academic Press, 1977.
4. Williams B. (Ed.), Compton scattering, McGraw-Hill, New York, 1977.
5. Hautajarvi P. (Ed.), Positrons in solids, Springer Verlag, New York, 1979.
6. Fava R.A. (Ed.), Methods of experimental physics, Academic Press, New York, 1980.
7. Schradev D.M. and Jean Y.C., Positron and positronium chemistry, Elsevier Science Publication, Amsterdam, 1988.
8. Jayaram B., Mass spectrometry–Theory and applications, Plenum Press, New York, 1966.

## PHY-412: Modern Optics

### Course Outcome:

After completing this course the student will

- CO1. Understand the phenomenon of polarization of light using quantum mechanics
- CO2. Familiar with Non linear Optics
- CO3. Understand Pancharatnam phase in Quantum features of radiation field.
- CO4. Learn the concept of Radiation Field Quantization.
- CO5. Understand Squeezed states of light.

**Polarization of light:** Pure states and mixed states. Density operator, properties and equation of motion. Polarization of light, states of polarized light, Jones matrices, Jones formalism, Stokes parameters, Poincaré sphere, Mueller matrices and Mueller formalism, Mueller matrices and their characterization, Few illustrative examples; comparison of Jones and Mueller formalisms. Pancharatnam phase, dynamical phase, cyclic evolution of polarization state on Poincaré sphere; Applications of the concept of Pancharatnam phase. **[16 hours]**

**Quantum features of radiation field:** Planck's law of radiation and Einstein coefficients, Thermal equilibrium, Semi-classical theory of two level atoms, quantum theory of B coefficient, Optical resonance, damping, Theory of chaotic light, coherence, temporal, spatial, mutual coherence, line broadening, natural and Doppler width, collision broadening. **[16 hours]**

**Quantized radiation field:** Quantization of radiation field, States of radiation field; Fock states and phase eigenstates; Interaction of radiation with matter, theory of spontaneous emission; Coherent states and their properties, BCH formula, P, Q and Wigner distribution functions, Squeezed states of light and their properties; applications. Correlation functions, Brown-Twiss correlations. **[16 hours]**

**Tutorial** **[32 hours]**

### References:

1. Loudon R, The quantum theory of light, Clarendon Press, Oxford, 1973.
2. Mandel L. and Wolf E., Optical coherence and quantum optics, Cambridge University Press, 1995.
3. Louisell W.H., Quantum statistical properties of radiation, John Wiley and Sons, New York, 1973.
4. Blum K., Density matrix theory and applications, Plenum Press, New York, 1981.
5. Pancharatnam S., Collected works, Oxford University Press, 1975.

## PHD 280: Electronics

### Course Outcome:

After completing this course the student will

- CO1. Learn analyzing digital and analog devices and circuits.
- CO2. Analyze components associated with digital and analog electronic systems.
- CO3. Demonstrate proficiency in the use of electronic equipment and devices.
- CO4. Assist in the design, operation, and troubleshooting of electronic systems.
- CO5. Analyze electronics devices and circuits using computer simulations.
- CO6. Solve electronic devices and systems using mathematical concepts.

**BJT AC Analysis:** Amplification in AC domain. BJT transistor modeling, common emitter voltage divider bias configuration. Emitter follower configuration. Darlington connection. Hybrid equivalent model, Approximate Hybrid equivalent circuit; Voltage divider configuration, Complete hybrid equivalent model.

**Feedback and Oscillator Circuit:** Feedback concept, Feedback connections types, Practical feedback circuits. Feedback amplifier; Phase and frequency considerations. Oscillator operation, Phase - shift Oscillator, Wien-bridge Oscillator, Crystal Oscillator—BJT version.

**FET amplifiers:** JFET small signal model, Biasing of FET, Common drain, common gate configurations, FET amplifier and its frequency response. MOSFET – types and E – MOSFET Voltage divider configurations **[16 hours]**

**Operational amplifiers:** Concepts of differential amplifier, Ideal op-amp, op-amp parameters, ideal voltage transfer curve, open loop and closed op-amp configurations, inverting amplifier, non inverting amplifier, limitations of open loop op-amp configurations.

**Operational amplifier applications:** Summing, scaling and averaging amplifiers, voltage to current converter with grounded load, current to voltage converter, integrator, differentiator, V to I and I to V converters, Log and antilog amplifiers, Wave form generators, phase shift oscillator, Wein bridge oscillator. Non-linear circuit applications: Crossing detectors, 555 timer as a mono-stable and astable multivibrators, Active Filters—First and second order Low pass and High pass filters, Butterworth filters (**Gaekwad R.A**) **[16 hours]**

**Digital electronics:** Boolean Laws and Theorems, addition and subtraction based on 1's and 2's complements, Families of gates, RS and JK flip-flops, The Master-Slave JK Flip-Flop, D and T flipflops. Karnaugh maps for 3 and 4 variables, Decoders-BCD decoders, Encoders.

**Combinational logic circuits:** Shift registers-series, series in-series out and parallel in parallel out. Half and full adders, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Synchronous counters, Synchronous Mod-6 Counter using clocked JK Flip-Flops. Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops. Memory cells, memory registers **[16 hours]**

**Tutorial**

**[32 hours]**

**References:**

1. Boylestad R.L. and Nashelsky L., Electronic devices and circuit theory, 4th Edn., Pearson Education, 2006.
2. Bell D.A., Operational amplifiers and linear circuits, 2nd Edn., Pearson Education, 2004.
3. Gayakwad R.A., Operational amplifiers and linear integrated circuits, Prentice-Hall of India, New Delhi, 1993.
4. Malvino A.P. and Leach D.P., Digital principles and applications, 4th Edn., Tata McGraw Hill, 1988.
5. Arivazhagan S. and Salivahananan S., Digital circuits and design, Vikash Publishing House Pvt. Ltd. New Delhi, 2001.
6. Op-amps and linear integrated circuits, ramakanth A Gaekwad, 3<sup>rd</sup> edition, Pearson education Asia, 2002
7. Linear ICs and applications Uday A Bakshi & Atul P Godse, Technical Publications
8. Linear integrated Circuits, Roy & Choudary
9. Digital fundamentals, Thomos L Floyd

**PHY-414: Minor Project**

**Course Outcome:**

- After completing this course the student will have
- CO1. Hands on experience to various experimental Techniques
  - CO2. Research exposure to Physics experiments.
  - CO3. Knowledge on construction of electronic circuits for various application.
  - CO4. Data analysis techniques and plotting of experimental results.

**PHD 090: Nuclear and Particle Physics Lab**

*For those who have completed Condensed Matter Physics Lab PHY311*

**Course Outcome:**

- After completing this course the student will
- CO1. Be familiar with theoretical concepts & experimental techniques of Nuclear & particle Physics.
  - CO2. Be able to make quantitative estimates of phenomena in elementary particles
  - CO3. Understand stability of the nucleus, nuclear forces, interactions and nuclear models; critically assess applications of nuclear technology.
  - CO4. Acquire Theoretical and practical experience in the scattering experiments and gamma-ray spectroscopy.
  - CO5. Be able to realise the Nuclear Electronic circuits

*For those who have completed Condensed Matter Physics Lab PHY311*

Any eight of the following experiments:

1. Half-life of Indium-116 measurement.
2. Energy Resolution of a NaI(Tl) scintillation spectrometer.
3. Compton scattering determination of the rest energy of an electron.
4. Beta absorption coefficient measurement.
5. Dekatron as a counter of signals.
6. Gamma-ray absorption coefficient measurement.
7. End-point energy of beta particles by half thickness measurement.
8. Common source amplifier.
9. Astable multivibrator using timer IC 555.
10. Dead time of the G.M. counter.

Total work load : 2 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **128 hours**

### **PHD 080: Condensed Matter Physics Lab**

For those who have completed *Nuclear Physics Lab PHY 312*

#### **Course Outcome:**

After completing this course the student will

- CO1. Independently collect single crystal XRD data and evaluate the crystal structure,
- CO2. Analyse Diffraction data and their suitability for single crystal structure.
- CO3. Independently work on raw diffraction data and Solve and refine crystal data
- CO4. Understand the properties of Condensed Materials such as Structural, Magnetic, Electrical and Semiconducting Properties.
- CO5. Acquire theoretical and practical experience in the Condensed Matter Physics

Any eight of the following experiments :

1. Determination of the paramagnetic susceptibility of the given salt by Quincke's method.
2. Study of mercury spectrum by superimposing it on brass spectrum.
3. Sodium spectrum analysis by using Edser-Butler fringes.
4. Temperature coefficient of resistance of a thermistor.
5. Analysis of the powder X-ray photograph of a simple cubic crystal.
6. Thermionic work function of a metal (Richardson-Dushman formula).
7. Energy gap of semiconductor.
8. Determination of Stefan's constant.
9. Frank Hertz experiment
10. Magnetic hysteresis.
11. Measurement of magneto resistance of semiconductors.

Total work load : 2 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **128 hours**

### **PHD 240: Solid State Physics Lab 2**

For those who opted for *Solid State Physics Specialisation*

#### **Course Outcome:**

After completing this course the student will

- CO1. Be able to make quantitative estimates for phenomena in solid state physics.
- CO2. Describe characteristics of thermal and vibrational properties of solids, Compute Band structures
- CO3. Compute trajectories in real and reciprocal space, Characterize magnetism
- CO4. Characterize intrinsic and doped semiconductors
- CO5. Describe superconductivity
- CO6. Understand the mechanism and working of semiconductor devices.

Any five of the following experiments:

1. Photovoltaic cell.
2. Photoconductive cell.
3. Hall effect in semiconductors.
4. Determination of the energy gap of semiconductors by four-probe method.
5. Temperature variation of the junction voltage of a p-n diode.
6. Temperature variation of the reverse saturation current in a p-n diode.
7. Depletion capacitance of a junction diode.
8. Determination of material constant of an intrinsic semiconductor.
9. Schottky effect.
10. Ionic conductivity of an alkali halide crystal.
11. Dielectric constant and its temperature variation.
12. Ultrasonic velocity and elastic constants of a solid.
13. Determination of Curie temperature of a magnetic material
14. Magnetic field variation along with axis of the solenoid
15. Magnetic Hysteresis
16. Thermal Diffusivity of Brass
17. Temperature co-efficient of resistance of copper

*Total work load:* 1 day(s) per week × 4 hours × 16 weeks = **64 hours**

### PHD 250: Nuclear Physics Lab 2

*For those who opted for Nuclear Physics Lab Specialisation*

#### **Course Outcome:**

After completing this course the student will

- CO1. Be familiar with Concepts of Nuclear Detectors, Pulse techniques, nuclear models, timing spectroscopy and nuclear technology.
- CO2. Be familiar with Theoretical and practical experience in the scattering experiments and gamma-ray spectroscopy.
- CO3. Learn Instrumentation, development of sensors, detectors, and larger complex instruments.
- CO4. Familiarise in Fundamentals of reactor theory and nuclear decay mechanisms
- CO5. Learn Accelerator physics, research and development for the next generation of particle accelerators.

Any five of the following experiments:

1. Schmitt trigger.
2. Variable delay line.
3. Pulse recorder.
4. Display devices.
5. Feather analysis: End-point energy of beta rays measurement.
6. Z dependence of external Bremsstrahlung radiation.
7. Fermi-Kurie plot : Determination of the end-point energy of beta rays using a plastic scintillation detector.
8. Determination of the resolving time of a coincidence circuit.
9. Determination of source strength by gamma-gamma coincidence.
10. Determination of source strength by beta-gamma coincidence.
11. Multichannel analyser : Study of the variation of energy resolution as a function of gamma ray energies.
12. Verification of Mosley's law
13. Beta ray absorption studies – relation between —and end point energy.
14. Absorption coefficient of Al using Sr-90 and Y-90 beta sources.

*Total work load :* 1 day(s) per week × 4 hours × 16 weeks = **64 hours**



## **PHY-425: Theoretical Physics Lab 2**

*For those who opted Theoretical Physics Lab Specialisation*

### **Course Outcome:**

After completing this course the student will

- CO1. Tackle a wide range of topics using powerful analytical tools including formal methods in classical and quantum physics
- CO2. Clearly communicate information and conclusions in written and verbal formats on ideas in Theoretical Physics
- CO3. Evaluate complex problems and formulate solutions, indentifying the role of theory, hypothesis and experiment in the scientific method
- CO4. Apply computation to solve the problems in theoretical physics
- CO5. Plan, carry out and report theoretical physics based investigation
- CO6. Apply classical and quantum theoretical techniques in research

Any five of the following experiments:

1. Density matrix description of polarization of light.
2. Double scattering of spin-1/2 particles on spin-zero targets.
3. Second order QED processes (Compton scattering).
4. Evolution of matrix elements between coupled angular momentum states.
5. Dirac matrix representations.
6. Algebra of Dirac matrices.
7. Electron-proton scattering, Rosenbluth formula.
8. Relativistic kinematics-3: Study of decay and production processes.
9. Feynman diagrams and calculations.
10. Energy matrix calculation.

*Total work load* : 1 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **64 hours**

**JSS MAHAVIDHYAPEETHA**  
**JSS COLLEGE OF ARTS COMMERCE & SCIENCE**

(Autonomous) Ooty road, Mysore – 25  
II and IV Semester Examination May / June 2018

**M.Sc PHYSICS Question Paper Pattern**

**Time:3 Hours**

**Answer all the questions**

**Max. Marks: 70**

**SECTION A**

1. (a)  
(b)  
(c)

**18 Marks**

**OR**

2. (a)  
(b)  
(c)

**18 Marks**

**SECTION B**

3. (a)  
(b)  
(c)

**18 Marks**

**OR**

4. (a)  
(b)  
(c)

**18 Marks**

**SECTION C**

5. (a)  
(b)  
(c)

**18 Marks**

**OR**

6. (a)  
(b)  
(c)

**18 Marks**

**SECTION D - (Problems only)**

7.

**5 Marks**

**OR**

8.

**5 Marks**

9.

**6 Marks**

**OR**

10.

**6 Marks**

11.

**5 Marks**

**OR**

12.

**5 Marks**

**J.S.S. College of Arts, Commerce and Science  
(Autonomous)  
Ooty Road, Mysuru-570 025**

**DEPARTMENT OF ZOOLOGY (PG)**

**Programme outcome, Programme specific outcome, Course outcome and  
curriculum for Postgraduate Zoology  
(2018-2019 & onwards)**

## **Program Outcome**

1. Imbibe the knowledge with facts and figures related Zoology.
2. Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.
3. Identify, formulate, research literature, and analyze complex problems reaching substantiated conclusions using first principles of mathematical, biological, physical and chemical sciences.
4. Will be able to think creatively to propose novel ideas in explaining facts and figures or providing new solution to the problems.
5. Develop scientific outlook not only with respect to Zoology but also in all aspects related to life.
6. Realize that interdisciplinary knowledge in other faculties can have greatly and effectively influence which inspires in evolving new scientific theories and inventions.
7. Imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality.
8. Develop various communication skills such as reading, listening, speaking, etc.
9. Realize that acquiring knowledge is a continuous process and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life.

**Programme Specific outcome:**

At the completion of M.Sc. in Zoology the students are able to:

1. Understand the classification and taxonomic aspects of the animal world (chordates and non-chordates). The students will be able to identify the taxonomic group of a given animal based on the external characteristics.
2. Understand the basic concepts of Animal physiology. The students will be able to identify and understand the important life processes which are essential for continuation of life on earth.
3. Understand the nature and structure of biomolecules and basic concepts of Biological chemistry.
4. Understand the concepts of Genetics, Cell Biology and Molecular Biology.
5. Understand the basic principles and concepts of environmental science, ecology and nature conservation.
6. Understand the importance of knowledge of wild life and animal behaviour for conservation and balancing the nature.
7. Understand the tools and techniques employed in Biological research and experiments.
8. Understand the process of evolution.
9. Understand the concept and applications of sericulture, apiculture, animal husbandry, Lac culture etc.

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
**OOTY ROAD, MYSURU**  
**PG DEPARTMENT OF ZOOLOGY**  
**Syllabus Adopted from the academic year 2018-19**

Semester	HC / SC	Paper title	CREDITS			Total Credits
			L	T	P	
<b>I</b>	HC - 1.1	Biosystematics & Non Chordata	2	0	2	<b>4</b>
	HC - 1.2	Biological Chemistry	2	0	2	<b>4</b>
	HC - 1.3	Cytogenetics	2	0	2	<b>4</b>
	SC - 1.4	Tools and techniques in Biology	3	1	0	<b>4</b>
	SC - 1.5	Chronobiology	3	1	0	<b>4</b>
	SC - 1.6	Histology and Histopathology	3	0	1	<b>4</b>
<b>Any two of the Soft core paper may be opted</b>						<b>20</b>
<b>II</b>	HC - 2.1	Chordata	2	0	2	<b>4</b>
	HC - 2.2	Animal Physiology	2	0	2	<b>4</b>
	HC - 2.3	Entomology	2	0	2	<b>4</b>
	SC - 2.4	Developmental Biology	3	0	1	<b>4</b>
	SC - 2.5	Immunology	3	1	0	<b>4</b>
	SC - 2.6	Evolutionary Biology	3	1	0	<b>4</b>
<b>Any two of the Soft core paper may be opted</b>						<b>20</b>
<b>III</b>	HC - 3.1	Molecular Biology & Biotechnology	2	0	2	<b>4</b>
	HC - 3.2	Reproductive Biology	2	0	2	<b>4</b>
	HC - 3.3	Ecology and Wildlife**	2	0	2	<b>4</b>
	SC - 3.4	Ethology *	3	1	0	<b>4</b>
	SC - 3.5	Pollution and Toxicology *	3	1	0	<b>4</b>
	OE - 3.6	Concepts of Zoology	3	1	0	<b>4</b>
*Any one of the Soft core paper may be opted ** Field visits are included in this paper						<b>20</b>
<b>IV</b>	HC - 4.1	Advanced Genetics and Computational Biology	2	0	2	<b>4</b>
	HC - 4.2	Applied Zoology*	2	0	2	<b>4</b>
	HC - 4.3	Project	0	2	6	<b>8</b>
* Field visits are included in this paper						<b>16</b>

**Total credits**

**Hard Core - 52 Credits**

**Soft Core - 20 Credits**

**Open Elective - 04 Credits**

**Total credits required to complete M.Sc Course - 76 Credits**

**M.Sc, I SEMESTER  
HC 1.1 Non Chordata**

**32hrs**

Course Outcome:

After completing the course student will be able to

1. Understand the classification of major and minor invertebrate phyla
2. Give some examples and basic characteristics of some examples of each phylum
3. Understand the evolutionary pathway and its significance
4. Adaptive characters of animals coming under different invertebrate phyla

**UNIT I Basic concepts of animal taxonomy:**

**8 hrs**

- A. Introduction and history of taxonomy
- B. Species concept
- C. Zoological classification - theories of classification - taxonomic ranks – hierarchy
- D. Zoological nomenclature: Binomial nomenclature, trinomial nomenclature-ICZN
- E. taxonomical keys: key to the species
- F. Linnaean taxonomy and classical taxonomy - level of taxonomy.

**Unit II : Classification, Locomotion and Nutrition:**

**8 hrs**

- A. General Characteristics of Non chordata.
- B. **Locomotion:** Muscle filaments and myonemes, Flagella and cilia. Amoeboid movement.
- C. **Nutrition in Protozoa:** Filter feeding in polychaetes, Filter feeding and digestion in Deuterostomia and molluscs.
- D. **Respiration:**  
Structure and function of respiratory organs- Skin, gills, book lungs and Trachea. Respiratory pigments

**Unit III:**

**8 hrs**

- A. **Excretion and osmoregulation:**  
Osmoregulation in fresh water and marine Invertebrates  
Structure and function of excretory organs- Coelom, Coelomoducts, Nephridia, Malpighian tubules and Coxal glands
- B. **Nervous system:**  
Primitive nervous system: Coelenterata and Echinodermata  
Advanced nervous system: Annelida, Arthropoda( Crustacea and insecta) and Mollusca (Cephalopod)
- C. Sense organs and their importance

**Unit IV:**

**8 hrs**

- A. **Invertebrate paleontology and larval forms:**  
Free living and parasitic Larval forms
- B. **Fossil:** types and importance of fossil study, overview of Geological Time Scale

**NON CHORDATA –PRACTICALS**

**4x16=64 Hrs**

**1. PROTOZOA;**

**4x12=48 hrs**

Slides : 1) *Trypanosoma cruzi* 2) Plasmodium – signet ring stage 3) Ceratium  
4) *Leishmania donovani* 5) Vorticella 6) Noctiluca 7) Radiolaria 8) *Entamoeba histolytica*  
9) Foraminifera 10) Opalina

**2. PORIFERA;**

a) Slides: 1)Sponge spicules 2)Sponge gemmules

b) Specimen: 1) Grantia 2) Euspongia 3) Clypeaster

### 3. CNIDARIA:

a) Slides: 1) Obelia polyp and Medusa 2) Pennaria 3) Aurelia-tentaculocyst

b) Specimens: 1) Physalia 2) Gorgonia 3) Spongodus 4) Zoanthus 5) Favia 6) Pennatula  
7) Sea anemone 8) *Corallium rubrum*

### 4. HELMINTHES:

a) Slides: 1) *Fasciola hepatica* 2) *Ancylostoma*

b) Specimens: 1) Planaria 2) Male and female *Ascaris lumbricoides* 3) *Taenia solium* 4)

### 5. ANNELIDA:

a) Slides: 1) Leech 2) Earthworm setae

b) Specimens: 1) Neries 2) *Chloea flava* 3) *Pheretima postuma* 4) Terebella 5) Eurythoe

### 6. ARTHROPODA:

a) Slides: 1) Daphnia 2) Sacculina 3) T.S of Peripatus

b) Specimens: 1) Balanus 2) Lepas 3) Palinurus 4) Scolopendra 5) Rhinoceros beetle  
6) Spider 7) Gongylus 8) Belostoma 9) Limulus 10) Squilla 11) Eupagarus 12) Julus

### 7. MOLLUSCA :

Specimens: 1) Aplysia 2) Glochidium 3) Loligo 4) Chiton 5) Cypreae 6) Octopus  
7) Sanguinolaria 8) Chicoreus 9) Ficus 10) Lambis 11) Mytillus 12) Doris 13) Onchidium  
14) Oliva 15) Murex 16) Turritella 17) Cardium

### 8. ECHINODERMATA:

Specimens: 1) Sea Urchin 2) Linckia 3) Echinodiscus 4) Holothuria 5) Antedon

### 9. MINOR PHYLA: —1) Lingula

### 10. LARVAL FORMS:

Slides: 1) Cercaria 2) Trochophore 3) Megalopa larva 4) Nauplius 5) Zoea 6) Mysis

7) Phyllosoma 8) Protozoa 9) Bipinnaria 10) Veliger 11) Tornaria

12) Glochidium 13) Pluteus

### 11. Field Study: Visit to different areas around the college campus, to observe and study

Non chordates in their natural habitat.

4x2=8 hrs

### II. Study of Nervous system, Respiratory system, Reproductive system and Excretory system

in invertebrates by employing computer animation/charts:

4x2=8 hrs

### REFERENCES :

1. Barnes, R.D. 1974. Invertebrate Zoology, III edition. W.B Saunders Co., Philadelphia
2. Barrington, E.J.W, 1976. Invertebrate Structure and Function. Thomas Nelson and Sons Ltd., London.
3. Hyman L.H. 1940. The invertebrates. Vol. 1. Protozoa through Ctenophora, McGraw hill Co., N.Y.
4. Hyman. L H. 1959. The Invertebrates smaller coelomate groups, Vol. V. McGraw Hill Co.,
5. Hyman. L. H. 1951. The Invertebrates. Vol. 2. McGraw Hill Co., N.Y.
6. Hyman. L H. 1968. The invertebrates Vol. 8. McGraw Hill Co., N.Y and London.
7. Simpson, G C. Principles of Taxonomy.



**M.Sc, I SEMESTER  
HC -1.2 BIOLOGICAL CHEMISTRY**

**32 hrs**

**Course Outcome:**

After completing the course student will be able to

1. Identify the five classes of polymeric biomolecules and their monomeric building blocks.
2. Explain the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action.
3. Understand types, Structure, biochemical properties and functions of vitamins.
4. Explain how the metabolism of organic compounds leads ultimately to the generation of large quantities of ATP.

**UNIT I Chemical Bonds and Carbohydrates: 8 Hrs**

- A. Structure of an atom, orbitals, chemical bonds - covalent, co-ordinate, ionic and hydrogen; Vander-Waal's force; hydrophobic interactions; Normality and Molarity of solutions.
- B. Carbohydrates – Chemistry and biological properties

**UNIT II Proteins and Lipids: 8 Hrs**

- A. Proteins- Chemistry and biological properties, Christian Anfinsen's experiment, Biological values of proteins
- B. Lipids: Chemistry, triglycerides; prostaglandins and steroids –biosynthesis, Chemical importance of lipids.

**UNIT III Enzymes: 8 Hrs**

- A. Enzymes: Nomenclature – current status; factors influencing velocity of enzyme reaction, enzyme dynamics and enzyme inhibition.  
Ribozymes and abzymes; co-enzymes, isozymes, clinical importance.

**UNIT IV Nucleic acids & Vitamins: 8 Hrs**

- A. Nucleic acids: Chemistry, alternative models of DNA,
- B. Vitamins and trace elements – chemical nature, vitamins as co-enzymes, Deficiency diseases, role of trace elements

**Biological Chemistry practicals 4x16=64 Hrs**

1. Qualitative analysis for identification of carbohydrates (Starch, Glycogen, Sucrose, Lactose, Maltose, Glucose, Fructose).
2. Qualitative analysis for identification of Proteins (Egg albumin, Casein, Gelatin, Peptone)
3. Precipitation reaction of proteins (Egg albumin, Peptone)
4. The absorbance curves for two dyes and demonstration of Beer-Lambert's law.
5. Estimation of amino acids by Sorenson's formal titration (Arginine, Alanine, Leucine, lysine)
6. Determination of concentration of Glucose and Maltose by calibration curve.
7. Determination of amylase activity.
8. Determination of effect of temperature, pH and incubation period on amylase activity.
9. Test for non-esterified fatty acid.
10. Demonstration of gel electrophoresis.

**REFERENCES**

1. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology, Oxford University press, London.
2. Conn, E. E., Stumft, P. K., Bruencing, G. and Dol, R. G. 1995. Outlines of Biochemistry. Pub. John Wiley, Singapore.

3. Eckert, R and Randall, D. 2002, Animal physiology, 2<sup>nd</sup> Edn, W.H..Freman
4. Guyton. A.G. 1986, Text book of Medical Physiology, 7<sup>th</sup> Edn., Saunders Publication
5. Harper, H. A. 1993. A review of Physiological Chemistry, Lange Medical Publication, 2<sup>nd</sup> Edn.
6. Lehninger, A. L., Nelson, D. L. and Cox, M. M., 2<sup>nd</sup> Edn. 1993. Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
7. Oser, B. L. (Ed.) 1993. Hawk's Physiological Chemistry. Tata Graw Hill Publishing Co. Ltd. New Delhi.

**M.Sc., I SEMESTER  
HC – 1.3 CYTOGENETICS**

**32 Hrs**

Course Outcome:

After completing the course student will be able to

1. Described the fundamental molecular principles of genetics
2. Understood the structure and function of DNA & RNA
3. Understand about the transmission, distribution, arrangement, and alteration of genetic information and how it functions and is maintained in populations
4. Described the basics of genetic mapping
5. Explain basic structure of animal cell and its organelles
6. Describe the functions and organization of cell organelles

**Unit I: Introduction to the Cell & Cell Organelles**

**8 hrs**

- A. The origin and evolution of the cell, From molecules to first cell, from Prokaryotes to eukaryotes, from single cell to multicellular organisms.
- B. Membrane Structure and Function,
- C. Structural organization and functions of intracellular organelles- The nucleus, Mitochondria, Lysosomes, Peroxisomes, Golgi apparatus, and endoplasmic reticulum.

**Unit II: Cell Cycle and Cell signalling**

**8 Hrs**

- A. Phases of cell cycle.
- B. Biochemical studies with oocytes, eggs and early embryos.
- C. Regulation of cell cycle: Molecular mechanisms regulating mitotic events.  
Regulation of cell cycle progression.  
Check points in cell cycle regulation.  
Cell cycle control in polytene cells.
- D. Molecular basis of signal transduction
- E. Cellular aging and death: (a) Causes of aging  
(b) Cellular changes due to aging  
(c) Theories of aging  
(d) Apoptosis  
(e) Longevity genes

**UNIT III Gene mutations**

**8 Hrs**

- A. Types of mutations (Spontaneous, Induced, Base substitutions and frameshifts - Transitions, Transversions, gain in function, loss in function, Neutral mutations),
- B. Molecular mechanism of mutations (Base analogs, alkylating agents); Detection of mutations: Dominant lethal test, Sex-linked recessive lethal test, II-III translocations, Ames test, P-mediated mutagenesis

**UNIT IV Chromosomal mutations**

**8 Hrs**

- A. Structure and organization of eukaryotic chromosomes
- B. Structural and numerical variations of chromosomes, Chromosomal rearrangements and their cytogenetic consequences with examples from plants, Drosophila and Man,

Practical applications of chromosome rearrangements - Balancers and attached X-chromosome in *Drosophila*. Cytogenetic effects of ionizing and nonionizing radiations

**CYTOGENETICS PRACTICALS**

**4X16 =64 Hrs**

- 1) Life cycle of *Drosophila melanogaster* 1x4=04hrs
- 2) Preparation of culture media. Culture of *Drosophila* - Methods of maintenance. 1x4=04hrs
- 3) Study of morphology of *Drosophila melanogaster* 1x4=04hrs
- 4) Mounting of Sex comb of *Drosophila melanogaster* 1x4=04hrs
- 5) Mounting of Wing of *Drosophila melanogaster* 1x4=04hrs
- 6) Study of mutants of *D. melanogaster* 1x4=04hrs
- 7) Preparation of genital plate of *D. melanogaster* 2x4=08hrs
- 8) Chi square Analysis of F1, F2 and Test cross progeny in *Drosophila melanogaster* to understand pattern of inheritance of different characters and to demonstrate. 3x4=12hrs
  - a) Law of segregation
  - b) Law of Independent assortment
  - c) Sex-linked inheritance
- 9) Temporary squash preparation of Mitotic chromosomes from root tip meristem of *Allium cepa* 2x4=08hrs
- 10) Temporary squash preparation of Meiotic chromosomes from testis of *Poicelocerus pictus* 2x4=08hrs
- 11) Study of Barr body using buccal smear of volunteers 1x4=04hrs

**REFERENCES:**

1. Alberts, B., A. Jhonson, J. Lewis, M. Raff, K. Roberts and P. Walter 2008. Molecular Biology of the cell. V Ed. Garland Science, New York.
2. Brachet, J. 1985. Molecular Cytology, Academic Press, N. Y.
3. Furukawa, R., and M. Fechheimer. 1997. The structure, function and assembly of actin filament bundles. Int. Rev. Cytol. 175: 29-90.
4. Lewin B. (1997) Gene VI Oxford University Press, Oxford
5. Lodish, H., A. Berk, C.A Kaiser, M.P. Scott, A Bretscher, H. Ploegh, P. Matsudaira. 2008. Sixth Edition, Molecular Cell Biology. W. H. Freeman and Co., N. Y.
6. Pollard, T. D. and W. C. Earnshaw. 2002. Cell Biology. Saunders
7. Russel P.J (1998) Genetics. The Benjamin Cummings Publishing Co Inc.
8. Snustad D.P and M.J.Simons. (1997) Principles of Genetics. John Wiley and Sons Inc. N.Y.
9. Strickberger M.W. (1977) Genetics. MacMillan Collier Co. Pvt Ltd
10. Watson J.D, Hopkins, N.H, Roberts J.A, Steitz and A.M.Weiner. (1987) Molecular biology of gene. The Benjamin Cummings Publishing Co Inc.
11. Wolfe, A. 1995. Chromatin: Structure and function. Academic Press, N. Y.

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**M.Sc., I SEMESTER**  
**SC – 1.4 TOOLS AND TECHNIQUES OF BIOLOGY**

**48 hrs**

Course Outcome:

After completing the course student will be able to

1. Describe the methodology involved in biotechniques.
2. Describe the applications of bioinstruments
3. Demonstrate knowledge and practical skills of using instruments in biology and medical field.
4. Perform techniques involved in molecular biology and diagnosis of diseases
5. Update current knowledge regarding biomedical engineering involving new methods and the instrumentation.

**UNIT I: MICROSCOPY:**

**12hrs**

Basic principles of microscopy, Types of microscopes and their biological applications  
Bright-field microscope, numerical aperture, limit of resolution, types of objectives, ocular & stage micrometers, Electron Microscope, SEM, Confocal microscope.

Dark-field microscope

Phase-contrast microscope

Differential interference contrast microscope

Fluorescence microscope

Photomicrography and image processing

**UNIT II: SEPARATION TECHNIQUES:**

**12hrs**

**Centrifugation** - Basic principles, Types of rotors, Clinical, high speed & ultracentrifuge

**Electrophoresis** – Agarose and polyacrylamide gel, Two-dimensional, Isoelectrofocussing

**Chromatography** - Paper and Thin layer chromatography, Column chromatography, Gel filtration, Ion-exchange, Affinity, Introduction to FPLC and HPLC

**UNIT III:**

**12hrs**

**A. Radio-tracer techniques**

Unit of radioactivity and half life, Measurement of radioactivity ( $\beta$  and  $\gamma$  emission), Applications of radioisotopes, Safety measures

**B. Techniques in immunodetection:** Immunoblotting and immunofluorescence

**C. Immunological techniques:** Immunodiffusion and Immunoelectrophoresis

**UNIT IV:**

**12hrs**

**A. Cell culture techniques:** Design and functioning of tissue culture laboratory; Culture media, essential components and preparation; Cell viability testing

**B. Cytological techniques:** Mitotic & Meiotic chromosome preparations from insects and vertebrates Chromosome banding techniques (G-, C-, Q-, R- banding etc.)

**C. Molecular cytological techniques:** In situ hybridization (radiolabelled & non-radiolabelled methods), FISH, and Restriction banding

**D. Molecular biology techniques:** Southern hybridization and Northern hybridization DNA sequencing Polymerase chain reaction (PCR)

**TUTORIALS**

**2x16 = 32 Hrs**

**REFERENCES**

1. Alberts et al: Molecular Biology of the Cell, Garland, 2002
2. Karp: Cell and Molecular Biology, John Wiley & Sons, 2002
3. Lodish et al: Molecular Cell Biology, Freeman, 2000
4. Pollard & Earnshaw: Cell Biology, Saunders, 2002
5. Ruthman: Methods in Cell Research, Bell & Sons, 1970.

6. Boyer: Modern Experimental Biochemistry and Molecular biology (2nd Ed.), Benjamin/Cumin, 1993
7. Freifelder: Physical Biochemistry (2nd Ed.), Freeman, 1982
8. Holme and Peck: Analytical Biochemistry (3rd Ed.), Tata McGraw Hill, 1998
9. Plumer: An Introduction to Practical Biochemistry (3rd Ed.), Tata-McGraw Hill, 1990
10. Switzer and Garrity: Experimental Biochemistry 92nd Ed.), Freeman, 1999
11. Wilson and Walker: Practical Biochemistry (3rd Ed.), Cambridge Univ. Press, 2000

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**M.Sc., I SEMESTER  
SC – 1.5 CHRONOBIOLOGY**

**48 hrs**

Course Outcome:

After completing the course student will be able to

1. Understand the concept of Chronobiology
2. Identify the way by which circadian rhythms affect life from the genome to the complex behaviour of the individual
3. Acknowledge the role of Chronobiology and chronodisruption on several physiopathological events
4. Acknowledge the input of the synchronizers on homeostasis
5. Characterize the biological relevance of several chronotypes
6. Acknowledge the relevance of circadian rhythms on therapeutic interventions
7. Acknowledge the importance of scientific research on Chronobiology
8. To interpret study designs and scientific parameters related to Chronobiology.

**UNIT I: Introduction:**

**4 hrs**

History, Biological rhythms, Biological clocks, Significance of biological timekeeping

**UNIT II: Biological rhythms:**

**10 hrs**

- A. Types of rhythms- Circadian, Circatidal, Circalunar, Circannual
- B. Methods of measurement
- C. Properties: Entrainment, Re-entrainment, Phase angle difference, Freerun, Phase shift, Phase response curve, Arrhythmia.

**UNIT III: Factors influencing biological rhythms:**

**10 hrs**

- A. Environmental: Photoperiod -Photoreception and photo-transduction;  
The physiological clock and measurement of day length;  
Role of photic and non-photic cues in seasonality, Other zeitgebers  
Reversal of roles of principal and supplementary cues.
- B. Evolution of photoperiodism: comparative studies; Circannual rhythms and seasonality.

**UNIT III: Circadian pacemaker system:**

**8 hrs**

- A. Suprachiasmatic nuclei, B. Pineal gland, C. Optic lobes.

**UNIT IV: Molecular basis of circadian rhythms**

**8 hrs**

- A. Clock genes, B. Drosophila, C. Mouse

**UNIT V: Applied Chronobiology:**

**8 hrs**

- A. Human circadian rhythms: Melatonin: Input or output signal of the clock system, Clock function (dysfunction); Human health and diseases
- B. Applications of circadian rhythm principles: Jet-lag/shift work, Depression and

sleep disorders, Chronopharmacology and Chronotherapy

**TUTORIALS**

**2X16=32 Hrs**

**References**

1. Binkley, S. (1990): The clockwork sparrow: time, clocks, and calendars in biological organisms, Prentice-Hall, New Jersey.
2. Chandrashekar, M. K. (1985): Biological rhythms, Madras Science Foundation, Chennai.
3. Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004: Chronobiology Biological Timekeeping, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
4. Nelson, R. J. (2000) An Introduction to Behavioural Endocrinology, 2<sup>nd</sup> edition, Sunderland Publishers, Massachusetts.
5. Saunders D.S., C.G.H. Steel, X., afopoulou (ed.)R.D. Lewis. (3rd Ed) 2002: Insect Clocks, Baren and Noble Inc. New York, USA
6. Shapiro, C. M. and Heslegrave, R. J. (1996): Making the shift work, Joli Joco Publications, Inc. Toronto.
7. Vinod Kumar (ed 2002) : Biological Rhythms Narosa Publishing House, Delhi/ Springer-Verlag, Germany

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**M.Sc., I SEMESTER  
SC – 1.6 HISTOLOGY AND HISTOPATHOLOGY**

**48 Hrs**

Course Outcome:

After completing the course student will be able to

1. Understand the applications of dyes and its classification.
2. Know the functional morphology of various mammalian organs.
3. Imbibe the knowledge on histochemical techniques.
4. Describe the etiology and pathology of liver cirrhosis and atherosclerosis.
5. Explain histopathology of breast and prostate tumours.

**UNIT – I Basics of Histology**

**8Hrs**

- A. Objectives and applications
- B. Tissue fixation : Objectives, methods, chemical fixatives-types and chemistry of fixation; Physical methods:-freezing and microwave fixation; choice of fixatives, fixation artifacts.
- C. Dyes. –Natural and Synthetic, Classification

**UNIT-II Functional Morphology (mammalian)**

**8 Hrs**

- A. Histological organization of GI tract- stomach and intestine,
- B. Histological organization of lungs & kidney
- C. Histological organization of spleen & thymus,
- D. Bone and bone marrow.

**Unit-III Histochemistry**

**8 Hrs**

- A. Principles and methods of application
- B. Classical histochemical Techniques: for localization of glycoproteins (PAS), nucleic acids (Feulgen) and steroid dehydrogenase activity.

**Unit-IV Immunohistochemistry**

**8 Hrs**

- A. Principles, method of application
- B. Immunohistochemistry techniques for localization of proteins in endocrine cells (Pituitary cell types or islet of Langerhans)

C. Immunofluorescence: In situ hybridization of nucleic acids

**UNIT-V Histopathology**

**8 Hrs**

- A. Morphological alterations in cells due to disease,
- B. Types of degeneration: clouding, hyaline, hydrophic and fatty degeneration.
- C. Etiology, pathogenesis and histopathology of Liver cirrhosis and atherosclerosis
- D. Neuropathology of alcoholism and methanol poisoning.

**Unit-VI Histopathology of tumors**

**8 Hrs**

- A. Malignant and non-malignant
- B. Types of carcinoma
- C. histopathology of breast and prostate tumors

**PRACTICALS**

**2x8= 16 Hrs**

**I. Histology:**

- 1. Microtomy and staining: Hematoxylin-eosin - Demonstration 2x2=4 hrs
- 2. Histology: 2x2=4 hrs

Observations of permanent slides of mammalian organs – stomach, intestine, spleen, liver, kidney, lungs, testis, epididymis, vas deferens, ventral prostate, seminal vesicle, ovary, uterus and Fallopian tube.

**II. Histometry:**

**2x3=6hrs**

Histometrical measurements and statistical analysis of some tissues.

**III. Histopathology:**

**2x1=2hrs**

Study of histopathological changes (permanent slides) – gastric ulcers, cirrhosis of liver, breast tumors, cystic follicles of ovary, pancreas in diabetics, cryptorchid testis and leukemia.

**REFERENCES:**

- 1. Boyd, W. 1976: A text book of Pathology. Structure and function in disease, 4th edition. Lea and Fibiger, Philadelphia.
- 2. Pearse, A.G.E. (1980): Histochemistry, theoretical and Applied, J & A, Churchill Ltd., London.
- 3. Rogers, A.W. (1983): Cells and Tissues, An introduction to Histology and Cell Biology, Academic Press, NY.
- 4. Telford, I.R. and Bridgman, C.F. (1990). Introduction to Functional Histology, Harper and Row, NY.

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**M.Sc., II SEMESTER  
HC – 2.1 CHORDATA**

**32 Hrs**

**Course Outcome:**

After completing the course student will be able to

- 1. Understand the classification of chordates
- 2. Give some examples and basic characteristics of some examples of protochordates
- 3. Give some examples and basic characteristics of some examples of vertebrates
- 4. Understand the evolutionary pathway and its significance
- 5. Analyse adaptive characters of animals coming under different vertebrate classes

**UNIT I General characters and outline classification of Chordata**

**8hrs**

- A. General and Comparative study: Comparison of three Protochordates, Subphyla in terms of General comparison, Habits and habitats,

- B. Alimentary canals and associated glands, Pharynx, Food and feeding and excretory system in Protochordates.
- C. Adaptive radiation in vertebrates – fishes, amphibians, reptiles, aves and mammals

## UNIT II

8hrs

- A. **Integument and its Derivatives:** Epidermal Integument or Skin Functions, Structure & its Derivatives (Glands, Scales and scutes, digital cornifications, horns, feathers, hairs), Integument in different classes of Chordates.
- B. **Nervous system-** Development of Brain, spinal cord, Peripheral nerves and sense organs

## UNIT III

8hrs

- A. **Respiratory System:** Introduction Respiratory organs: Gills (Internal or true gills, External or Larval gills). Lungs and Ducts, Accessory Respiratory organs and Swim Bladders.
- B. **Circulatory system:** Evolution of heart and aortic arches

## UNIT IV

8hrs

- A. **Digestive System:** Introduction Embryonic Digestive Tract Alimentary Canal: Divisions, Digestive Glands
- B. **Urinogenital System:** Vertebrate kidneys and ducts, Gonads and their ducts

## CHORDATA PRACTICALS

4x16=64 Hrs

1. **Protochordates:** Specimens: 1) *Amphioxus*, *Herdmania*

Slides- *Salpa* (sexual), *Doliolum*

2. **Fishes :** 1) *Rhinobatus* 2) *Hippocampus* 3) Goldfish (aquarium fish) 4) *Clarius*

5) *Anabas* 6) *Coffe* fish 7) *Acipenser* 8) *Periophthalmus* 9) *Triacanthus*

10) *Notopterus* 11) *Exocoetus* 12) *Diodon hystrix* 13) *Echeneis neucrates*

3. **Amphibians :** 1) *Ichthyophis* 2) Axolotl Larva 3) *Rana tigrina* 4) *Amblystoma*

4. **Reptiles :** 1) *Calotes* 2) *Mabuya* 3) Chameleon 4) *Phrynosoma* 5) *Chelone mydas*

5) *Varanus* 6) *Naja naja* 7) Krait 8) *Hydrophis* 9) Viper

5. **Birds :** 1) Blue jay 2) Indian koel -male and female 3) Kite

6. **Mammals :** 1) Guinea pig 2) Domestic cat 3) Loris 4) *Megaloderma lyra* (bat)

5) Pangolin

7. **Integuments of vertebrates:** Scales of fish, Hoofs, nails, horns, claws,

plastron and carapace of tortoise, snout of saw fish

8. **Osteology :**

1) **Skull and lower jaw:-** a) Crocodile b) Bird c) Carnivore mammal (dog)  
d) Herbivore mammal (horse)

2) **Types of vertebrae:-** a) Procoelous b) Ophisthocoelous c) Amphicoelous  
d) Amphiplatian e) Heterocoelous f) Axis and atlas vertebrae.

## II. Study of following systems in rat by employing computer animation/charts:

- a) Circulatory system b) Nervous system c) Reproductive system
- d) Digestive system e) Sense organs f) Urinary system



## REFERENCES :

1. Alexander, R. M. 1975. The Chordata. Cambridge University Press, London.
2. Barrington, E.J.W. 1965. The Biology of Hemichordata and Protochordata, Oliver and Boyd, Edinburgh.
3. Colbert, E. H, 1969. Evolution of the vertebrates, John Wiley and Sons, Inc., N.Y.
4. Kent, C. G. 1954. Comparative anatomy of vertebrates
5. Kingsley, J.S. 1962. Outlines of Comparative anatomy of vertebrates. Central book depot Allahabad.

## M.SC., II SEMESTER HC – 2.2 ANIMAL PHYSIOLOGY

32 Hrs

### Course Outcome:

After completing the course student will be able to

1. Understand the mechanism of transport of molecules, stepwise release of energy , aerobic and anaerobic respiration
2. Describe the physiology of digestive and respiratory system of human beings.
3. Understand the blood composition, types, groups and circulatory system.
4. Describe the physiology of excretory system and nervous system of human beings.
5. Know the physiology of sense organs, muscles and reproductive system.

### UNIT I: Membrane Transport, Bioenergetics & Circulation

8 Hrs

#### A. Membrane Transport:

Molecular mechanisms of passive and active transport.

#### B. Bioenergetics:

- a) Energy – Concept, laws of thermodynamics
- b) Redox potential
- c) Stepwise release of energy through cytochromes, production of ATP, uncoupling of oxidative phosphorylation, inhibitors.
- d) Anaerobic and aerobic breakdown of glucose, alternate pathway – HMP shunt and glucuronic acid pathway.
- e) Citric acid cycle as common metabolic pathway.

#### C. Circulation:

- a) Major types of body fluids and their composition.
- b) Neurogenic and myogenic hearts.
- c) Mammalian heart – cardiac cycle, ECG.

### UNIT II: Physiology of excitation & Excretion

8 Hrs

#### A. Muscle Physiology:

- a) Molecular organization of sarcomere.
- b) Mechanism of contraction with emphasis on sliding filament and Davies models, regeneration of storage phosphate.
- c) Physiological adaptations of muscles for jumping, swimming and flight.

#### B. Neurophysiology:

- a) Axonal and synaptic transmission of nerve impulses.
- b) Synaptic integrity, synaptic plasticity.
- c) Molecular mechanism of sensory transduction and neural output in receptor cells.

#### C. Excretion:

- a) Comparative physiology of excretion in animals- Nitrogenous wastes and waste elimination.
- b) Mammalian kidney- Structure and physiology of urine formation.

### Unit III: Basic Concepts of Endocrinology

8 hrs

#### A. Chemical messengers:

Autocrine, Paracrine and endocrine secretions,  
Types of hormones, an overview of human endocrine system

#### B. Hormone synthesis: Peptide and steroid hormones.

Role of Hormones in homeostasis- Glucose and Water balance

#### C. Hypothalamus and pituitary gland:

Structure, function and control of hypothalamic hormones.  
Pituitary hormones and their physiological actions  
chemical structure and. Feedback regulation. Pathophysiology.  
Hypothalamo - hypophysial portal system

#### D. Pineal gland–Structure and function.

### Unit IV:

8 hrs

**A. Thyroid gland:** Structure, function and biosynthesis of thyroid hormone

**B. Parathyroid :** Structure and PTH – Calcitonin – Role of hormones in calcium and phosphate metabolism.

#### C. Adrenal gland hormones

**Adrenal cortex hormones:** Corticoids: role played in Stress management – Aldosterone and the rennin- angiotensin system

**Adrenal medullary hormones:** Catecholamines as emergency hormones

**D. Gastrointestinal hormones:** Secretion, control and function

**E. Pancreatic Hormones:** Insulin and glucagons, their role in the regulation of Carbohydrate, protein and lipid metabolisms.

### ANIMAL PHYSIOLOGY PRACTICALS

4x16=64 Hrs

1. Estimation of Proteins by Lowry *et al* method. (in tissue sample from slaughter house)
2. Determination of serum cholesterol. (Clinical sample)
3. Determination of glucose content by Anthrone method. ((in tissue sample from slaughter house)
4. Estimation of liver and skeletal muscle glycogen. (in tissue sample from slaughter house)
5. Determination of serum/ blood urea by DAMO method. (Clinical sample)
6. Estimation of creatinine in the urine sample.
7. Total count of RBC and WBC.
8. Differential count of WBC
9. Response of RBC's to Hypertonic, hypotonic and isotonic solutions
10. Observation of permanent slides of T.S of endocrine glands
  - a. Pituitary gland
  - b. Thyroid gland
  - c. Adrenal gland
  - d. Pancreas
11. Identification of chemical structures of steroid hormones

### REFERENCES:

1. Adler N. T (1981) Neuroendocrinology of Reproduction, Physiology and Behaviour. Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells and Fertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial control of reproduction, Cambridge University press, London.
2. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology, Oxford University press, London
3. Raghavendra Puri (2003) Mammalian endocrinology Vol. I & II, Dominant Publishers and Distributors, New Delhi.
4. Eckert, R and Randall, D. 2002, Animal physiology, 2nd Edn, W.H..Freman

5. Guyton. A.G. 1986, Text book of Medical Physiology, 7th Edn., Saunders Publication

**M.Sc., II SEMESTER  
HC – 2.3 ENTOMOLOGY**

**32hrs**

Course Outcome:

After completing the course student will be able to

1. Understand insects encountered in agricultural fields.
2. Envisage an insight on economically important pests of various foods, fiber and household
3. Understand various insect pest management methods and its significance
4. Learn to apply various agricultural equipment and understand the effect of chemicals and its dosages in agricultural pest management
5. Learn to apply the pest control methods wisely to minimise ecological backlash
6. Discuss the evolutionary significance of insect plant interaction and insect animal interaction.

**Unit I: General Entomology** **10 hrs**

A. Classification of class Insecta up to orders with suitable examples; Integument appendages.

**B. Insect Endocrinology**

- I. Insect Hormones and their regulation: Chemistry and functions of hormones, Hormones in metamorphosis, Ecdysis and Diapause
- II. Semiochemicals: Allelochemicals and Pheromones (Primer & releaser)

**Unit II: Agricultural Entomology** **10hrs**

A. Role of insects in plant pollination

B. Insects pests: Classification and categories of pests, origin and emergence of pests, pest out breaks and pest resurgence  
Structure, life history, significance, nature of damage and control methods of major pests of sugarcane, Paddy and Coconut.

C. Structure, life history, significance, nature of damage and control measures of stored grain pests: (a) *Sitophilus* (b) *Trogoderma* (c) *Rhizopertha* (d) *Tribolium* (e) *Bruchus* (f) *Sitotrua* (g) *Ephestia*

**Unit III: General and household insect pests** **06hrs**

A. Structure, life history, significance, nature of damage and control measures of following general pests: (a) grasshoppers & locusts (c) termites (d) aphids (e) hairy caterpillars

B. Household pests: Cockroaches, Ants, Wasps, Silverfish, furniture beetle, and their control

**Unit IV: Medical Entomology** **06hrs**

A. Insect vectors: Role of insect as vectors of human diseases (Malaria, filariasis, Kala azar and their control)

Mosquitoes as pests and their control.

Housefly: A human health hazard and its control

B. Arboviral diseases: Dengue, chicken gunya, swine flu.

**PRACTICALS:** **4x16=64 Hrs**

1. Collection and preservation of dead insects for systematic studies & field report 4x4=16 hrs

2. Identification of different insects upto orders- House fly, Cockroach :

Mosquitoes, stored grain beetles, destructive insects, important crop and household pests

4x4=16 hrs

4. Fixing and preservation of dead insects by Plastination technique. 4x4=16 hrs  
 5. Field studies of insects to understand their habit: Ants, Butterflies, termite, wasps, Moths. 4x2=08 hrs  
 6. Study of insect mouth parts: Mosquito, Cockroach, House fly, Butterfly 4x2=08 hrs

**REFERENCES:**

1. Awasti V.B. 2009 Introduction to general entomology 3rd Ed. Scientific publication (India), Jodhpur
2. Awasti V.B. 2007, Agricultural Insect Pests and their control. Scientific publishers (India) Jodhpur
3. Trigunayat M.M. 2009, A Mannual of practical entomology, scientific publishers, Jodhpur, India.
4. Dhaliwal G.S. Ramsingh and B.S. Chillar 2006, Essentials of Agricultural entomology. Kalyani Publishers, New Delhi.
5. L . K Jha. Applied Agricultural Entomology. New central book agency. Culcutta

**M.Sc., II- SEMESTER  
 SC – 2.4 DEVELOPMENTAL BIOLOGY**

**48 Hrs**

**Course Outcome:**

After completing the course student will be able to

1. Understand the molecular concepts of developmental biology during fertilization.
2. Know about Noble prize concepts during frog development viz., Nucleocytoplasmic interactions.
3. Explain on axis development in drosophila.
4. Describe endocrine and molecular control in metamorphosis of insects and amphibians.
5. Explain the various stages of chick embryonic development.

**Unit I:**

- A) Introduction : Descriptive V/s. Experimental Embryology **8hrs**  
 B) Fertilization : a) An overview of structure and differentiation of egg and sperm  
 b) General sequence and molecular events during fertilization

**Unit II: Early development - I**

**8 hrs**

- a) Nucleocytoplasmic interactions in early development: An overview of Nuclear transplanted experiments in Amphibians and mammals
- b) Creations of multicellularity: Cleavage-Regulatory mechanism
- c) Gastrulation: Morphogenetic movements and regulatory mechanisms in amphibian and mammalian embryo.

**Unit III: Early development - II**

**8hrs**

- a) Morphogenetic determinants and their role in development:  
 Yellow cytoplasm in Ascidians, Polar body in Mollusca, Pole plasm in *Drosophila*
- b) Laying down the embryonic body plan :  
 Determination of embryonic axes in *Drosophila* – Anterior-posterior (maternal effect genes) & Dorsoventral; Amphibians (cell-cell interaction) & Mammals (Hox Genes)
- c) Cell lineage studies and cell death genes in *Caenorhabditis elegans*.

**Unit IV: Morphogenesis –I**

**8 hrs**

- a) Early embryogenesis in *Drosophila* : Regional specification by. Segmentation genes: Gap genes, Pair rule genes, Segment polarity genes, and Homeotic genes.
- b) Cellular differentiation and morphogenesis:
  - i. Neuronal v/s epidermal fate specification in *Drosophila*.

ii. Vulval induction in *Caenorhabditis elegans*.

**Unit V: Morphogenesis-II**

**8 hrs**

- a) Role of Cell Adhesion molecules in morphogenesis : Cadherins and Fibronectins
- b) Genetics of imaginal discs and transdetermination
- c) Limb development-an over view :
  - i. Proximo-distal axis specification in developing limb.
  - ii. Cell death and formation of digits.

**Unit VI: Post embryonic development**

**8 hrs**

- a) Metamorphosis : Endocrine and molecular control of metamorphosis in insects and amphibians
- b) Types of growth
- c) Regeneration : Types, Blastema formation, Sources of cells for regeneration
- d) Abnormal development as seen in Teratogenesis.

**PRACTICALS**

**16X2=32Hrs**

- 1. Study of internal changes during early development of frog & chick (permanent slides) 3X2=06hrs
- 2. Development of chick-Embryo mounting-permanent preparation 2X2=04hrs
- 3. Study of early developmental stages of *Drosophila* (Live Observation of embryo) and dechoriation and observation of embryos 2X2=04hrs
- 4. Study of Imaginal discs – the precursors of adult structures in *Drosophila* 3X2=06hrs
- 5. Demonstration of window technique to observe chick embryo development 2X2=04hrs
- 6. Effect of thyroid hormone on development in frog 2X2=04hrs
- 7. Study of various developmental stages in frog up to tadpole stage 2X2=04hrs

**REFERENCES:**

- 1. Balinsky, B.I., 1965. An introduction to embryology, W.B.Saunders company.
- 2. Gilbert, S. F. 2006, Developmental Biology, 8th Ed. Sinauer Associates Inc.,
- 3. Kalthoff, 2000, Analysis of Biological Development, 2nd Ed., McGraw-Hill Science, New Delhi, INDIA. Massachusetts, USA.
- 4. Vasudeva Rao, 1994. Developmental Biology: A modern synthesis, Oxford & IBH, New Delhi.
- 5. Wolpert, Beddington, Brockes, Jessell, Lawrence, Meyerowitz, (3rd Ed., 2006) Principles of Development, , Oxford University Press, New Delhi, INDIA.
- 6. Wolpert, L, Beddington, R Jessell, T. Lawrence P, Meyerowitz, E, Smith J., 2001, Principles of Deveopment Oxford University Press Oxford.
- 7. Ann Kiessling and Scott C. Anderson, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, 2003. Jones and Bartlett Publishers, Boston MA, USA

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**M.Sc., II SEMESTER  
SC – 2.5 IMMUNOLOGY**

**48hrs**

**Course Outcome:**

After completing the course student will be able to

- 1. Outline the key components of the innate and adaptive immune responses.
- 2. Describe about cell types and organs which are involved in an immune response—
- 3. Describe the Infectious diseases, hypersensitivity, autoimmune disorders,— immunodeficiency diseases

- Unit I: Introduction to immunity** **8hrs**
- A. History; types of immunity – Innate and acquired immunity.
  - B. Cells and Organs of immune system: Cells: Lymphocytes (T & B cells), monocytes, macrophage; eosinophills, basophills, neutrophils and mast cells.
  - C. Primary and secondary lymphoid organs: Bone marrow, Thymus, Spleen, Lymph nodes
- Unit II: Antigens and Immunoglobulins** **8hrs**
- A. Antigens: factors influencing immunogenicity, adjuvant, epitope, hapten
  - B. Immunoglobulins: Basic structure of the immunoglobulin;  
Types and functions of immunoglobulins.
  - C. Monoclonal antibodies:Antigen-antibody reactions
- Unit III: Immune response** **8hrs**
- A. Humoral and cell mediated immune responses
  - B. Primary and secondary immune modulation; Cytokines; role of complement system in immune response (Classical pathway, Alternate pathway);
  - C. Immune response against bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections;
- Unit IV Immunotechniques** **8hrs**
- A. Agglutination; Precipitation;
  - B. Immunofluorescence; RIA, ELISA, Immuno-electrophoresis and Western blotting.
- Unit V Major histocompatibility complex and Hypersensitivity** **8hrs**
- A. Transplantation and graft rejection,
  - B. Genetic organization of H2 and HLA complexes, HLA typing;
  - C. Immediate and delayed hypersensitivity.
- Unit VI Vaccines and Vaccination** **8hrs**
- A. Types of Vaccines and their significance
  - B. Vaccine delivery systems.
  - C. Congenital and acquired immunodeficiencies

**TUTORIALS** **2X16=32 Hrs**

**References:**

1. Austyn, J.M. and Kathym, J. Wood. 1993. Principles of cellular and molecular Immunology. Oxford University Press. Oxford.
2. Benjamin, Elisunshine, Geoffrey Leskowitz.1996. Immunology: A short course. 3rd Edition. New York.
3. Kubey, J.M. 1990. Essential Immunology. 6th Edition. Blackwell Scientific Publication, New York.
4. Rao, C.V. 2002. An introduction to Immunology. Narona Publishing House, New Delhi.
5. Rotti, I. 1994. Essential Immunology. Blackwell, London.
6. Stibes, D.P. and Terr, A.I. 1991. Basic and Clinical Immunology. 7th Edition. Appleton and Large. California.

**M.Sc., II SEMESTER**  
**SC – 2.6 EVOLUTIONARY BIOLOGY**

**48 Hrs**

Course Outcome:

After completing the course student will be able to

1. Understand that many of the organisms that inhabit the Earth today are different from those that inhabited it in the past
2. Understand that the propositions underlying Darwin's theory of evolution.
3. Explain adaptation, providing examples from several different fields of biology
4. Explain how the molecular record provides evidence for evolution
5. Understand the Human origin and evolution.

**UNIT I Emergence of concept of evolution: 8 Hrs**

- A. Pre Darwinian concepts, Darwinism and its impact in the development of synthetic theory.
- B. Neodarwinism: Birth of population genetics, Components of population genetics, Mendelian population, gene pool, allele frequencies and genotype frequencies,

**UNIT II Speciation: 8 Hrs**

- A. Concept of species,
- B. Types of species
- C. Models of speciation,
- D. Patterns and mechanisms of reproductive isolation,
- E. Hybridization, polyploidy and speciation.

**UNIT III Molecular evolution 8 Hrs**

- A. Phyletic gradualism and punctuated equilibrium.
- B. Micro and macroevolution.
- C. Molecular evolution: Selectionists theory of evolution, Neutral theory of evolution and Molecular clock and emergence of non-darwinism,

**UNIT IV Phylogeny 8 Hrs**

- A. Phylogenetic trees : Construction with nucleic acid and amino acid sequences,
- B. Types of trees and Techniques employed in construction of phylogenetic trees,
- C. Molecular phylogenetics of Homo sapiens.

**UNIT V Population genetics and Evolution 8 Hrs**

- A. Gene pool, gene frequency, Hardy-Weinberg Law.
- B. Destabilizing forces of evolutionary equilibrium (Mutation, Migration, Selection, Meiotic drive and genetic drift).
- C. Founder effect, Isolating mechanisms and speciation.
- D. Micro Macro and Mega evolution, Co-evolution.

**UNIT VI Genome and Evolution 8 Hrs**

- A. Genes and gene clusters
- B. Origin of new genes by gene duplication (Ohno's concept)
- C. Selfish DNA
- D. Karyotypic evolution (Drosophila).

**TUTORIALS 2X16=32Hrs**

**REFERENCES:**

1. Dobzhansky Th, (1951) Genetics and origin of species, 3rd Edn. Chapman and Hall, London.
2. Dobzhansky Th, Ayala F.J, Stebbins G.L and J.M. Valentine, (1976) Evolution, Surjeet Publication, New Delhi.
3. Futuyama D.J (1986) Evolutionary Biology, Sinuauer Associates Inc. USA
4. Hartl D.L (2000) A primer of population genetics, Sinuauer Associates Inc. USA
5. Jha A.P (1992) Genes and Evolution - John Wiley Publicaion, New Delhi

6. King M (1993) Species evolution - The role of chromosomal change. The Cambridge University Press, Cambridge

**M.Sc., III SEMESTER**  
**HC – 3.1 MOLECULAR BIOLOGY AND BIOTECHNOLOGY**

**32 hrs**

Course Outcome:

After completing the course student will be able to

1. Know nucleic acids, DNA replication and its mechanism.
2. Understand transcription and its modifications.
3. Explain genetic code, enzymes, factor and the process of translation.
4. Analyse gene regulation, lytic and lysogenic cycles in prokaryotes.
5. Understand gene regulation in eukaryotes.
6. Explain molecular mechanism of DNA damage repair.

**Part A: Molecular Biology**

**Unit I** Introduction to nucleic acids

**8hrs**

- A. DNA Replication: i) Enzyme components of replication unit ii) Mechanism with emphasis on Dna A in initiation, Co-ordinated synthesis, End replication in eukaryotes iii) Fidelity.
- B. Transcription: i) Transcription apparatus and process (RNA polymerase, cisregulatory elements, terminators, transcription factors). ii) Post transcriptional modifications of mRNA in eukaryotes (G-cap, Poly tail, Splicing).
- C. Translation: i) Genetic code (major features, usage of different codons). ii) Enzymes, factors and the process (Aminoacyl t-RNA synthetase, Peptidyl transferase, IFs, EFs, RFs and Ribosome)

**Unit II Gene regulation**

**8hrs**

- A. Gene regulation in Prokaryotes: (i) Regulation at transcription initiation: Eg. lac operon (+ve and -ve control) (ii) Regulation beyond transcription initiation: trp attenuator (iii) Regulation in Lambda Phage - Lytic and lysogenic cycle induction.
- B. Gene regulation in Eukaryotes: (a) Transcriptional activators (b) Transcriptional repression: (i) direct repression, indirect repression (ii) Gene silencing by modification of histones and DNA (c) RNA interference
- C. Molecular basis of homologous recombination: Models and protein machinery
- D. Molecular mechanisms of DNA damage repair.

**Part B: Biotechnology**

**Unit III:**

**8 hrs**

**A. Genetic engineering:**

Definition, objectives and outline of recombinant DNA technology procedure.

Enzymes: Restriction Enzymes; DNA ligase, Klenow enzyme,

T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase.

**Cloning vectors:** Plasmids, Phages, Cosmids, Phagemids, Artificial chromosomes (YAC, BAC, HAC),

**B. Cloning:**

Construction of Genomic and cDNA libraries.

Identification of Recombinants: Genetic selection, Use of chromogenic substrates, Insertional inactivation.

Analysis of recombinant DNA clones: Characterization of clones, Restriction mapping, Southern hybridization.

Polymerase chain reaction and DNA sequencing-Maxam and Gilbert's method, Sanger's method, Automated DNA sequencing



**Unit IV:****8 hrs****C. Applications of Biotechnology:**

Production of medicinally important products – vaccines, Gene therapy, AIDS therapy, Biofertilizers, biopesticides, medicine and human health

**D. Animal Biotechnology**

Animal cell and Tissue culture: Principles of cell culture, cell and tissue types, cell lines, transformation.

Cell and tissue culture media: Natural and defined, role and components of serum in culture.

Applications of tissue culture: Tissue culture in biomedical research karyological studies, amniocentesis, mutagenesis, Cytotoxicity assays.

**PRACTICALS****4x16=64 Hrs**

1. Extraction of DNA by rapid method.
2. Extraction of DNA by standard method.
3. Estimation of DNA concentration by Diphenylamine method.
4. Localization of DNA in prefixed paramecium slides by Feulgen staining
5. Localization of nucleic acids in prefixed paramecium slides by Toluidine blue staining
6. Estimation of RNA concentration by Orcinol method
7. PCR amplification of DNA and gel electrophoresis.
8. Restriction digestion and gel electrophoresis.
9. Isolation of plasmid DNA from bacteria.
10. Molecular biology problems

**REFERENCES**

1. Griffiths A J F, H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart 2000. An introduction to genetic analysis. W. H. Greeman. New York.
2. Lewin, B 2003 Genes VIII. Oxford University Press. Oxford
3. Dale, Jeremy W and Schantz, Malcom V. 2002. From Gene to Genomes. John Wiley and Sons Ltd, NY, USA
4. Das, H.K. 2007. Text book of Biotechnology. Wiley India Pvt. Ltd. New Delhi
5. Freshney, Ian, R. 2006. Culture of Animal Cell (5th edn). Wiley- Liss publications
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7. Primrose, S.B., Twyman, R.M., and Old, R.W. 2001. Principle of Gene Manipulation (6th edn). Blackwell Science Ltd, London
8. Singh .B.D. 2006. Biotechnology. Kalyani Publishers, New Delhi
9. Sobti, R. C. and Pachauri, Suparna S. 2009. Essentials of Biotechnology. Ane Books Pvt. Ltd. New Delhi

**M.Sc., III SEMESTER  
HC – 3.2 REPRODUCTIVE BIOLOGY**

**32 hrs****Course Outcome:**

After completing the course student will be able to

1. Understand structure and function of reproductive organs
2. Explain the structure of reproductive cells
3. Describe the role of internal cues in reproduction
4. Describe the role of external factors in reproduction
5. Analyse the role of endocrine glands and their secretions in reproduction
6. Identify the factors affecting fertility
7. Know different types of assisted reproductive technologies.

**UNIT I: Male reproduction:** **8 hrs**

- A. Functional morphology of male reproductive system
- B. Kinetics of spermatogenesis – wave and cycle
- C. Hormonal control of mammalian testis and spermatogenesis
- D. Ultrastructure of spermatozoa
- E. Abnormalities of sperm
- F. Brief description of histomorphology and hormonal control of male accessory organs viz., epididymis, vas deferens, seminal vesicles, ventral prostate, bulbourethral gland and preputial gland
- G. Sperm maturation – morphological and biochemical events, influence of accessory organ secretions
- H. Biochemistry of semen and capacitation

**UNIT – II Female reproduction :** **8 hrs**

- A. Origin and migration of primordial germ cells; genetic and hormonal control of differentiation of gonads and gonadal ducts in mammals.
- B. Female Reproductive System-Functional morphology of mammalian ovary, Fallopian tube and uterus.
- C. Ovarian steroid hormones and their actions

**UNIT III: Reproductive cycles in Mammals:** **8 hrs**

- A. Comparison of estrous and menstrual cycles
- B. Menstrual cycle : Different phases, changes in the ovary and uterus and hormonal control
- C. Implantation – Process, Types and hormonal control
- D. Pregnancy – length of gestation, hormonal control
- E. Parturition – Process of birth and influence of hormones
- F. Lactation – Hormonal control of mammary gland, development and lactogenesis

**UNIT – IV: Fertility and reproductive management** **8 hrs**

- A. Fertility control – Need, principles of different male and female temporary and permanent contraceptive methods.
- B. Assisted Reproduction: Causes of infertility, Artificial insemination, different methods of assisted reproduction (*In-vitro* Fertilization, Gamete Intra Fallopian tube Transfer, Zygote Intra Fallopian tube Transfer).

**PRACTICALS** **16X4=64 hrs**

- 1. Demonstration of surgical technique by video clipping
- 2. Counting of spermatozoa in semen sample collected from volunteers
- 3. Staining of spermatozoa for abnormalities in semen samples collected from volunteers /clinical samples
- 4. Study of different contraceptive devices
- 5. Observation of permanent Histology slides
  - a. Comparative morphology of ovary
  - b. Comparative morphology of testis
  - c. Comparative study of male accessory organs
  - d. Comparative study of female accessory organs
- 6. Observation of permanent slides of T.S of endocrine glands
  - a. Pituitary gland b. Thyroid gland c. Adrenal gland d. Pancreas

**REFERENCES**

1. Adler N. T (1981) Neuroendocrinology of Reproduction, Physiology and Behaviour.
2. Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells and Fertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial control of reproduction, Cambridge University press, London.
3. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology, Oxford University press, London
4. Raghavendra Puri (2003) Mammalian endocrinology Vol. I & II, Dominant Publishers and Distributors, New Delhi.
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6. Moudgal, N. R. Yoshinaga K Rao, A. J. and P. R. Adiga (1991) Perspectives in primate reproductive biology. Wiley Eastern Ltd., New Delhi, Bangalore
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8. Jones, R. E (1991) Human Reproductive Biology press N.Y
9. Knobil, E and Neil J. D (1994) The physiology of reproduction, Vol. I & II. Raven press, New York.

**M.Sc., III SEMESTER  
HC – 3.3 ECOLOGY AND WILDLIFE**

**32 hrs**

**Course Outcome:**

After completing the course student will be able to

1. Demonstrate and Understand ecological relationships between organisms and their environment.
2. Present an overview of diversity of life forms in an ecosystem.
3. Explain and identify the role of the organism in energy transfers
4. Describe the Habitat ecology and Resource ecology
5. Understand the types of environmental Pollution and their management
6. Scope, Values and Conservation strategies of wildlife.

**Part-A Ecology**

**UNIT - I**

**8 hrs**

**A. Ecosystem:** Historical account, Scope, Basic concepts and Approaches to the study of Environmental Biology. Components of Environment - An overview of abiotic factors and Biotic factors. Concepts of habitat and Ecological niche. Ecotone and Edge effect. Food chains, Food-webs and their structure in Ecological Pyramids in aquatic, terrestrial and parasitic Environments.

**B. Population Ecology:** Introduction. An overview of important population attributes – Density, Natality, Growth rates, Growth forms and concept of carrying capacity, Patterns in human population growth and its explosion -Remedial measures. Mortality - life tables and survivorship curve, sex ratio, age distribution, dispersal and dispersion, aggregation and Allee's principle, population fluctuation and cyclic oscillations and Population interactions.

**UNIT - II**

**8 hrs**

**A. Community Ecology** Concept of community - community structure and attributes, concept of climax Species diversity in community and it's measurement- Alpha diversity- Simpson's diversity index, Shannon index, Fisher's alpha, rarefaction. Beta diversity- Sorensen's similarity index, Whittaker's index, Evenness, Gamma diversity. Drivers of species diversity loss and conservation.

**B. Bioecology of Freshwater Zooplankton:** Definition, Types and adaptations of Zooplankton. Brief study of organizations, life cycles and Ecological importance of Rotifers, Cladocerans, Copepods-Calanoids, Harpacticoids and Cyclopoids, and Ostracods. Mass culturing of Zooplankton.

**C. Microbial Ecology:** Ecological role, beneficial and pathogenic Microorganisms. Indicator Microorganisms. Role of microorganisms in biodegrading and bioremediation of organic and metal pollution.

### **Part B Wildlife Biology**

#### **UNIT – III**

**8hrs**

- A.** Scope and values of wildlife (Ecological, Aesthetic, Scientific, Recreational, Medicinal)
- B.** Causes of wildlife depletion: Degradation and destruction of natural habitats, Exploitation for commercial purposes, Deforestation, Agricultural expansion, Urbanization and Industrialization, forest fires and hunting.
- C.** Wildlife corridors, Human-wildlife conflicts
- D.** Wildlife awareness and education, Wildlife and tribal welfare

#### **UNIT – IV**

- A.** Conservation strategies: Red data book, protected area network, Role of NGOs in conservation.
- B.** Wildlife act and legislation: Wildlife Protection Act 1972; Biological Diversity Act 2002.
- C.** Wildlife conservation projects in India (with special reference to Project Tiger, Project Hungul and Gir Project)
- D.** In-situ conservation: Bioreserves, National parks, Wildlife sanctuaries and Safari's in India
- E.** Management of Bioreserves, National parks, Wildlife sanctuaries and Safari.
- F.** Ex-situ conservation: Zoo garden, Management of Zoos, Captive breeding, Artificial insemination, Cryopreservation (techniques and applications) Germplasm banks,

#### **PRACTICALS:**

**4X16=64 Hrs**

1. Qualitative and Quantitative study of freshwater planktons.
2. Determination of species diversity by Shannon-Weiner Index
3. Determination of species diversity by Simpson's index
4. Field visit to Sewage pond, Natural lake (and if possible river): Collection of water samples and study of physico-chemical parameters such as colour, pH, temperature, conductivity, total solids and turbidity
5. Estimation of Dissolved Oxygen in three natural (sewage, pond and Tap) water samples.
6. Estimation of free Carbon di-Oxide in three natural (sewage, pond and Tap) water samples.
7. To study the relationship between Dissolved Oxygen and free Carbon di-Oxide, if any, in three natural (sewage, pond and Tap) water samples.
8. Determination of BOD in three natural (sewage, pond and Tap) water samples
9. Determination of COD in three natural (sewage, pond and Tap) water samples
10. To study the relationship between BOD and COD, if any, in three natural (sewage, pond and Tap) water samples
11. Collection, observation of planktons (Phytoplankton and Zooplankton) from polluted and non-polluted water bodies.
12. Estimations of bacterial abundance in different water samples – using DDMT.
13. Visit to RMNH, Mysore, to study models of freshwater, marine, estuarine and terrestrial habitats.
14. Survey of Animal Population - to visit different habitats/areas in and around Mysore and collect data on some population attributes, application of Bio-statistical tests to the collected data and its interpretation.
15. Visit to nearby Zoological garden, wildlife sanctuaries, Animal rehabilitation centres.

## REFERENCES

1. Begon, Harper and Townsend, 1995. Ecology: Individuals, populations and community. II edition. Blackwell Series, U.S.A.
2. Bhatia, H.S. 1998: A Text book on Environmental Pollution and Control, Galgotia, New Delhi.
3. Clarke, G.L. 1963. Elements of Ecology, . Wiley Eastern Limited. New Delhi.
4. Emmel, T.C. 1976. Population Biology, Harper and Row publishers, N.Y.
5. Kormondy, E.J. 1978. Concepts of Ecology, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Odum E.P. 1971. Fundamentals of Ecology. III Edition. W.B.Saunders's Co., Philadelphia.
7. Odum, E.P. 1983. Basic Ecology, Holt Saunders, Japan.
8. Sharma, P.D. 1996: Ecology and Environment Rastogi, Publications, Meerut.
9. APHA, 1992: Standard methods for examination of water and waste water, 18th edition
10. Negi, S.S and Bahuguna, V.K. 1983. An Introduction to wildlife management. Bishen Singh Mahendra Pal Singh. Dehara Dun, India.
11. NBA. 2004. The Biological Diversity Act (2002) and Biological Diversity rules (2004). National Biodiversity Authority, India.
12. Saharia, V.B. 1982. Wildlife in India. Natraj Publishers. Dehara Dun.

### M.Sc., III SEMESTER SC 3.4 ETHOLOGY

48 Hrs

#### Course Outcome:

After completing the course student will be able to

1. Evaluate the learning and instinct behavior.
2. Explain the mechanisms in instinct and behaviour
3. Explain how animals learn
4. Compare learning and instinct behaviour.
5. Analyse any problem about animal behaviour
6. Explain the importance of evolution for animal behaviour.
7. Explain evolution and behaviour.
8. Explain natural selection and behaviour.
9. Explain the relationship between predators and prey
10. Explain social behaviour.

#### UNIT - I

8 Hrs

- A. Descriptive versus experimental approaches
- B. Reflexes and complex behaviour- Latency, after discharge, summation, warm up, fatigue inhibition and feedback control
- C. Instinctive Behaviour - Fixed action pattern, Types of sign stimuli and releasers as triggers, Genetic basis of instinctive behaviour.

#### UNIT- II

8 Hrs

- A. Development and behaviour- Causes of behavioral changes during development, development of bird song.
- B. Learning- Classical conditioning experiment, latent and insight learning. Social learning, learning sets and play.
- C. Importance of early experience – Critical period- Filial imprinting, Sexual imprinting in birds, Imprinting like process in mammals.

#### UNIT- III Foraging and anti-predator behaviour

8 Hrs

- i. Anti predator behaviour – avoiding detection through colour and Markings (Mullarian mimicry)

- ii. Warning coloration
- iii. Batesian mimicry

**UNIT-IV Biological communication**

**8 Hrs**

- i. Forms of signals,
- ii. Visual communication with suitable examples,
- iii. Auditory Communication
- iv. Tactile and Chemical communication

**UNIT -V Sexual Behaviour**

**8 Hrs**

- i. Hormones and sexual behaviour – Selected examples of courtship and mating behaviour.
- ii. Pheromones in Insects and Mammals
- iii. Lee Boot, Whitten, Bruce, Collidge and Castro-Vandenberg effect/s
- iv. Selected examples of courtship and mating behaviour

**UNIT-VI Social Behaviour**

**8 Hrs**

- i. Introduction
- ii. Advantages of grouping
- iii. Social organization in insects with special reference to ants and honeybees
- iv. Social organization in sub human primates
- v. Altruism, Kin selection and Genetic control of behaviour

**TUTORIALS – On the basis of the proposed chapters.**

**2x16 = 32 Hrs.**

**REFERENCES**

- 1) Goodenough J.E., Mc Guire B. and Wallace R. A. (1993) Perspectives on Animal Behaviour. John Wiley and sons, New York.
- 2) Tinbergen (2006) Social behaviour in Animals. J.V. Publishing House Jodhpur India.
- 3) Vandenberg. J.E.(Ed) (1983). Pheromones and Reproduction in mammals. Academic Press. NewYork.
- 4) Agrawal, K.C. 2000. Biodiversity. Agrobios. India.

**M.Sc., III SEMESTER  
SC – 3.5 POLLUTION AND TOXICOLOGY**

**48hrs**

**Course Outcome:**

After completing the course student will be able to

1. broader understanding of how science and the scientific method work to address environmental problems.
2. Earth's major systems (ecosystems and biogeochemical cycles), how they function and how they are affected by human activity (population growth, air, water and soil pollution, ozone depletion, global warming, and solid waste disposal).
3. the interaction of human society (urban sprawl, energy use/generation, resource consumption and economics) with the Earth's systems.

**Part A - Pollution**

**24 hrs**

**Unit I:**

**8 hrs**

**A. Concept of Biosphere:** Its components, hydrosphere, atmosphere, and lithosphere, Origin of life in the biosphere.

**B. Water pollution:** Definition, sources Types and classification of pollutants. Effects of Water Pollution, River Pollution, Oxygen sag curves and Eutrophication Drinking water: Collection, purification and distribution. Wastewater treatment: Primary, secondary and tertiary treatment.

**Unit II:****8 hrs**

**A. Atmospheric pollution:** Primary and secondary air pollutants. Biological effects of Nox, SO<sub>x</sub>, SPM, Hydrocarbons, Acid rain, Global warming, Photochemical smog and Ozone hole.

**B. Solid waste and Biomedical waste:** Sources, collection, transport, treatment and Disposal methods.. Noise Pollution: Sources, Biological effects, Control measures and OSHA standards.

**Unit III:****8hrs**

**A. Radiation & Thermal pollution:** Sources, types, effects, Atmospheric fallout and abatement.

**B. Environmental Impact Assessment:** Basic elements, Methods Guideline for industrial EIA, Aquaculture related EIA, Transport related EIA and Water related EIA. Case studies: Konkan Railway, Silent valley, Bhopal Tragedy and Love canal tragedy, Mangalore Bojpe tragedy

**Part B – Toxicology****24 hrs****Unit IV:****8hrs**

**A. General Principles of Toxicology:** Introduction, Definition of toxicology Importance of Dose and Dose-response, factors influencing toxicity, Bioassay-toxicity evaluation studies using fish as model.

**B. Toxic compounds:** Heavy metals-Lead and mercury, Hydrocarbons- Aromatic and Aliphatic, and cyanides, and toxic gases - Bhopal tragedy.

**Unit V:****8hrs**

**A. Biotransformation:** Bioactivation, Biotransformation of organo phosphates and organo chlorines in the bodies of animals.

**B. Natural toxins, Venoms and poisons:** Properties and their effects, Major Sites and mechanism of action, Toxins in lower and higher organisms, Toxin and Venom therapy.

**Unit VI:****8hrs**

**A. Smoking aids:** Active and Passive smoking, Consumption of tobacco, Marijuana(Ganja), their effects and Prevention measures.

**B. Cosmetics:** Types of cosmetics, Chemical Characteristics, Applications, Exposure and risk assessment, Cosmetic safety regulations.

**C. Risk assessment:** Exposure assessment, Dose-Dosage, Risk characterization, Risk analysis and communications, Occupational health and illness.

**TUTORIALS – On the basis of the proposed chapters****2x16 = 32 Hrs****REFERENCES:**

1. Nandini, .N. Sunitha N. and T. Sucharita 2010. Environmental Studies, Sapna Book House Bangalore
2. Frant C.L.V. 1991, Basic Toxicology II (Eds.), Hemisphere publishing corporation, Washington, London
3. Sambasiva Rao K.R.S. 1999. Pesticide impact on fish metabolism. (Eds.) Discovery Publishing House, New Delhi.
4. Bio-pesticides in Insect Pest Management 1999. S. Ignacimuthu and Alok Sen, Phoenix Publishing House Pvt., Ltd., New Delhi.
5. APHA, AWWA and WEF. 1992: Standard Methods for Examination of Water and Wastewater, XVIII Ed, American Public Health Association. NY, USA
6. Nebel, B.T. and Wrigly R.T. 1998. Environmental Science, VI Ed. Prentice Hall New Jersey, USA

7. Hosetti, B.B. 2001. A Text Book of Applied Aquatic Biology, Daya Publishing House, Delhi.
8. Hassall, K.A. 1990. The Biochemistry and uses Pesticides structure, metabolism and Mode of action and uses in crop protection, John Wiley & Sons. Inc.
9. Pandey, K. and J.P. Shukla, 1990. Elements of Toxicology. Radha publ. New Delhi.

**M.Sc., III Semester:  
OPEN ELECTIVE-(For Science discipline students).  
CONCEPTS OF ZOOLOGY.**

**48 Hrs**

Course Outcome:

After completing the course student will be able to

1. Broader understanding of Zoology and its concepts
2. Understand the concepts and basics of animals taxonomy
3. Understand the basics of histology
4. Describe the structure and basic functions of organ systems
5. Explain ecological concepts and effects of environmental pollution
6. Explain the mechanism of inheritance.

**1. Introduction:**

**8 Hrs**

a) Branches of animal science: Taxonomy, Animal Physiology, Genetics, Developmental Biology, Evolution, Ethology, Ecology, Applied Zoology, Entomology, Histology, c) Indian Wildlife- Status, Causes of wildlife depletion, Wildlife corridors, Conservation strategies- *In situ* and *Ex situ* d) e) Animals and human welfare.

**2. Animal Taxonomy:**

**4 Hrs**

a) Carl Linnaeus – Taxonomic hierarchy: Kingdom, Division, Phylum, Class, Order, Family and Binomial nomenclature

**3. Animal cells and Tissues :**

**8 Hrs**

a) Brief description of animal cell (light and ultra structure) b) Functions of cell organelles c) Structure and functional diversity in animal cell d) Cell division: Types and significance e) Structure and functions of basic tissues.

**5. Structure and functions of organ systems:**

**16 Hrs**

a) Human alimentary canal and outlines of digestion and absorption  
 b) Respiration: Human respiration – exchange of gases.  
 c) Circulation : Structure of human heart, Blood vessels and capillaries, composition of blood, blood coagulation.  
 d) Excretion : Mammalian kidney and urine formation.  
 e) Locomotion in vertebrates – Swimming, walking running, flying  
 f) Nervous system and their functions, A brief account of human endocrine system  
 g) Reproduction : Asexual and sexual reproduction, significance of sexual reproduction, outlines of human reproduction and fertility control

**6. Ecology and Environmental Biology:**

**8 Hrs**

a) Abiotic and Biotic factors b) Environmental Pollution – brief account of Air, Water and Noise pollution.

**7. Heredity:**

**4 Hrs**

a) Continuity of life – Mendel's laws b) Structure of chromosomes c) DNA and RNA

**TUTORIALS**

**2x16=32 Hrs**

**REFERENCES :**

1. Barnes, R. D. 1974. Invertebrate Zoology, III edition, W. B. Saunders Co., Philadelphia.
2. Barrington, E. J. W. 1976. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London



4. Hyman L. H. 1940. The invertebrates Vol.1 Protozoa through Ctenophora, McGraw hill co., N. Y.
5. co., N. Y.
6. Hyman. L. H. 1968. The Invertebrates Vol.8 McGraw Hill Co., N. Y and London.
7. Parker, T. J. Haswell, W. A. 1961. Text book of Zoology, Vol.I, Macmillon Co., London.
8. Russel – Hunter, W.D 1969. A. biology of higher invertebrates, Mac millon Co., Ltd.,
9. London.
10. Barrington, E. J. W. 1965. The Biology of Hemichordata and Protochordata – Oliver and Boyd, Edinbrough.
11. Clark, W. E 1963. History of the Primates IV Edn., Univ. of Chicago Press, Chicago.
12. Malcom Jollie, 1962. Chordata morphology – East-West Press Pvt. Ltd., New Delhi.
13. Romer, A. S. 1966. Vertebrate Paleontolgy, 3rd Ed., Univ. of Chicago Press, Chicago.
14. Romer A. S., 1960. Vertebrate body, 3rd Ed., W. B. Saunders Co., Philadelphia.
15. Young. J. Z., 1950. Life of vertebrates The Oxford University Press, London
16. Young J Z 1957 Life of mammals, Oxford University Press, London.

### **M.Sc., IV SEMESTER**

#### **HC – 4.1 ADVANCED GENETICS AND COMPUTATIONAL BIOLOGY**

**32 hrs**

##### **Course Outcome:**

After completing the course student will be able to

1. Understand the genomic organization of prokaryotes and eukaryotes.
2. Know the applications of various model organisms in genomic research.
3. Able to analyse the pedigree, psychosomatic disorders, prenatal diagnosis and genetic counselling.
4. Recognise few heritable diseases in man.
5. Understand the basic concepts of genomics
6. Understand the basic concepts of proteomics
7. Understand the nucleic acid and proteinr databases and tools.

#### **Part A-Advanced Genetics**

##### **Unit I: Genome organization:**

**3 hrs**

Prokaryotes, Eukaryotic nuclear genomes - C-value paradox, Eukaryotic organelle genomes Split Genes Mobile genetic elements in Prokaryotes (bacteria) and Eukaryotes (*Drosophila*, maize and humans), Genome Projects of model organisms (*C. elegans*, *Drosophila* and Mouse).

##### **Unit II: Cancer Genetics:**

**5 hrs**

Cancer incidence and mortality, types of cancer, causes of cancer, properties of cancer cells, Genetic basis of Carcinogenesis- Oncogenes: proto-oncogenes, oncogenes, retroviral oncogenes in human cancer. Tumor suppressor genes: Functions of tumor suppressor gene products. Cancer as a multistep process. Animal models of cancer research: Transgenic mouse and *Drosophila* models.

##### **Unit III: Human genetics:**

**5 hrs**

History of human genetics, pattern of inheritance, pedigree analysis. Human genome: Organization, distribution of genes, gene families. Genetic basis of syndromes and disorders: Cystic fibrosis, Neurofibromatosis, Schizophrenia, Anxiety disorder, Congenital heart diseases, Dyslexia.

##### **Unit IV: Quantitative genetics:**

**3hrs**

Introduction, types of quantitative trait, Nature of quantitative traits and their inheritance- Polygenic inheritance (Multifactorial hypothesis) – analysis of continuous variation; Variations associated with polygenic traits.

## Part B-Computational Biology

### **Unit VII: Introduction and Scope of the Computational Biology** **4 hrs**

Genomics: Definition and types of genomics Structural genomics: whole genome shotgun sequencing, gene annotation, gene families and clusters. Orthologs and paralogs. Functional genomics: Transcriptome, Microarray technology.

### **Unit VIII: Proteomics:** **4 hrs**

Definition, Protein structure determination, protein domains, protein folding, Computer aided protein structure analysis, Protein-protein interactions, Protein microarrays.

### **Unit IX: Nucleic acid sequence and Protein analysis:** **4 hrs**

Alignment, similarity searches including remote similarity searches, secondary structure element, motifs, Single nucleotide polymorphism (SNP), Two dimensional polyacrylamide gel electrophoresis, Mass Spectrometry.

### **Unit X: Genomics and proteomics databases and tools:** **4 hrs**

Nucleic acid sequence databases and tools: Genbank, UCSC, ENSEMBL, EMBL, DDBJ, BLAST vs FASTA, file formats-FASTA, GCG, Genscan and ClustalW. Protein sequence databases and tools: Uni-prot, PDB, PIR, BLAST, PSI- BLAST (steps involved in use and interpretation of results).

### **PRACTICALS:**

1. Study of mitotic chromosomes of *Drosophila* species- *Drosophila melanogaster*, *Drosophila nasuta*.
2. Preparation of metaphase chromosomes from bone marrow cells of mouse.
3. Karyotypic studies of normal human chromosomes and syndromes.
4. Creation of pedigrees and study of patterns of inheritance.
5. Studies on phenotypes of different diseases and syndromes.
6. Study of Quantitative characters: Sternopleurals, Acrosticals – mean, standard deviation.
7. Data mining for sequence analysis.
8. Web– based tools for sequence searches and homology screening-BLAST, FASTA
9. Nucleic acid sequence databases: GenBank retrieval, GeneScan.
10. Proteomics data bases: Uni-Prot, PROSITE, PDB, PIR, ProtParam.
11. Annotations: ORF finder, Use of ARTEMIS or any other suitable software

### **REFERENCES:**

1. The Human Genome 2001, Nature Vol. 409.
2. The Drosophila Genome. 2000, Science Vol. 267.
3. The Caenorhabditis elegans genome 1998. Science Vol. 282.
4. Introduction to Genetic Analysis. Griffiths, Anthony J.F.; Miller, Jeffrey H.; Suzuki, David T.; Lewontin, Richard C.; Gelbart, William M. New York: W.H. Freeman & Co.; 1999
5. Fundamental Neuroscience. Larry R. Squire, Darwin Berg, Floyd Bloom, and Sascha du Lac. Third Edition, Academic Press; 3 edition (2008)
6. Principles of Neural Science. Eric R. Kandel, James H. Schwartz, and Thomas M. Jessell. McGraw-Hill Medical; 4 edition(2000)
7. Neurogenetics: Scientific and Clinical Advances (Neurological Disease and Therapy) David R. Lynch, Informa HealthCare; 1 edition (2005)
8. The Molecular and Genetic Basis of Neurologic and Psychiatric Disease. Roger N Rosenberg, Salvatore DiMauro, Henry L Paulson, and Louis Pt (2007) Lippincott Williams & Wilkins; Fourth edition

9. Bioinformatics for Dummies, Claverie J. M., Notredame C., (2nd Ed., 2007), Wiley Publishing, Inc., New York, USA
10. Brown T. A. 2007, Genomes 3. Garland Science Publishing, New York.
11. A.Malcolm Campbell and Laurie J.Heyer. Discovering Genomimcs, Proteomics and Bioinformatics. 2004. Low Price edition. Pearson Education, Inc.

**M.Sc., IV SEMESTER  
HC – 4.2 APPLIED ZOOLOGY**

**32 hrs**

**Course Outcome:**

After completing the course student will be able to

1. Explain plant insect interaction, origin of pest and its control.
2. Understand vectors and its communicable diseases.
3. Explain races of silkworm their disease and its control.
4. Know about the importance of insects in forensic science and medicine.
5. Know about aquaculture and its practices in India.

**UNIT I: Aquaculture**

**8hrs**

Aquaculture in India: an overview – nutritional value and food security - Site selection and preparation of culture ponds - Fish culture: carps, marine fishes and ornamental fishes. Prawn culture: Freshwater prawns and marine shrimps. Fattening of crabs. Crayfish and Lobster - Molluscs: mussels, clams, chanks and oysters including pearl oyster. Live feeds: micro algae, micro-invertebrates (*Artemia* nauplii, Rotifers, Cladocerans, Copepods, Ostracodes) and worms as live baits – Water quality management and maintenance of sanitation - Plant and animal nutrients - Balanced diet (iso-nitrous and iso-caloric) - Artificial feed formulation – Low cost feed formulation - Aquatic weeds.

**UNIT II: Sericulture**

**8hrs**

Salient features of Saturnidae and Bombycidae. Mulberry and non mulberry silkworms, classification based on voltinism, moulting and geographic origin. Morphology and life cycle of *Bombyx mori*. Structure and functions of Silk glands. Silkworm rearing technology: Building, equipments, disinfection, environmental factors, Seed cocoons, preservation, grainage activity, LSPs, egg production, incubation, artificial hatching. **Pests and diseases:** Protozoan, Fungal, Viral and Bacterial diseases and their control measures. Silkworm pests and Predators

**UNIT III: Apiculture**

**8hrs**

Scope and its importance, Classification and morphology of honey bees, species and races of honey bees, tribal life and bee hunting. sex seperation, comb building, orientation of comb, communication, collection of propolis and water. Honey and its chemical composition, medicinal importance. Economic importance of honey, wax, bee pollination, pollen and Venom.

**UNIT IV: Vermiculture**

**8hrs**

A. Introduction to vermiculture. Definition, meaning, history, economic importance, their value in maintenance of soil structure. Useful species : Local species and Exotic species of earthworms. Role of four R's.  
 B. Taxonomy Anatomy, Physiology and Reproduction of Lumbricidae and Eudrilidae.  
 C. Earthworm Farming (Vermiculture) for home gardens, larger scale, Extraction (harvest), vermicomposting harvest and processing.  
 D. Nutritional Composition of Vermicompost for plants, comparison with other fertilizers  
 E. Enemies of Earthworms, Sickness

**PRACTICALS:****16X4=64 hrs**

1. Study of morphometric characters of Indian major carps.
2. Diversity of fishes.
3. Collection of phytoplankton and zooplankton from natural resources and their identification.
4. Study of morphology of honey bee and cast system.
5. Mounting of mouth parts, stinging apparatus of honey bee.
6. Study of digestive system of honeybee.
7. Study of structure and types of honey comb.
8. Study of bee plants.
9. Study of morphology of lifecycle of *Bombyx mori*
10. Study of digestive and silk gland of *Bombyx mori*
11. Study of Non mulberry silkworms and their food plants.
12. Field trip- Collection of native earthworms & their identification
13. Study of systematic position& External characters of locally available earthworm species.
14. Mounting of setae and identification of earthworm species.
15. Study of equipments used in Vermiculture.

**REFERENCES**

1. Ashok Kumar (2009) Textbook of Animal Diseases
2. Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.
3. G.S. Shukla, V.B. Upadhyay (2006) Economic Zoology.
4. Kevin, A and K.E.Lee (1989) " Earthworm for Gardeners and Fisherman" (CSIRO, Australia, Division of Soils)
5. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.
6. Pradip. V Jabde, (2005) Text Book of Applied Zoology.
7. R. L. Kotpal (2000) Modern Textbook of Zoology. Rastogi Publications
8. Satchel, J.E. (1983) "Earthworm Ecology" Chapman Hall, London.
9. Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.

**M.Sc., IV SEMESTER  
HC – 4.3 Project****Course Outcome:**

After completing the course student will be able to

1. understand the concepts of Project Management for planning to execution of projects
2. find importance of reference work Using tools of information such as periodical , journals, online resources
3. break work down the tasks of project and determine handover procedures
4. Interpret, analyse and presentation of the results obtained and compare with similar works and draw conclusion.

**M.Sc., Examination**  
**(Scheme CBCS)**  
**M.Sc., ZOOLOGY**  
**HARD CORE- Model question paper**

**Time: 3 hrs**

**Max Marks: 70**

**Instructions:** *1. Answer all questions*

*2. Illustrate your answer wherever necessary*

**I. Write short notes on the following:**

**[8×2=16]**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Write elaborate notes on any FIVE of the following:**

**[5×6=30]**

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.

**Q3. Answer the following:**

**[2×12=24]**

17. (i)  
Or  
(ii)
18. (i)  
Or  
(ii)

**M.Sc Examination  
(Scheme CBCS)  
M.Sc., ZOOLOGY  
Softcore - Model question paper**

**Time: 3 hrs**

**Max Marks: 70**

**Instructions:** *1. Answer all questions*

*2. Illustrate your answer wherever necessary*

**I. Write short notes on the following:**

**[8×2=16]**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Write elaborate notes on any FIVE of the following:**

**[5×6=30]**

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.

**Q3. Answer the following:**

**[2×12=24]**

17. (i)  
Or  
(ii)
18. (i)  
Or  
(ii)

**M.Sc Examination  
(Scheme CBCS)  
M.Sc., ZOOLOGY  
Open Elective-Model question paper**

**Time: 3 hrs**

**Max Marks: 70**

**Instructions:** *1. Answer all questions*

*2. Illustrate your answer wherever necessary*

**I. Write short notes on the following:**

**[8×2=16]**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Write elaborate notes on any FIVE of the following:**

**[5×6=30]**

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.

**Q3. Answer the following:**

**[2×12=24]**

17. (i)  
Or  
(ii)
18. (i)  
Or  
(ii)

<b>M.Voc (Food Processing and Engineering) Syllabus</b>		
<b>1<sup>st</sup> -M.Voc</b>		
<b>NSQF Level: 8 – Semester I &amp; II</b>		
<b>Sub Sector: Fruits &amp; Vegetables</b>		
<b>Job Role: Head of Production</b>		
<b>UNIT I</b>		
<b>Post Harvest Management of Fruits</b>		
<b>S.No</b>	<b>THEORY</b>	<b>Hrs</b>
1.	General Introduction of fruits-citrus, tropical and subtropical, pome, stone, soft, and berry fruits, melons and watermelons	1
2.	Importance and scope of post harvest management of fruits, Morphology, structure and composition of fruits	2
3.	Maturity Indices and standards for standards for selected fruits, methods of maturity determination	2
4.	Post-harvest physiological and biochemical changes in fruits; ripening of climacteric and non-climacteric fruits	2
5.	Harvesting and handling of important fruits. Harvesting tools; field heat removal/precooling of fruits. Sorting and grading at farm and cluster level; factors affecting post harvest losses	2
6.	Nature of post harvest deterioration; physiological change- physical damage; chemical injury-pathological decay; identification of diseases and disorders in fruit-nutritional disorders, respiratory disorders, temperature disorders and miscellaneous disorders. Classification of diseases and diseases organisms, types of diseases and agents of diseases in fruits.	4
7.	Pre-cooling of fruits and cold storage, zero energy cool chamber	3
8.	Shelf life enhancement- permitted chemicals for ripening, wax coating	3
9.	Storage practices: Refrigerated storage, modified atmospheric storage-novel MAP gases and their role, novel MAP applications, Applying high oxygen MAP; MAP of minimally processed fruits; controlled atmosphere storage/ultra low oxygen storage of fruits, recent advances in CAP and MAP	9
<b>TOTAL</b>		<b>28</b>
<b>S.No</b>	<b>PRACTICALS</b>	<b>Hrs</b>
1.	Familiarization of various fruits available in India and categorization of fruits used for pulping	3
2.	Studies on morphological features of some of the fruits	3
3.	Studies on maturity indices; Studies on harvesting of fruits	3
4.	Studies on permitted chemicals for ripening and enhancing the shelf life of fruits	3
5.	Studies on regulations of ripening of banana and mango	3
6.	Studies on physiological disorders like chilling injury of certain fruits	3
7.	Studies on pre cooling and storage of fruits and vegetables	3
8.	Demonstration on wax coating on apples, citrus and Mango	3
9.	Studies on various storage systems and structures;	3
10.	Studies on pre packaging of whole and cut vegetables	3
11.	MAP of minimally processed fruits & vegetables	3



12.	Visit to commercial packaging houses for mango, banana, pomegranate, grapes	3
13.	Visit to Controlled Atmospheric packaging centres	4
14.	Visit to commercial storage structures for onion and potato	4
15.	Visit to multi chamber cold storages for fruits and vegetables	4
16.	Visit to Fruit Orchards -Observations on Pruning, orchard Hygiene, Irrigation, Manuring, Insect Pests, Pathological Spoilages, Pre-harvest spray schedules to control pathological spoilages and insect infestation	4
17.	Visit to Fruit Orchards - Studies on Causes for pre and post harvest losses. Spoilage factors, post harvest field operations including methods to reduce the post harvest losses	4
<b>TOTAL</b>		<b>56</b>
<b>UNIT II</b>		
<b>Technology for processing of Fruit Pulp</b>		
<b>S.No</b>	<b>THEORY</b>	<b>Hrs</b>
1.	Process of receiving, ripening, checking raw material quality, sorting, washing, cutting/slicing, deseeding/destining, pulping, precooking/pasteurization, sterilizing, aseptic packaging or canning, retort pouching, sampling for quality analysis and storing	2
2.	Machineries and tools used for the fruit pulping process such as fruit washer, peeler, slicer, fruit pulper, steam jacketed kettles, packaging machines etc	2
3.	Quality assessment of packaging materials	2
4.	Enzymes in quality and processing of tropical and sub tropical fruits	3
5.	Non thermal processing methods-ultra violet light, high pressure processing, ultrasound, ozone application, irradiation, pulsed electric field	7
6.	Introduction, canning machineries, various steps involved in canning of fruit pulp, syrup preparation, pretreatment for canning operation	7
7.	Canning of various fruits, process flow diagram for canning, filling, exhausting, sealing and processing operations	5
<b>TOTAL</b>		<b>28</b>
<b>S.No</b>	<b>PRACTICALS</b>	<b>Hrs</b>
1.	Canning of mango pulp	5
2.	Canning of tomato pulp	5
3.	Preservation of tomato pulp by chemical preservation method	5
4.	Preservation of banana pulp by freezing method	5
5.	Canning of mango slices in syrup	5
6.	Canning of pineapple slices in syrup	5
7.	Canning of banana slices in syrup	5
8.	Visit to fruit processing units and collection of data on wastes and by products	5
9.	Visit to Aseptic packing units for fruit pulps & concentrates	8
10.	Visit to the pilot plants of CFTRI & DFRL Mysore	8
<b>TOTAL</b>		<b>56</b>
<b>UNIT III</b>		
<b>Food Quality and Food Microbiology</b>		
<b>S.No</b>	<b>THEORY</b>	<b>Hrs</b>
1.	Introduction – definition, historical development and significance of food microbiology; Microscope; Classification & morphology of microbes; Techniques of	3

	pure culture; Bacteriology of air & water; Anti-microbial agents – physical & chemical – mechanism & action	
2.	Sources of Contamination: Air, Water, Soil, Sewage, Post processing Contamination. Intrinsic & extrinsic factors influencing the growth of Microorganisms in foods	3
3.	Disinfection & disinfectants; Energy metabolism of aerobic & anaerobic microbes; Thermal inactivation of microbes; Concept, determination & importance of TDT, F, Z & D values; Factors affecting heat resistance; Pasteurization and sterilization	4
4.	Microbiology of Fruits and vegetables and their products like jam, jelly, sauce, juice/pulp	3
5.	Food Quality aspects of Fruits & vegetables; Introduction, Quality principles, Quality enhancement model. Application of quality enhancement model	3
6.	Food Waste Treatment : Liquid waste, Solid waste vessel containers & wrapping waste, Hazardous waste .Quality and Safety of Frozen Foods: Fruits, Vegetable	3
7.	Measuring and Controlling Devices: Role of transducers measurements in food processing; Humidity, Turbidity and Color, Food & Process temperature controller and indicators. Statistical Quality Control for food Industry : Food Quality System, Fundamentals, Process control implementing quality control program, six sigma, RSM	4
8.	Food additives – preservatives, antioxidants, sequestrates, surface active agents, stabilizers and thickeners, bleaching and maturing agents, starch modifies, buffers, acids, alkalis, food colors, artificial sweeteners, nutritional additives, flavoring agents.	5
	<b>TOTAL</b>	<b>28</b>
	<b>PRACTICALS</b>	<b>3</b>
1.	Determination of firmness of fruits	3
2.	Determination of moisture content	3
3.	Titrate acidity estimation	3
4.	Estimation of SO <sub>2</sub> in food sample	3
5.	Estimation of sodium benzoate in food sample	3
6.	Estimation of polyphenol and polyphenol oxidase	3
7.	Estimation of Reducing sugar, Non-reducing and total sugars	3
8.	Determination of organic acid content	3
9.	Ascorbic acid estimation	3
10.	Determination of pH in food products	3
11.	Determination of total Ash	3
12.	Determination of total soluble solids	3
13.	Estimation of ash content	3
14.	Estimation of crude fibre	3
15.	Estimation of pectin	3
16.	Flow process chart of food plant Waste utilization processes, various treatment for waste disposal analysis of cleaners & sanitizers, CIP Cleaning	11
	<b>TOTAL</b>	<b>56</b>
<b>UNIT IV</b>		
<b>Food Safety, Hygiene and Sanitation for Processing of Fruit Pulp</b>		
<b>S.No</b>	<b>THEORY</b>	<b>Hrs</b>
1.	Food safety, hygiene and sanitation for processing of fruit pulp: food safety standards and regulations for fruit pulp, definition of hygiene, hygiene practices	14

	and its importance at every stage of fruit pulp processing at industrial level; personal hygiene requirements; physical, chemical and biological hazards and methods for prevention of various hazards; CIP and COP methods and procedures, GHP, GMP and HACCP; waste management-pre and post production.	
2.	Microbiological aspect of Food; types of food microbes, causes of food spoilage, types of food spoilage/deterioration, criteria to check the food spoilage, need for food preservation, different types of food preservation methods, method of assessing the quality of products based on physical parameters	14
	<b>TOTAL</b>	<b>28</b>
<b>S.No</b>	<b>PRACTICALS</b>	<b>Hrs</b>
1.	Clean and maintenance of work area using appropriate sanitizers, ensure the work area safe and hygienic for fruit processing, disposal of waste material as per SOPs and industrial requirement	8
2.	Check the working and performance of machineries and tools for fruit pulp process, clean the machineries and tools used with recommended sanitizer, to place the necessary tools required for the process, to attend minor repair, faults of all machineries if required.	8
3.	Disassembling and assembling of machineries used in fruit pulp industry (Fruit mill, crusher etc)	8
4.	Demonstration of CIP and COP methods of cleaning the machines with approved sanitizers	8
5.	Visit to industry to learn about GHP, GMP, HACCP	12
6.	Visit to industry to learn about waste management pre and post production	12
	<b>TOTAL</b>	<b>56</b>
<b>S.No</b>	<b>UNIT V</b>	<b>Hrs</b>
<b>Plant Design, Plant Economics and Plant Management</b>		
1.	Food Industry management- location of plant land and building requirements, plant capacity, plant and machinery requirement, building and plant layout, utilities, byproducts, waste, energy and safety audit, manpower requirements	5
2.	Introduction to economics: Meaning, scope, and contribution to business decisions. Analysis of Demand: Law of demand, Utility function, Rate of commodity substitution, Maximization of utility, Demand functions, Indifference curve analysis, Substitution and income effects. Market demand and demand elasticities: concept of market demand, price and income elasticities of demand, importance of elasticity. Demand forecasting: causes and techniques of demand forecasting	6
3.	Analysis of supply and market equilibrium: Law of supply, price elasticity of supply, equilibrium of demand and supply. Theory of the Firm: Production function, returns to scale, Optimizing behavior, Input demands, Cost functions, Profit maximization, economics & diseconomies of scale, break even analysis. Market structures perfect competition: Profit maximization and equilibrium of firm and industry, Short run and long run supply curves; Price and output determination, practical applications	6
4.	Plant maintenance program; Role of maintenance staff and plant operators, Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'. Hygiene and sanitation requirement in food processing and fermentation industries; CIP	6

	methods, sanitizing & disinfestation, pest control in food processing; storage and service areas	
5.	Supply chain management for fruits	5
	<b>TOTAL</b>	<b>28</b>
<b>PRACTICALS</b>		
1.	Visit to industry to learn the management system	16
2.	Visit to Fruit & Vegetable Processing Industries. Preparation of a Business Plan for setting up fruit & vegetable processing unit	40
	<b>TOTAL</b>	<b>56</b>
VI	<b>Hands on Training in Fruit Pulp Processing Industry and submission of report</b>	120
	<b>TOTAL</b>	<b>540</b>

# Model Curriculum

## Plant Manager

**SECTOR: FOOD PROCESSING**

**SUB-SECTOR: FRUIT & VEGETABLE, FOOD GRAIN MILLING (INCLUDING OILSEEDS), DAIRY PRODUCTS, MEAT & POULTRY, FISH & SEAFOOD, BREAD & BAKERY, ALCOHOLIC BEVERAGES, AERATED WATER/ SOFT DRINKS, SOYA FOOD, PACKAGED FOOD**

**OCCUPATION: PROCESSING**  
**REF ID: FIC/Q9004, V1.0**  
**NSQF LEVEL: 9**



**FICSI**

**Certificate**

**CLERK'S LOG COMPLIANCE TO  
QUALIFICATION PACK - NATIONAL OCCUPATIONAL  
STANDARDS**

Awarded to/ku  
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# Plant Manager

## CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Plant Manager”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

<b>Program Name</b>	<b>Plant Manager</b>		
<b>Qualification Pack Name &amp; Reference ID. ID</b>	FIC/Q9004, v1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	30/03/2016
<b>Pre-requisites to Training</b>	Preferably Class 12 and 6-7 years' experience in a food processing unit		
<b>Training Outcomes</b>	<b>After completing this programme, participants will be able to:</b> Daily management of food processing unit Coordination of food processing unit operations including production planning, managing human resources, supply chain, production operation, maintenance, quality assurance, storage and distribution of finished products.		





This course encompasses 3 out of 3 National Occupational Standards (NOS) of “Plant Manager” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<b>Introduction to the training program</b>  <b>Theory Duration</b> (hh:mm) 00:30  <b>Practical Duration</b> (hh:mm) 00:00  <b>Corresponding NOS Code</b> Bridge Module	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
2	<b>Overview of the “Plant Manager” Role</b>  <b>Theory Duration</b> (hh:mm) 01:00  <b>Practical Duration</b> (hh:mm) 00:00  <b>Corresponding NOS Code</b>	Understanding the roles and responsibilities of plant manager Awareness of the nature and availability of job opportunities	Laptop/computer white board, marker, projector, chart papers
3	<b>Introduction to the Food Processing Industry</b>  <b>Theory Duration</b> (hh:mm) 01:30  <b>Practical Duration</b> (hh:mm) 00:00  <b>Corresponding NOS Code</b>	Define food processing List the various sub sectors of food processing industry	Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual
4	<b>Introduction to food processing process</b>  <b>Theory Duration</b> (hh:mm) 02:00  <b>Practical Duration</b> (hh:mm)	List the common machineries used in food processing Explain the process of testing food for accepted quality standards Demonstrate the test for checking the quality of food Describe the procedure for processing various food	Laptop, white board, marker, chart papers, projector, trainer’s guide and student handbook

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	04:00 <b>Corresponding NOS Code</b>	Identify different equipment used in food industry	
5	<b>Organizational standards and norms</b>  <b>Theory Duration</b> (hh:mm) 04:00  <b>Practical Duration</b> (hh:mm) 02:00  <b>Corresponding NOS Code</b>	State the roles and responsibilities of a plant manager State how to conduct yourself at the workplace State the personal hygiene and sanitation guidelines State the food safety hygiene standards to follow in a work environment	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
6	<b>Lead operations of a food processing unit</b>  <b>Theory Duration</b> (hh:mm) 15:00  <b>Practical Duration</b> (hh:mm) 11:40  <b>Corresponding NOS Code</b> FIC/N9017	<ul style="list-style-type: none"> <li>• Develop operational plans for the operation of food processing unit that is consistent with the objectives and goals of organisation, and to produce quantity and quality products</li> <li>• Develop operational plan that is flexible and complements supply chain, inventory, human resource, production, maintenance, quality and logistics management of production unit</li> <li>• Develop operational plan to improve output in all areas of functions with the objective to reduce overall cost, and to produce quantity and quality products</li> <li>• Develop operational plan considering national and international regulatory requirements, health and safety, food safety and hygiene requirements on process and product(s), and to maintain safe and environmental compliant workplace</li> <li>• Develop objectives and set demanding but achievable targets for operation function managers, and assign clear responsibilities with expected targets/performance</li> <li>• Provide direction and professional expertise to all function managers to achieve organisation goals</li> <li>• Monitor and control the operational plan to achieve its overall objectives</li> </ul>	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> <li>• Evaluate the implemented operational plan periodically, analyze performance data, identify areas for improvement and recommend changes</li> <li>• Monitor performance of managers and employees to ensure that departmental and individual objectives are achieved within scheduled timelines and budget</li> <li>• Design new work processes, procedures, systems, structures and roles for any changes implemented in the organisation to achieve organizational goal and regulatory requirements</li> <li>• Review and ensure implemented changes are effective and meet the requirements of the organization</li> <li>• Maintain professionalism, tact, diplomacy, sensitivity, diversity and equality, and lead food processing unit to achieve organisation objectives and goals</li> <li>• Ensure that work arrangements, resources and business processes respond to different needs, abilities and values</li> <li>• Develop and implement new business strategies for improving processes and procedures to improve performance</li> <li>• Develop a leadership style and apply them appropriately for managers to follow the lead willingly to achieve organisation targets and goals</li> <li>• Communicate clearly the organisation vision, values and goals to employees, make managers understand and commit their expertise to achieve organisation goals</li> <li>• Lead managers of all operation functions, link operational plans and drive managers towards achieving organisation vision, objectives and goals</li> <li>• Lead managers through difficulties, challenges and conflicts</li> <li>• Conduct meetings with managers regularly and effectively, encourage them to share their views, provide guidance and support to overcome process issues and lead to achieve organisation goal</li> </ul>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"><li>• Encourage managers to take lead in their own areas of expertise, take own decisions in their area of function, and provide recognitions when they are successful</li><li>• Lead the managers and organisation successfully through difficulties and challenges</li><li>• Design processes with achievable targets and realistic timeline, proper resource allocation, with defined process responsibilities to manage food processing operation based on organizational goals</li><li>• Develop processes that are effective and sustainable, implement and ensure it is followed, review its effectiveness and make necessary changes if required</li><li>• Develop process measures that are affordable, and provide enough information and required training for managers and employees to manage the process</li><li>• Review and understand resource requirements for process and allocate necessary resources to all functional areas</li><li>• Develop systems to link all function processes, and encourage function heads and employees to interact across the organisation to form a complete system</li><li>• Establish effective methods to review the quality of work and product, and improve the process</li><li>• Focus attention on issues that are critical to achieve results, provide solutions and guidance to overcome the issues that affect the process</li><li>• Identify issues and trends and recognize their impact upon current and future work, work out solutions and implementation plan to overcome and utilize latest trends to achieve long term goals of the organisation</li><li>• Develop policies and procedures for any change in organisation goal, organisation structure PC31. set responsibilities for managers, set and prioritize objectives for change, clearly communicate change and make the managers understand their responsibilities and commitment</li></ul>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> <li>• Implement change, identify and deal with obstacles to change, and support managers and employees through the change process</li> <li>• Brief managers on their responsibilities and make them understand their role, objectives for their area and the overall organisation, and expected performance</li> <li>• Monitor progress and performance quality of the managers on regular basis against the level of expected performance and provide prompt and constructive feedback PC35. support managers in identifying and dealing with problems and unforeseen events</li> <li>• Identify gaps and performance issues, discuss the causes and recommend solutions to improve performance of managers and their team</li> <li>• Monitor performance, analyze employee strength and weakness, and make changes in their tasks/responsibilities</li> <li>• Review performance and update work plans in their area, monitor and conduct review meetings on regular basis, recognize successful completion of work or work activities by function manager(s) and their teams</li> <li>• Motivate managers to complete expected target and any additional work allocated and provide additional support and resources to complete work</li> </ul>	
7	<p><b>Ensure proper production and operation management</b></p> <p><b>Theory Duration</b> (hh:mm) 08:00</p> <p><b>Practical Duration</b> (hh:mm) 12:00</p> <p><b>Corresponding NOS Code</b> FIC/N9018</p>	<p>Update self with an understanding of the goals of the organisation and forecast/requirements of the sales and marketing manager, with the knowledge of production method and process, plant capacity, resource availability, plan products and quantity to be produced</p> <p>Monitor and regulate supply chain management which includes sourcing and procurement, conversion of raw materials to finished products, all logistics activities, coordination and collaboration with suppliers,</p>	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook ,



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>intermediaries, third party service providers, and customers, to integrate supply and demand management within and across companies</p> <p>Monitor and regulate inventory process to meet the production requirement of the organisation, review current procurement procedures, analyze benefits and risks that may impact the procurement of supplies, implement plans and methods to improve and provide solutions to resolve any immediate problems</p> <p>Evaluate current storage methods and identify ways of improving the storage of supplies to provide better fit with supply chain strategy</p> <p>During production process, coordinate production activities with procurement, maintenance, and quality control function to obtain optimum production and efficient utilization of human resources, machines and equipment</p> <p>Make adjustments/revise/reschedule production schedules and priorities in case of breakdown down of equipment/issues with physical or human resource/ urgent orders/unforeseen issues or any operational problems</p> <p>Direct production activities and establish production priorities to produce quantity and quality products within the operation budget</p> <p>Review and analyze human resource, production, quality control, maintenance, and operational reports to identify reason for nonconformance/ non-compliance to organisation and regulatory standards for product and process, develop and implement operating methods and procedures to eliminate problems and improve product and process quality</p> <p>Monitor storage and distribution of products to and from the plant/processing unit warehouse, ensure storage and distribution norms and procedures like palletizing, stacking height, labeling, fefo etc are followed</p>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>Establish systems to collect and assess information on performance of all functions, analyze data and evaluate performance of departments and organisation, through knowledge and understanding identify reasons for problems and low performance</p> <p>Establish and implement methods and procedures for improvement, ensure implemented methods deliver expected result, and identify opportunities to improve organization performance</p> <p>Read financial responsibilities, compile available financial information, evaluate the cost, benefits and risks of the current budget, and estimate financial requirements for operation of food processing unit</p> <p>Consult with department managers the objectives and associated plans, discuss and identify priorities and develop a realistic master budget for food processing operation, communicate the final proposed budget with all managers</p> <p>Submit the proposed master budget with clear proposals to the management for approval, assist them to evaluate the budget, negotiate with clarity and strong reasoning and get the budget approved</p> <p>Evaluate, analyze and allocate budget to departments of food processing operation, allocate budget to each department managers with expectations and targets, provide required ongoing support and resources</p> <p>Establish systems to monitor and evaluate performance against delegated budgets and the master budget and put contingency plans in place</p> <p>Identify reason for significant variances between budget and actual expenditure, discuss with managers, provide solutions and ensure immediate corrective action is taken</p> <p>In case of unforeseen situation/emergency/shortage,</p>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>identify any additional financial needs, prepare provisional budget, negotiate and get it approved by the management, delegate provisional budget to respective managers, monitor and control expenditure</p> <p>Encourage managers to identify ways of reducing expenditure, analyze and pursue potential ideas, implement those in all areas of function</p> <p>Review the financial performance of managers regularly, and identify improvement opportunities and ensure it is implemented, provide information to the management on the financial performance of the operation management</p> <p>Determine human resource requirement including contingencies to achieve organisation goal, organize interview, hiring and training of new employees through human resources manager</p> <p>Ensure that all employees receive appropriate training on job duties, corporate policies and applicable regulations</p> <p>Oversee and direct the activities of subordinate managers, provide coaching and mentoring, and conduct evaluations of all</p> <p>Discuss with managers of operation function and identify resource requirement for their area, analyze, estimate and approve resources, monitor effective use of those resources</p> <p>Ensure compliance of all employees with organization policy, procedures and applicable regulations</p> <p>Conduct meetings to address grievances, to resolve or effect settlements within the scope of authority, and refer unresolved grievances for management-union negotiations</p> <p>Take personnel actions, such as promotions, transfers, discharges or disciplinary measures, within the scope of authority</p> <p>Update self with knowledge of quality management system, legal and regulatory requirements, environmental issues related to the</p>	





Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>organisation, process and products produced</p> <p>Ensure system, plan and resources are in place to assure food products produced in the organisation meet the organisation standards, national and international regulations</p> <p>Implement procedure, standards and specifications to meet quality goals of the organisation, co-ordinate departments and provide support to implement food safety system like HACCP in the organisation</p> <p>Evaluate records of quality of product and process to assess the effectiveness of quality system followed in the organisation, review and revise the quality system through quality assurance manager and implement changes</p> <p>Organize training for employees to update on latest developments/systems/ tools and techniques in quality management system and evaluate their competency to fulfill organisation goals</p> <p>Encourage employees of all functions to take personal responsibility for achieving quality standards of product and process and address or report/address any non-conformance</p> <p>Monitor process and product quality against target and plan, identify and assess risks of shortfalls in the quality of processes and products/services and take immediate corrective action to address risks</p> <p>Direct and coordinate implementation of quality system such as ISO, HACCP, etc. in the organisation through quality manager</p> <p>Ensure managers responsible for organizational processes understand the requirements of quality system, establish their roles in implementation of quality system in their functional areas, enhance their confidence and commitment to quality by providing continuous support</p> <p>Encourage and support department heads and employees for quality</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>audit process to obtain accreditation, certifications to a standard or a mark of quality, monitor quality audit process, review results and take immediate corrective action through concerned managers</p> <p>Identify the environmental impact related to the resources, process and products produced in the organisation such as air/water/noise pollution, effluent treatment, waste disposal etc, identify risks to the environment, consult with experts and identify opportunities to improve environmental performance</p> <p>Set and implement policies and procedures through managers, monitor to ensure its efficiency and effectiveness and make changes as required to meet the regulatory requirements</p>	
8	<p><b>Manage new projects and ensure compliance to regulatory requirements</b></p> <p><b>Theory Duration</b> (hh:mm) 07:00</p> <p><b>Practical Duration</b> (hh:mm) 09:00</p> <p><b>Corresponding NOS Code</b> FIC/N9019</p>	<p>Implement new project/business plans of the organisation for introducing new products or for improving processes, procedures and performance</p> <p>Map or perform comparative study of the project with the current project/product to understand the ways proposed project fits with the overall vision, objectives and plans of the organization</p> <p>Read the key objectives and scope of the proposed project, prepare resource requirement for implementation of new project, negotiate with clarity and strong reasoning and get approval from superiors/management</p> <p>Consult with experts and managers and prepare realistic and thorough plan to implement the project successfully, prepare project report considering all possibilities</p> <p>Submit the project report to the superiors/management, discuss plan, consider suggestions and recommendations and make necessary changes where necessary, take approval of final plan</p> <p>brief project team managers on the project plan and their roles and responsibilities, start implementation of project and provide ongoing</p>	<p>Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, logbooks, internal audit register, food safety manual, quality policy etc.</p>



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>support, encouragement and information for successful completion</p> <p>Monitor, control and review project plan during each stage of implementation</p> <p>Provide sufficient resources to deal with contingencies and to manage any potential risks</p> <p>Inform the management/superiors of the developments in the project on regular basis, discuss progress and problems, take approval for any changes in project plan</p> <p>Complete project within agreed level of resources, meeting all legal and regulatory requirements, share the success with the project team members, recognize and reward their contribution</p> <p>Update self with understanding of national and international food safety regulations and standards related to the food processing units, process and products produced in the organisation</p> <p>Ensure effective policies and procedures are in place in the organization to meet to legal and regulatory requirements</p> <p>Ensure regulatory standards set by the organisation for products are stringent in context of the national and international legal requirements</p> <p>Ensure managers of all functional area have a clear understanding of the policies and procedures on food regulatory standards</p> <p>Organize training for all employees on policies and procedures on food regulatory standards and the importance of following regulations</p> <p>Monitor and ensure relevant legal and regulatory requirements pertaining to food processing units and products produced in the organisation are followed and met</p> <p>Identify reasons for non-compliance, review and revise the policies and procedures in consultation with quality and regulatory affairs manager to correct and overcome failures, provide support to all managers to implement corrective actions for the organisation and</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>products to comply with regulatory standards</p> <p>Update self with understanding of health and safety requirements, and food safety, hygiene and sanitation requirements for the organisation and products produced</p> <p>Ensure that the organisation has written policy and procedures on health and safety, food safety, hygiene and sanitation, and those are clearly communicated to all employees of the organisation, and are put into practice and followed</p> <p>Implement a system for identifying hazards and assessing risk in food processing and products and set procedures to control and prevent them</p> <p>Implement system for GMP, HACCP, FIFO/FEFO, product recall, etc., organize training to the employees on health and safety, food safety, hygiene and sanitation for effective implementation of the systems, allocate required resources for implementation, and ensure those are followed by all employees</p> <p>Ensure systems are in place for effective monitoring, measuring and reporting on the performance of health and safety system</p> <p>Evaluate the existing systems and procedures, consult with managers and experts and identify methods to reduce risks/improve control measure</p> <p>Ensure health and safety policies are practiced across the organisation, effectively monitored, reviewed and revised at regular intervals to meet the changes in national and international regulations</p>	
9	<p><b>Professional and Core Skills</b></p> <p><b>Theory Duration</b> (hh:mm) 03:00</p> <p><b>Practical Duration</b> (hh:mm) 05:00</p>	<p>Undertake a self-assessment test</p> <p>Identify personal strengths and weaknesses</p> <p>Plan and schedule the work order and manage time effectively to complete the tasks assigned</p> <p>Prevent potential problems from occurring</p>	<p>Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Corresponding NOS Code</b>	Resolve issues and problems using acquired knowledge and realize the importance of decision making Identify potential problems and make sound and timely decision Improve your reading skills State the importance of listening	
10	<b>IT Skills</b>  <b>Theory Duration</b> (hh:mm) 05:00  <b>Practical Duration</b> (hh:mm) 07:00  <b>Corresponding NOS Code</b>	Identify parts of the computer Use the computer keyboard effectively to type Use computer applications effectively to record day-to-day activities Use the word processor effectively Use the spreadsheet application effectively Use the computer to document day-to-day activities	Laptop, white/black board, marker, chart papers, projector, Trainer's guide, Student manual
11	<b>Field Visits</b>  <b>Theory Duration</b> (hh:mm) 04:00  <b>Practical Duration</b> (hh:mm) 30:00  <b>Corresponding NOS Code</b>	Observe the factory location, layout and safety aspects of food processing Observe the storage facilities for raw materials and finished products Observe the various machineries used in process Observe the various machineries used in process Observe the cleaning methods and processes followed to maintain the process machineries and tools Observe the raw materials used and their storage procedures Observe the packaging and storage processes of raw material and finished product Observe the post-production cleaning and maintenance process followed in the industry	All the tools and equipment listed above must be available at the site of field visit
12	<b>Revision</b>  <b>Theory Duration</b> (hh:mm) 02:00  <b>Practical Duration</b> (hh:mm) 02:00  <b>Corresponding NOS Code</b>	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision
13	<b>Evaluation</b>	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above



Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Theory Duration</b> (hh:mm) 08:00  <b>Practical Duration</b> (hh:mm) 20:00  <b>Corresponding NOS Code</b>		must be available for evaluation
14	<b>On-the-job Training</b>  <b>Theory Duration</b> (hh:mm) 30:00  <b>Practical Duration</b> (hh:mm) 65:00  <b>Corresponding NOS Code</b>	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	<b>Total Duration</b> <b>240:00</b>  <b>Theory Duration</b> <b>88:00</b>  <b>Practical Duration</b> <b>152:00</b>	<b>Unique Equipment Required:</b> Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual	

Grand Total Course Duration: **240Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by SSC: Food Industry Capacity and Skill Initiative)*



## Trainer Prerequisites for Job role: “Plant Manager” mapped to Qualification Pack: “FIC/Q9004, v1.0”

Sr. No.	Area	Details
1	<b>Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q9004”, Version 1.0
2	<b>Personal Attributes</b>	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	<b>Minimum Educational Qualifications</b>	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 9-10 years of hands on experience in a food industry
4a	<b>Domain Certification</b>	Certified for Job Role: “Plant Manager” mapped to QP: “FIC/Q9004, v1.0”. Minimum accepted score is 80%
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “SSC/Q1402”. Minimum accepted SCORE IS 80 % as per FICSI guidelines.
5	<b>Experience</b>	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 9-10 years of hands on experience in a food industry



**Annexure: Assessment Criteria**

<b>Assessment Criteria</b>	
<b>Job Role</b>	<b>Plant Manager</b>
<b>Qualification Pack</b>	<b>FIC/Q9004, v1.0</b>
<b>Sector Skill Council</b>	<b>Food Processing</b>

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
<b>1. FIC/N9017: Lead Operations of a food processing unit</b>	PC1. Develop operational plans for the operation of food processing unit that is consistent with the objectives and goals of organisation, and to produce quantity and quality products	<b>100</b>	3	1	2
	PC2. Develop operational plan that is flexible and complements supply chain, inventory, human resource, production, maintenance, quality and logistics management of production unit		2.5	1	1.5
	PC3. Develop operational plan to improve output in all areas of functions with the objective to reduce overall cost, and to produce quantity and quality products		2.5	0.5	2
	PC4. Develop operational plan considering national and international regulatory requirements, health and safety, food safety and hygiene requirements on process and product(s), and to maintain safe and environmental compliant workplace		2.5	1	1.5



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC5. Develop objectives and set demanding but achievable targets for operation function managers, and assign clear responsibilities with expected targets/performance		3	1	2
	PC6. Provide direction and professional expertise to all function managers to achieve organisation goal		2.5	1	1.5
	PC7. Monitor and control the operational plan to achieve its overall objectives		2.5	0.5	2
	PC8. Evaluate the implemented operational plan periodically, analyze performance data, identify areas for improvement and recommend changes		2.5	1	1.5
	PC9. Monitor performance of managers and employees to ensure that departmental and individual objectives are achieved within scheduled timelines and budget		3	1	2
	PC10. Design new work processes, procedures, systems, structures and roles for any changes implemented in the organisation to achieve organizational goal and regulatory requirements		2.5	1	1.5
	PC11. Review and ensure implemented changes are effective and meets the requirements of the organisation		2.5	1	1.5
	PC12. Maintain professionalism, tact, diplomacy, sensitivity, diversity and equality, and lead food processing unit to achieve organisation objectives and goals		2.5	1	1.5
	PC13. Ensure that work arrangements, resources and business processes respond to different needs, abilities and values		2.5	0.5	2
	PC14. Develop and implement new business strategies for improving processes and procedures to improve performance		2.5	1	1.5
	PC15. Develop a leadership style and apply them appropriately for managers to follow the lead willingly to achieve organisation targets and goals		2.5	1	1.5
	PC16. Communicate clearly the organisation vision, values and goals to employees, make managers understand and commit their expertise to achieve organisation goals		2.5	0.5	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC17. Lead managers of all operation functions, link operational plans and drive managers towards achieving organisation vision, objectives and goals		3	1	2
	PC18. Lead managers through difficulties, challenges and conflicts		2.5	1	1.5
	PC19. Conduct meetings with managers regularly and effectively, encourage them to share their views, provide guidance and support to overcome process issues and lead to achieve organisation goal		2.5	0.5	2
	PC20. Encourage managers to take lead in their own areas of expertise, take own decisions in their area of function, and provide recognitions when they are successful		2.5	1	1.5
	PC21. Lead the managers and organisation successfully through difficulties and challenges		3	1	2
	PC22. Design processes with achievable targets and realistic timeline, proper resource allocation, with defined process responsibilities to manage food processing operation based on organizational goals		2.5	1	1.5
	PC23. Develop processes that are effective and sustainable, implement and ensure it is followed, review its effectiveness and make necessary changes if required		2.5	1	1.5
	PC24. Develop process measures that are affordable, and provide enough information and required training for managers and employees to manage the process		2.5	0.5	2
	PC25. Review and understand resource requirements for process and allocate necessary resources to all functional areas		2.5	1	1.5
	PC26. Develop systems to link all function processes, and encourage function heads and employees to interact across the organisation to form a complete system		2.5	0.5	2
	PC27. Establish effective methods to review the quality of work and product, and improve the process		2.5	0.5	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC28. Focus attention on issues that are critical to achieve results, provide solutions and guidance to overcome the issues that affect the process		2.5	1	1.5
	PC29. Identify issues and trends and recognize their impact upon current and future work, work out solutions and implementation plan to overcome and utilize latest trends to achieve long term goals of the organisation		3	1	2
	PC30. Develop policies and procedures for any change in organisation goal, organisation structure		2.5	1	1.5
	PC31. Set responsibilities for managers, set and prioritize objectives for change, clearly communicate change and make the managers understand their responsibilities and commitment		2.5	1	1.5
	PC32. Implement change, identify and deal with obstacles to change, and support managers and employees through the change process		2.5	1	1.5
	PC33. Brief managers on their responsibilities and make them understand their role, objectives for their area and the overall organisation, and expected performance		2	1	1
	PC34. Monitor progress and performance quality of the managers on regular basis against the level of expected performance and provide prompt and constructive feedback		3	1	2
	PC35. Support managers in identifying and dealing with problems and unforeseen events		2.5	1	1.5
	PC36. Identify gaps and performance issues, discuss the causes and recommend solutions to improve performance of managers and their team		3	1	2
	PC37. Monitor performance, analyze employee strength and weakness, and make changes in their tasks/responsibilities		2.5	1	1.5
	PC38. Review performance and update work plans in their area, monitor and conduct review meetings on regular basis, recognize successful completion of work or work activities by function manager(s) and their teams		2.5	1	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC39. Motivate managers to complete expected target and any additional work allocated and provide additional support and resources to complete work		2	1	1
			<b>100</b>	<b>35</b>	<b>65</b>
<b>2. FIC/N9018: Ensure proper production and proper management</b>	PC1. Update self with an understanding of the goals of the organisation and forecast/requirements of the sales & marketing manager, with the knowledge on production method and process, plant capacity, resource availability, plan products and quantity to be produced	<b>100</b>	2	1	1
	PC2. Monitor and regulate supply chain management which include sourcing and procurement, conversion of raw materials to finished products, all logistics activities, coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers, to integrates supply and demand management within and across companies		3	0.5	2.5
	PC3. Monitor and regulate inventory process to meet the production requirement of the organisation, review current procurement procedures, analyze benefits and risks that may impact the procurement of supplies, implement plans and methods to improve, provide solutions to resolve any immediate problems		3	1	2
	PC4. Evaluate current storage methods, identifying ways of improving the storage of supplies to provide better fit with supply chain strategy		3	1	2
	PC5. During production process, coordinate production activities with procurement, maintenance, and quality control function to obtain optimum production and efficient utilization of human resources, machines and equipment		1.5	0.5	1
	PC6. Make adjustments/revise/reschedule production schedules and priorities in case of breakdown down of equipment/issues with physical or human resource/ urgent		1.5	0.5	1

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	orders/unforeseen issues or any operational problems				
	PC7. Direct production activities and establish production priorities to produce quantity and quality products within the operation budget		3	1	2
	PC8. Review and analyze human resource, production, quality control, maintenance, and operational reports to identify reason for non-conformance/ noncompliance to organisation and regulatory standards for product and process, develop and implement operating methods and procedures to eliminate problems and improve product and process quality		3	1	2
	PC9. Monitor storage and distribution of products to and from the plant/processing unit warehouse, ensure storage and distribution norms and procedures like palletizing, stacking height, labeling, FEFO etc are followed		3	0.5	2.5
	PC10. Establish systems to collect and assess information on performance of all functions, analyze data and evaluate performance of departments and organisation, through knowledge and understanding identify reasons for problems and low performance		1.5	1	0.5
	PC11. Establish and implement methods and procedures for improvement, ensure implemented methods deliver expected result, and identify opportunities to improve organization performance		1.5	1	0.5
	PC12. Read financial responsibilities, compile available financial information, evaluate the cost, benefits and risks of the current budget, and estimate financial requirements for operation of food processing unit		3	1.5	1.5
	PC13. Consult with department managers the objectives and associated plans, discuss and identify priorities and develop a realistic master budget for food processing operation, communicate the final proposed budget with all managers		3	1	2



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC14. Submit the proposed master budget with clear proposals to the management for approval, assist them to evaluate the budget, negotiate with clarity and strong reasoning and get the budget approved		2.5	1	1.5
	PC15. Evaluate, analyze and allocate budget to departments of food processing operation, allocate budget to each department managers with expectations and targets, provide required ongoing support and resources		3	1	2
	PC16. Establish systems to monitor and evaluate performance against delegated budgets and the master budget and put contingency plans in place		2.5	1	1.5
	PC17. Identify reason for significant variances between budget and actual expenditure, discuss with managers, provide solutions and ensure immediate corrective action is taken		2.5	1	1.5
	PC18. In case of unforeseen situation/emergency/shortage, identify any additional financial needs, prepare provisional budget, negotiate and get it approved by the management, delegate provisional budget to respective managers, monitor and control expenditure		3	1	2
	PC19. Encourage managers to identify ways of reducing expenditure, analyze and pursue potential ideas, implement those in all areas of function		2.5	1	1.5
	PC20. Review the financial performance of managers regularly, and identify improvement opportunities and ensure it is implemented, provide information to the management on the financial performance of the operation management		2.5	1	1.5
	PC21. Determine human resource requirement including contingencies to achieve organisation goal, organize interview, hiring and training of new employees through human resources manager		3	1	2
	PC22. Ensure that all employees receives appropriate training on job duties,		2.5	1	1.5



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	corporate policies and applicable regulations				
	PC23 Oversee and direct the activities of subordinate managers, provide coaching and mentoring, and conduct evaluations of all		2.5	1	1.5
	PC24 Discuss with managers of operation function and identify resource requirement for their area, analyze, estimate and approve resources, monitor effective use of those resources		3	1	2
	PC25 Ensure compliance of all employees with organization policy, procedures and applicable regulations		2.5	1	1.5
	PC26 Conduct meetings to address grievances, to resolve or effect settlements within the scope of authority, and refer unresolved grievances for management-union negotiations		2.5	0.5	2
	PC27 Take personnel actions, such as promotions, transfers, discharges or disciplinary measures, within the scope of authority		3	1	2
	PC28 Update self with knowledge of quality management system, legal and regulatory requirements, environmental issues related to the organisation, process and products produced		2.5	0.5	2
	PC29 Ensure system, plan and resources are in place to assure food products produced in the organisation meet the organisation standards, national and international regulations		3	1	2
	PC30 Implement procedure, standards and specifications to meet quality goals of the organisation, coordinate departments and provide support to implement food safety system like HACCP in the organisation		3	1	2
	PC31 Evaluate records on quality of product and process to assess the effectiveness of quality system followed in the organisation, review and revise the quality system through quality assurance manager and implement changes		2.5	1	1.5
	PC32 Organize training for employees to update on latest		2.5	0.5	2



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	developments/systems/ tools and techniques in quality management system and evaluate their competency to fulfill organisation goals				
	PC33 Encourage employees of all functions to take personal responsibility for achieving quality standards of product and process and to address or report/address any non-conformance		2.5	1	1.5
	PC34 Monitor process and product quality against target and plan, identify and assess risks of shortfalls in the quality of processes and products/services and take immediate corrective action to address risks		3	1	2
	PC35 Direct and coordinate implementation of quality system like ISO, HACCP etc in the organisation through quality manager		3	1	2
	PC36 Ensure managers responsible for organizational processes understand the requirements of quality system, establish their roles in implementation of quality system in their functional areas, enhance their confidence and commitment to quality by providing continuous support		3	1	2
	PC37 Encourage and support department heads and employees for quality audit process to obtaining accreditation, certifications to a standard or a mark of quality, monitor quality audit process, review results and take immediate corrective action through concerned managers		2.5	1	1.5
	PC38 Identify the environmental impact related to the resources, process and products produced in the organisation like air/water/noise pollution, effluent treatment, waste disposal etc, identify risks to the environment, consult with experts and identify opportunities to improve environmental performance		1.5	0.5	1
	PC39 Set and implement policies and procedures through managers, monitor to ensure its efficiency and effectiveness and make changes as required to meet the regulatory requirements		1.5	0.5	1
			<b>100</b>	<b>35</b>	<b>65</b>



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
<b>3. FIC/N9019: Manage new projects and implement health and safety system in food processing unit</b>	PC1. Implement new project/business plans of the organisation for introducing new products or for improving processes, procedures and performance	<b>100</b>	3	1	2
	PC2. Map or perform comparative study of the project with the current project/product to understand the ways proposed project fits with the overall vision, objectives and plans of the organisation		4	1	3
	PC3. Read the key objectives and scope of the proposed project, prepare resource requirement for implementation of new project, negotiate with clarity and strong reasoning and get approved from superiors/management		5	2	3
	PC4. Consult with experts and managers and prepare realistic and thorough plan to implement the project successfully, prepare project report considering all possibilities		4	1.5	2.5
	PC5. Submit the project report to the superiors/management, discuss plan, consider suggestions and recommendations and make necessary changes where necessary, take approval of final plan		4	1.5	2.5
	PC6. Brief project team managers on the project plan and their roles and responsibilities, start implementation of project and provide ongoing support, encouragement and information for successful completion		5	2	3
	PC7. Monitor, control and review project plan during each stage of implementation		4	1.5	2.5
	PC8. Provide sufficient resources to deal with contingencies and to manage any potential risks		4	1.5	2.5
	PC9. Inform the management/superiors of the developments in the project on regular basis, discuss progress and problems, take approval for any changes in project plan		4	1.5	2.5
	PC10. Complete project within agreed level of resources meeting all legal and regulatory requirements, share the success with the project team		4	1.5	2.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	members, recognize and reward their contribution				
	PC11. Read national and international food safety regulations and standards related to the food processing units, process and products produced in the organisation		3	1.5	2.5
	PC12. Ensure effective policies and procedures are in place in the organization to meet to legal and regulatory requirements		5	2	3
	PC13. Ensure regulatory standards set by the organisation for products are stringent than the national and international legal requirements		4	1.5	2.5
	PC14. Ensure managers of all functional area have a clear understanding of the policies and procedures on food regulatory standards		4	1.5	2.5
	PC15. Organize training for all employees on policies and procedures on food regulatory standards and the importance of following regulations		4	1	3
	PC16. Monitor and ensure relevant legal and regulatory requirements pertaining to food processing units and products produced in the organisation are followed and met		5	2	3
	PC17. Identify reasons for noncompliance, review and revise the policies and procedures in consultation with quality and regulatory affairs manager to correct and overcome failures, provide support to all managers to implement corrective actions for the organisation and products to comply with regulatory standards		5	2	3
	PC18. Read the health and safety requirements, and food safety, hygiene and sanitation requirements for the organization and products produced		3	1	2
	PC19. Ensure that the organisation has written policy and procedures on health and safety, food safety, hygiene and sanitation, and those are clearly communicated to all employees of the organisation, and are put into practice and being followed		4	1	3



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC20. Implement system for identifying hazards and assessing risk in food processing and products, set procedures to control and prevent them		4	1	3
	PC21. implement system for GMP, HACCP, FIFO/FEFO, product recall etc, organize training to the employees on health and safety, food safety, hygiene and sanitation for effective implementation of the systems, allocate required resources for implementation, and ensure those are followed by all employees		5	2	3
	PC22. Ensure systems are in place for effective monitoring, measuring and reporting on the performance of health and safety system		4	1	3
	PC23. Evaluate the existing systems and procedures, consult with managers and experts and identify method to reduce risks/improve control measure		4	1	3
	PC24. Ensure health and safety policies are practiced across the organisation, effectively monitored, reviewed and revised at regular intervals to meet the changes in national and international regulations		4	1	3
	<b>Total</b>		<b>100</b>	<b>35</b>	<b>65</b>
	<b>Grand Total</b>	<b>300</b>	<b>300</b>	<b>200</b>	<b>100</b>
	<b>Percentage Weightage</b>		<b>100</b>	<b>60%</b>	<b>40%</b>
	<b>Minimum Pass% to qualify (aggregate):</b>			<b>70%</b>	



# **JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

**OOTY ROAD, MYSORE-570025, KARNATAKA**



ESTD-1964

## **SYLLABUS**

### **M. Voc. (Software Development)**

**2022-2023**

### **DEPARTMENT OF SOFTWARE DEVELOPMENT**

**Scheme of Instruction For M. Voc. (Software Development) year 2021-22**

General Education Component										
(L-Lecture;T-Tutorial;P-Practical/Practice)(1Credit=15Hrs)										
Years/Semesters	Paper No.	--Title	L:T:P	L	T	P	Total Hours	Total Credits		
<b>General Education</b>										
Year1	SemI		BusinessEnglish	2:0:1	30	0	15	45	3	
			Dataanalysis	3:0:0	30	0	15	45	3	
	SemII									<b>06</b>
			Presentationandtime management Skill	2:0:1	30	0	15	45	3	
			ConceptofData Mining	2:0:1	30	0	15	45	3	
									<b>06</b>	
	<b>SkillComponents</b>									
			Design Developer	200 hours						<b>48</b>
								<b>Total</b>	<b>60</b>	
<b>General Education</b>										
Year2	Sem III		Teamwork and Communication skills	2:0:1	30	0	15	45	3	
			AdvancedComputer networks	3:0:0	45	0	0	45	3	
									<b>06</b>	
	Sem IV		ProjectEstimation Skills	2:0:1	30	0	15	45	3	
			Meeting ManagementSkills	2:0:1	30	0	15	45	3	
									<b>06</b>	
	<b>SkillComponents</b>									
			SoftwareDeveloper	200 hours						<b>48</b>
								<b>Total</b>	<b>60</b>	

## Scheme of Assessment:

### Semester-I:

Sl. no	Course Code	CourseName	Credits		Marks				
			L:T:P	Total	Th	C1	C2	Pr	Total
1	MSA510	Business English	2:0:1	03	70	15	15	70	170
2	MSA520	Data analysis	2:0:1	03	70	15	15	70	170

### Semester-II:

Sl. no	Course Code	Course Name	Credits		Marks				
			L:T:P	Total	Th	C1	C2	Pr	Total
1	MSB510	Presentation and time management Skill	2:0:1	03	70	15	15	70	170
2	MSB520	Concept of Data Mining	2:0:1	03	70	15	15	70	170

### Semester-III:

Sl. no	Course Code	CourseName	Credits		Marks				
			L:T:P	Total	Th	C1	C2	P	Total
1	MSC510	Teamwork and Communication skills	2:0:1	03	70	15	15	70	170
2	MSC520	Advanced Computer networks	2:0:1	03	70	15	15	70	170

### Semester-IV:

Sl. no	Course Code	CourseName	Credits		Marks				
			L:T:P	Total	Th	C1	C2	P	Total
1	MSD510	Project EstimationSkills	2:0:1	03	70	15	15	70	170
2	MSD520	Meeting Management Skills	2:0:1	03	70	15	15	70	170



# General Education Component

## Semester-I:

<b>Subject Name: Business English</b>	
Course Code:	
No. of Teaching Hours – 45	Credits: 2:0:1 L-T-P

<b>Theory</b>		
<b>Unit .No</b>	<b>Title</b>	<b>Hrs</b>
1	Understanding company structures, Developing Relationships in the workplace, Correspondence-Emailing, Written reports and telephoning	15
2	Public speaking and presentations, Meetings: Chairing, setting the agenda, controlling the conversation, Participating, turn taking, listening and taking notes, Being diplomatic, agreeing and disagreeing. Negotiations: Key negotiating language, framing your argument, Negotiating with suppliers, Negotiating with customers	10
3	Reports: Skim reading reports and news feeds, How to report information and ideas, Writing reports – style, register, conventions	5
	<b>Total</b>	<b>30</b>

<b>Practical</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs</b>
1	Understanding company structures	2
2	Developing Relationships in the workplace	3
3	Correspondence-Emailing, Written reports and telephoning	3
4	Public speaking and presentations	3
5	Meetings and negotiations	2
		2
	<b>Total</b>	<b>15</b>

<b>SubjectName:DATAANALYSIS</b>	
CourseCode:	
No.ofTeachingHours–45	Credits:3:0:0L-T-P

<b>Unit.No</b>	<b>Title</b>	<b>Hrs</b>
1	DATAANALYSIS:Regressionmodeling,Multivariateanalysis, Bayesian modeling, inference and Bayesian networks, Support vectorandkernelmethods,Analysisoftimeseries:linearsystems analysis,nonlineardynamics–Ruleinduction–Neuralnetworks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.	15
2	MINING DATA STREAMS : Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling datainastream–Filteringstreams–Countingdistinctelementsina stream – Estimating moments – Counting oneness in a window – Decaying window – Realtime Analytics Platform(RTAP) applications – case studies – real time sentiment analysis, stock marketpredictions.	10
3	FREQUENTITEMSETSANDCLUSTERING:MiningFrequent item sets – Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Countingfrequentitemsetsinastream–ClusteringTechniques– Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern-based clustering methods–Clusteringinnon-euclidean space–Clusteringfor streams and Parallelism.	10
4	FRAMEWORKSANDVISUALIZATION:MapReduce–Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributedfilesystems–Visualizations–Visualdataanalysis techniques, interaction techniques; Systems and applications:	10
	<b>Total</b>	<b>45</b>

**Semester-II:**

<b>SubjectName:Presentationandtimemanagement Skill</b>	
CourseCode:	
No.ofTeachingHours–45	Credits:2:0:1L-T-P

<b>Theory</b>		
<b>Unit .No</b>	<b>Title</b>	<b>Hrs</b>
1	Understandbasicpatternsofaneffectivepresentation,Createand deliver an effective presentation, Asking questions, Answering questions, Evaluate presentation, Case study; Entrepreneurship development	10
2	Valuesandbeliefsoftimemanagement,Goalsandbenchmarks- The ladders of success, Managing projects and commitments, Prioritizing your to do's	10
3	Designing the projects that matter, Inspired action; Getting the resultsyouneed,Trackingprojects,Managingforaccomplishment, Tools for time management	10
<b>Total</b>		<b>30</b>

<b>Practical</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs</b>
1	Understandbasicpatternsofaneffectivepresentation	1
2	Createanddeliveraneffectivepresentation	1
3	Askingquestions	1
4	Answeringquestions	2
5	Evaluatepresentation	2
6	Casestudy;Entrepreneurshipdevelopment	2
<b>Total</b>		<b>15</b>

SubjectName: <b>Concepts of Data Mining</b>	
CourseCode:	
No. of Teaching Hours – 45	Credits: 2:0:1L-T-P

<b>Theory</b>		
<b>Unit .No</b>	<b>Title</b>	<b>Hrs</b>
1	Data Mining Introduction : Introduction to Data Mining, Need of Mine Data, Evolution of Data Mining, Data Mining Tasks, Classification, Clustering, Association Mining, Challenges of Data Mining	
2	Preprocessing: Data, Attribute Values, Measurement of Length, Types and Properties of Attributes & data , Data Preprocessing Data Exploration: Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Mean and Median, Visualization, Histograms, Box Plots	10
3	Classification: OLAP, OLAP Operations, Data Mining Classification, Decision Trees, Naive Bayes Data Mining Association: Data Mining Association Analysis, Association Rule Mining, Frequent Itemset Generation, FP-growth Tree Algorithm, Cluster Analysis.	15
		30

<b>Practical</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs</b>
1	Data Mining Tools: WEKA (Waikato Environment for Knowledge Analysis): is a well-known suite of machine learning software that supports several typical data mining tasks, particularly data pre-processing, clustering, classification, regression, visualization, and feature selection.	7
2	Rapid Miner: Formerly called YALE (Yet another Learning Environment), is an environment for machine learning and data mining experiments that is utilized for both research and real-world data mining tasks.	8
	<b>Total</b>	<b>15</b>

**Reference book:**

Tan, Steinbach, Kumar Introduction to Data Mining Pearson Addison Wesley, 2006  
 Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers

**Semester-III:**

<b>SubjectName:TeamworkandCommunicationskills</b>	
CourseCode:	
No.ofTeachingHours–45	Credits:2:0:1L-T-P

<b>Theory</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs.</b>
1	Teamstructure,Stagesofteam,Traditionalteamsvs.Collaborative teams, Taking team action & problem solving, Team communication, Conflict resolution, Meditation, Role-Specific issuesandProjectpresentations	2
2		
3	CommunicationinEnglish,Listeningskills,Readingskills,Writing skills, Speaking skills	
	<b>Total</b>	<b>30</b>

<b>Practical</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs.</b>
1	Teamstructure	1
2	Stagesofteam	1
3	Traditionalteamsvs.Collaborativeteams	1
4	Takingteamaction&problemsolving	2
5	Teamcommunication	2
6	Conflictresolution	3
7	Meditation	1
8	Role-Specificissues	2
9	Projectpresentations	2
	<b>Total</b>	<b>15</b>

<b>SubjectName:AdvancedCommunicationNetworks</b>	
CourseCode:	
No.ofTeachingHours–45	Credits:3:0:0L-T-P

<b>Theory</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs.</b>
1	Reviewoffundamentalconceptsinnetworkingandcommunication. Packet switching techniques and types, Foundations of networking protocols, Internet protocols and addressing. Basics of wireless Networks and Mobile IP. Routers, Routing and internetworking, network layer routing, Least cost path algorithms, Non least cost algorithms, Intra domain routing protocols, inter domain routing protocols,Congestioncontrolinnetworklayer	15
2	Transport and end to end protocols: Transport layer, TCP, UDP, Mobiletransportprotocols,TCPcongestioncontrol,Applications and network management	10
3	PacketQueuesanddelayanalysis,Queuingdisciplines,Markovian systems, Non Markovian systems, Networks in Queues, Basics of QoSandresourceallocation	10
4	VPNs, Tunneling and Overlay networks, VPN, MPLS, P2P networks,BasicsofVOIP,mobileadhocnetworksandwireless sensor networks. Recent trends in networking	10
	Total	45

**References:**

1. NaderMir :Computerandcommunicationnetworks, PearsonEducation2007
2. LeonGarciaandIndraWidjaja:CommuincationNetworks,TMHSecondEdition

**Semester-IV:**

<b>SubjectName:ProjectEstimationskills</b>	
CourseCode:	
No.ofTeachingHours–45	Credits:2:0:1L-T-P

<b>Theory</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs.</b>
1	Understandprojectestimation	3
2	Howtoestimatetimeaccurately	4
3	Methodsforestimatingtime	13
4	Preparingyourschedule	10
	<b>Total</b>	<b>30</b>

<b>Practical</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs.</b>
1	Understandprojectestimation	2
2	Howtoestimatetimeaccurately	3
3	Methodsforestimatingtime	5
4	Preparingyourschedule	5
	<b>Total</b>	<b>15</b>

<b>SubjectName:Meetingmanagement skills</b>	
CourseCode:	
No.ofTeachingHours–45	Credits:2:0:1L-T-P

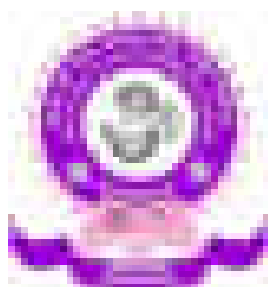
<b>Theory</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs.</b>
1	Understandingmeetingmanagement	3
2	Typesofmeetings	4
3	Settingmeetingobjectives	5
4	Greetings	2
5	Conductofmeeting	5
6	Meetingclosure	1
7	Minutesofmeeting	5
8	Meetingfollowup	5
	<b>Total</b>	<b>30</b>

<b>Theory</b>		
<b>Sl.No</b>	<b>Title</b>	<b>Hrs.</b>
1	Understandingmeetingmanagement	2
2	Typesofmeetings	1
3	Settingmeetingobjectives	2
4	Greetings	1
5	Conductofmeeting	3
6	Meetingclosure	1
7	Minutesofmeeting	2
8	Meetingfollowup	3
	<b>Total</b>	<b>15</b>



**Choice Based Credit System & Continuous  
Assessment Grading Pattern**

**SYLLABUS FOR  
MASTER OF ARTS IN ENGLISH**



**Programme Code: ENG**

**2021-24**

**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**

*(An Autonomous College of University of Mysore; Re-Accredited by NAAC with 'A' Grade)*

**POSTGRADUATE DEPARTMENT OF STUDIES & RESEARCH IN  
ENGLISH**

**OOTY ROAD, MYSURU-570 025, KARNATAKA**

**POSTGRADUATE DEPARTMENT OF STUDIES & RESEARCH IN  
ENGLISH**

**COURSES OFFERED**

**I SEMESTER**

<b>Course I – (Hard Core-I) English Literature from Chaucer to Milton</b>	<b>ENA 010</b>
<b>Course II – (Hard Core-II) Elizabethan Age</b>	<b>ENA 020</b>
<b>Course III – (Hard Core-III) 17<sup>th</sup> and 18<sup>th</sup> Century English Literature</b>	<b>ENA 030</b>
<b>Course IV – (Hard Core-IV) 19<sup>th</sup> Century English Literature</b>	<b>ENA 040</b>
<b>Course V – *(Soft Core-I) Realism and Fiction</b>	<b>ENA 250</b>
<b>*(Soft Core-II) Contemporary Indian Novels in English</b>	<b>ENA 220</b>

**II SEMESTER**

<b>Course I - (Hard Core – I) The Modern Age-I</b>	<b>ENB 040</b>
<b>Course II - (Hard Core-II) Literary Criticism-I</b>	<b>ENB 020</b>
<b>Course III – (Hard Core-III) Indian Writing in English – I</b>	<b>ENB 030</b>
<b>Course IV – (Hard Core-IV) 20<sup>th</sup> Century Women’s Writing: Theory &amp; Practice</b>	<b>ENB 050</b>
<b>Course V – *(Soft Core-I) Dalit Literature</b>	<b>ENB 230</b>
<b>*(Soft Core-II) English Essayists</b>	<b>ENB 220</b>

**Note: \* Soft Core Elective Courses**

### **III SEMESTER**

<b>Course I – (Hard Core-I) The Modern Age-II</b>	<b>ENC 010</b>
<b>Course II – (Hard Core-II) Indian Writing in English-II</b>	<b>ENC 020</b>
<b>Course III – (Hard Core-III) New Literatures in English</b>	<b>ENC 030</b>
<b>Course IV (Open Electives) A Course in Written and Spoken English</b>	<b>OE</b>
<b>Course V –* (Soft Core-I) Indian English Poetry After Independence</b>	<b>ENC 230</b>
<b>*(Soft Core-II) Feminism</b>	<b>ENC 220</b>

### **IV SEMESTER**

<b>Course I – (Hard Core-I) Literary Criticism-II</b>	<b>END 010</b>
<b>Course II – (Hard Core-II) American Literature</b>	<b>END 020</b>
<b>Course III – (Hard Core) Major Project Work leading to a Dissertation</b>	<b>END 030</b>
<b>Course IV – *(Soft Core I) Indian Diaspora Fiction</b>	<b>END 240</b>
<b>*(Soft Core II) African Fiction</b>	<b>END 220</b>

**Note: \* Soft Core Elective Courses**

**POSTGRADUATE DEPARTMENT OF STUDIES &  
RESEARCH IN ENGLISH**

**Choice Based Credit System & Continuous Assessment Grading Pattern Syllabus**

**MA PROGRAMME IN ENGLISH**

**2021-24**

Semester	Type of Course	Course Title	L	T	P	Credits	Credits required
<b>First Semester</b>	Hard Core	1. English Literature from Chaucer to Milton	3	1	0	4	16
		2. Elizabethan Age	3	1	0	4	
		3. 17 <sup>th</sup> and 18 <sup>th</sup> Century English Literature	3	1	0	4	
		4. 19 <sup>th</sup> Century English Literature	3	1	0	4	
	Soft Core Electives	1. Realism and Fiction	3	1	0	4	4
		2. Contemporary Indian Novels in English	3	1	0	4	
<b>Total Credits</b>							<b>20</b>
<b>Second Semester</b>	Hard Core	1. The Modern Age-I	3	1	0	4	16
		2. Literary Criticism-I	3	1	0	4	
		3. Indian Writing in English – I	3	1	0	4	
		4. 20 <sup>th</sup> Century Women’s Writing: Theory & Practice	3	1	0	4	
	Soft Core Electives	1. Dalit Literature	3	1	0	4	4
		2. English Essayists	3	1	0	4	
<b>Total Credits</b>							<b>20</b>

Semester	Type of Course	Course Title	L	T	P	Credits	Credits required
<b>Third Semester</b>	Hard Core	1. The Modern Age-II	3	1	0	4	<b>12</b>
		2. Indian Writing in English-II	3	1	0	4	
		3. New Literatures in English	3	1	0	4	
	Soft Core Electives	1. Indian English Poetry After Independence	3	1	0	4	4
		2. Feminism	3	1	0	4	
	Open Elective	1. A Course in Written and Spoken English	3	1	0	4	4
<b>Total Credits</b>							<b>20</b>
<b>Fourth Semester</b>	Hard Core	1. Literary Criticism-II	3	1	0	4	<b>12</b>
		2. American Literature	3	1	0	4	
		3. Major Project Work leading to Dissertation	0	0	4	4	
	Soft Core Electives	1. Indian Diaspora Fiction	3	1	0	4	4
		2. African Fiction	3	1	0	4	
<b>Total Credits</b>							<b>16</b>
<b>Total Credits at the end of the Course</b>							<b>76</b>

## **Programme Outcomes**

### **On graduating from this programme student is able to**

- PO1: Learn to write logically relating the real-life scenario with the issues depicted in literary texts.
- PO2: Demonstrate critical reading, writing, and thinking skills in writing analytical essays.
- PO3: Recognise and understand figurative language in literary works of various literatures.
- PO4: Equip the students to understand theoretical developments in literary studies.
- PO5: Acquire skills of criticism in reading literary works of different periods of various genres.
- PO6: Write focused, organised, well-developed text-based essays.

## **Programme Specific Outcomes**

### **On completion, the graduate of this programme is able to**

- PSO1: Acquire the competence to work as English Language teacher at Primary, Secondary, Higher secondary and Pre-University level.
- PSO2: Gain basic knowledge needed to enroll for M Phil or PhD programmes.
- PSO3: Demonstrate good communication skills.
- PSO4: Draft literary essays demonstrating the skills of critical thinking and creative writing.
- PSO5: Participate in discussions and debates demonstrating good communication skills.
- PSO6: Learn the skills to work as English language trainer.

## Course I – (HC-I) ENGLISH LITERATURE FROM CHAUCER TO MILTON

Course Code: ENA 010

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

### Course Outcomes

#### At the end of the Course, student able to

- CO1: Recognize and understand figurative language, such as allegory and metaphor, and literary techniques, such as irony, rhyme, and allusion.
- CO2: Identify the unique qualities of the authors studied, and compare and contrast them.
- CO3: Develop a well-written argument about one or more literary texts or authors, and accurately cite literary and other sources.
- CO4: Develop ability to read, summarize and critically analyse poems and sonnets of various themes.

### UNIT – I

- 1. Background – 14<sup>th</sup> Century – 1658
- 2. Renaissance, Reformation, Puritan Upsurge
- 3. Jacobean, Metaphysical School

### UNIT – II

- 1. Chaucer -- Prologue to the Canterbury Tales
- 2. John Milton – Paradise Lost: Book-I
- 3. Book of Job

### UNIT – III

- 1. Sidney: Sonnets I, V &VI (Astrophel and Stella)
- 2. Spenser: Prothalamion, Epithalamion
- 3. Surrey: 1. Love that liveth and reigneth in my thought  
2. Set me whereas the sun doth parch the green
- 4. Wyatt: 1. Who so list to hunt 2. They flee from me

### UNIT – IV

- 1. John Donne – The Goodmorrow, Song: Go and Catch a Falling Star, Death be Not Proud, At the Round Earth's Imagined Corner, Sunne Rising, Resurrection
- 2. George Herbert – The Pulley, The Collar, Virtue, Discipline
- 3. Andrew Marvell – To His Coy Mistress, Thoughts in a Garden
- 4. Robert Herrick- To the Virgins, To Find God.

### Books for Reference and Further Reading:

- 1. David Daiches – *A Critical History of English Literature*- Four volumes.
- 2. Boris Ford (Ed) - *Pelican Guide to English Literature*- Eight volumes.
- 3. Herbert Grierson - *Metaphysical Poets*.
- 4. Abrams M H et al. *The Norton Anthology of English Literature*. New York: Norton, 2006.
- 5. Al Poplaski: *English Literature in Context*.

## Course II – (HARD CORE-II) ELIZABETHAN AGE

Course Code: ENA-020

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

### Course Outcomes

#### At the end of the Course, student able to

- CO1: Understand the origin and growth of English Theatres and Renaissance plays.  
CO2: Demonstrate knowledge of Elizabethan culture, society and politics.  
CO3: Analyse Shakespearean Tragedies and Comedies in terms of language, character and Themes.  
CO4: Develop ability to read, summarize and critically analyse Shakespearean sonnets on various themes.

### UNIT – I

Background – Elizabethan Age

Elizabethan theatre and audience Shakespeare- Tragedy and Comedy

### UNIT – II

Marlowe: *Dr. Faustus*

Ben Jonson: *Volpone*

Thomas Nashe: *Dido: Queen of Carthage*

### UNIT – III

William Shakespeare: 1) *King Lear*  
2) *Julius Caesar*  
3) *As you Like It*  
4) *Tempest*

### UNIT – IV

Shakespeare's Sonnets: 18, 19, 29, 30, 33, 55, 60, 71, 73, 114, 116, 130, 131, 133

### Books for Reference and Further Reading:

1. A.C. Bradley – *Shakespearean Tragedy*
2. F R Leavis – *The Common Pursuit*
3. Wilson Knight – *The Wheel of Fire*
4. Stewart Justman – *Shakespeare: The Drama of Generations*
5. S. Vishwanathan - *Exploring Shakespeare*
6. Cleanth Brooks - *Understanding Drama*
7. Toropov - *Shakespeare for Beginners*



## Course III – (HARD CORE-III) 17<sup>th</sup> and 18<sup>th</sup> CENTURY ENGLISH LITERATURE

Course Code: ENA 030

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

### Course Outcomes

**At the end of the Course, student able to**

CO1: Apply knowledge of the historical and cultural contexts of the literature of this period to comprehend the works of major authors.

CO2: Recognize and understand figurative language, such as allegory and metaphor, and literary techniques - irony, rhyme, and allusion.

CO3: Reflect and write analytically about the literary texts and their contexts.

CO4: Develop skills of literary critical analysis reading the prescribed plays, novels and essays.

### UNIT – I

Background – Restoration, Neo-Classical, Augustan Satire, Comedy of Manners Spectator Essays

### UNIT – II

Dryden – *Absalom and Achitophel*

Alexander Pope – *The Rape of the Lock*

Bunyan – *Pilgrim's Progress Book-1*

### UNIT – III

William Congreve - *The Way of the World*

Sheridan – *The School for Scandal*

Aphra Behn- *Oroonoko (Royal Author)*

### UNIT – IV

Daniel Defoe: *Robinson Crusoe*

Jonathan Swift – *Gulliver's Travels – Book IV* (Voyage to the Land of Houyhnhnms)

Addison & Steele: Spectator Essays

Addison: (1) Sir Roger at Church, (2) Sir Roger at Assizes

Steele: (1) The Gentleman 2) The Spectator Club

### Books for Reference and Further Reading:

1. M.H. Abrams (Ed) *The Norton Anthology of English Literature* (Vol.1 & 2)
2. David Daiches – *A Critical History of English Literature* –Four volumes
3. Arnold Kettle- *The English Novel*- Two volumes
4. Ian Jack – *The Augustan Satire: Intention and Idiom in English poetry 1660-1750*
5. Pramod Nayyar (ed) – *English Poetry 1660-1780: An Anthology*

## Course IV (Hard Core – IV) – 19<sup>th</sup> CENTURY ENGLISH LITERATURE

**Course Code: ENA 40**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

### Course Outcomes

**At the end of the Course, student able to**

CO1: Understand the impact of French Revolution on Romantic and Victorian age.

CO2: Learn the issues related to Woman's Question during the period and contributions of Mary Wollstonecraft and J S Mill to this movement.

CO3: Recognize and understand the use of allegory, metaphor, irony, rhyme, rhythm, allusion in Romantic and Victorian poetry

CO4: Reflect analytical skill of understanding literary essays of Victorian philosophers.

CO5: Develop ability to read, summarize and critically analyse the novels of Jane Austen, Emily Bronte, Charles Dickens and Thomas Hardy.

### Unit I: Background:

1. French Revolution;
2. The Romantic Movement in Literature with special reference to leading Romantic poets; Influence of German Philosophy on Romanticism (Schiller and Kant)
3. Introduction to 19<sup>th</sup> Century Prose and Victorian Poetry
4. Women Question with reference to J S Mill and Mary Wollstonecraft

### Unit II: Poetry

1. William Blake: 1) Tyger; 2) London 3) The Chimney Sweeper
2. William Wordsworth: Tintern Abbey, Ode to Immortality, Lucy Poems: A Slumber Did My Spirit Seal, She Dwelt Among Untrodden Ways.
3. S T Coleridge: The Rime of the Ancient Mariner
4. P B Shelley: Ode to the West Wind; To A Skylark
5. John Keats: Ode on the Grecian Urn, Ode to Autumn
6. Robert Browning: My Last Duchess
- 4 Tennyson: Ulysses, Lotus Eaters

### Unit III: Fiction

1. Jane Austen: Emma
2. Emily Bronte: Wuthering Heights
3. Charles Dickens: Hard Times
4. Thomas Hardy: Jude the Obscure

### Unit IV: Prose

1. J. Ruskin: *Unto the Last* (Chs.1 and 2)
2. J.S. Mill: "On Liberty"
3. Mathew Arnold: Culture and Anarchy  
(Ch 1: Sweetness & Light , Ch 2: Hellenism & Hebraism)

### Books for Reference and Further Reading:

1. Russell Noyes (Ed.): *English Romantic Poetry and Prose*.
2. Harold Bloom and Lionel Trilling: *Romantic Poetry and Prose*.
3. M. Bowra: *The Romantic Imagination*.
4. William D. Templeman and Charles F. Harrold: *English Prose of the Victorian Era*.

**Any one of the soft cores to be chosen for earning 4 credits**

**PAPER- V – (SOFT CORE-I)**

**REALISM AND FICTION**

**Course Code: ENA-250**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes:**

**At the end of the Course, student able to**

CO1: Understand Realism as a literary movement and types of Realism.

CO2: Learn the narrative techniques employed by the realistic novelists.

CO3: Critically analyse the use of symbolisms in the prescribed novels.

CO4: Understand and analyse the realistic novels of British, American, and Indian writers.

CO5: Read, summarize and critically analyse the novels of Charlotte Bronte, George Eliot, William Makepeace Hawthorne, Henry James, Steinbeck, Premchand, Tagore and Kamal Markandaya.

**Unit I:**

Realism as a literary movement, Types: Social Realism, Regionalism, Kitchen Sink Realism, Naturalism and Realism, Narrative techniques, Realistic novelists

**Unit II:**

Charlotte Bronte: *Jane Eyre*

George Eliot: *Mill on the Floss*

William Makepeace Thackeray: *Vanity Fair*

**Unit III:**

Nathaniel Hawthorne: *The Scarlet Letter*

Henry James: *The Portrait of a Lady*

John Steinbeck: *The Grapes of Wrath*

**Unit IV:**

Premchand: *Nirmala*, translated into English by Alok Rai

Tagore: *The Home and the World*

Kamala Markandaya: *Nectar in a Sieve*

**Books/Texts for Reference and Further Reading:**

1. Henry James, *The Art of the Novel*, ed. R P Blackmore, 1934.
2. Percy Lubbock, *The Craft of Fiction*, 1921.
3. E M Forster, *Aspects of the Novel*, 1927.
4. Wayne C. Booth, *The Rhetoric of Fiction*, 1961.
5. Sandra Gilbert and Susan Gubar, *The Madwoman in the Attic: the Woman Writer and the Nineteenth-Century Literary Imagination*, 1979.

## **SOFT CORE II: Contemporary Indian Novels in English**

**Course Code: ENA-240**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

### **Course Outcomes**

**At the end of the Course, student able to**

- CO1. Learn to explore the thematic paradigm shift in the contemporary Indian writings.
- CO2. Appreciate the postmodern literary devices employed by the writers.
- CO3. Read and critically analyse the Indian novels published in 2000 and after.
- CO4. Develop ability to read, summarize and critically analyse various themes in the works of Anurag Mathur, Anita Desai, Vikram Seth, Shashi Deshpande, Amit Chaudhuri, Anita Nair, Upamanyu Chatterjee and Manju Kapur.

### **Unit I:**

1. Anurag Mathur: *The Inscrutable Americans* (1991)
2. Anita Desai: *Fasting, Feasting* (1999)

### **Unit II:**

1. Vikram Seth: *A Suitable Boy* (1993)
2. Shashi Deshpande: *A Matter of Time* (2000)

### **Unit III:**

1. Amit Chaudhuri: *A New World* (2000)
2. Anita Nair: *Ladies Coupe* (2001)

### **Unit IV:**

1. Upamanyu Chatterjee: *Way to Go* (2010)
2. Manju Kapur: *Custody* (2011)

**\*Note: Two lecture to introduce new themes and techniques of Contemporary Indian writing**

### **Books for Reference and Further Reading:**

1. K.R. Srinivasa Iyengar: *Indian Writing in English*, 1994.
2. Mukherjee, Meenakshi, C. Vijayshree and Vijay Kumar, eds. *The Nation Across the World: Postcolonial Literary Representations*. New York: OUP, 2008.
3. P K Dhawan and Veena Noble Das, ed. *Fiction of the Nineties*. 1990.
4. Shukla, Sheo Bhushan and Anu Shukla, ed. *The Novels of Amit Chaudhuri: An Exploration in the Alternative Tradition*, Sarup and Sons, 2012.

## II SEMESTER

### Course I – (HARD CORE-I) THE MODERN AGE- I

Course Code: ENB 040

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

#### Course Outcomes

At the end of the Course, student able to

CO1: Understand the social, political and cultural milieu of the age.

CO2: Learn the impact of World War I and II on 20<sup>th</sup> Century poetry.

CO3: Identify and analyse literary elements like rhyme, rhythm, tone, style, imagery and, symbols, etc.

CO4: Reflect the analytical skills of understanding war poetry.

#### UNIT – I

World Wars – I & II, Imagism, Surrealism, Symbolism, Free Verse, Existentialism, and Phenomenology

#### UNIT – II

G.M. Hopkins: The Wreck of Deutschland, Windhover

W.B Yeats: Sailing to Byzantium, Byzantium, Second Coming, Easter 1916

Thomas Hardy: The Darkling Thrush, The Man He Killed

Wilfred Owen: Strange Meeting, Insensibility

#### UNIT – III

T.S. Eliot – The Wasteland, The Journey of the Magi

W H Auden – In Memory of W. B. Yeats, Muse des Beaux Arts

Sylvia Plath: The Arrival of the Bee Box: Lady Lazarus

#### UNIT – IV

Dylan Thomas: After the Funeral, Fern Hill

Seamus Heaney: Tollund Man, Digging, Casualty

Philip Larkin: Church Going, Next Please

Ted Hughes: Thought Fox, Hawk Roosting

#### Books for Reference and Further Reading:

1. F. R. Leavis. *New Bearings in English Poetry*
2. Faber Book of Modern Verse
3. Norton Anthology of English Literature

## Course II (Hard Core-II) - LITERARY CRITICISM-I

Course Code: ENB 020

Credits: 4

### Course Outcomes

At the end of the Course, student able to

CO1: Learn the meaning, elements and characteristics of classical literary criticism.

CO2: Understand the basics of literary/ critical theories.

CO3: Learn the technique of early literary criticism.

CO4: Acquire the skills to interpret literary works using literary theories.

### Unit I:

Origin, growth, and development of Literary Criticism, Various Posits and Literary Contexts  
Principles of Literary and Practical Criticism

### Unit II:

1. Longinus: *On the Sublime*
2. Plato on Mimesis in *A Short History of English Literary Criticism* by Wimsatt & Brooks
3. Aristotle: *Poetics*

### Unit III:

1. Sidney: *Apology for Poetry*
2. Samuel Johnson: *Preface to Shakespeare*
3. Dryden: *On Dramatic Poesy*

### Unit IV:

1. W. Wordsworth: *Preface to Lyrical Ballads*
2. Coleridge: *Biographia Literaria* (Chapters 13, 14, 17)
3. Arnold: *The Function of Criticism at the Present Time*

### Books for Reference and Further Reading:

1. I.A. Richards. Principles of Literary Criticism
2. C.T. Indira et al. English Literary Criticism
3. M.S. Nagarajan. English Literary Criticism and Theory
4. Vernon Hall. A short history of literary criticism

**Course III – (HC-II) INDIAN WRITING IN ENGLISH – I**

**Course Code: ENB 030**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Understand the Origin and Growth of Indian English Writing.

CO2: Study different phases of Indian writing and understand their features.

CO3: Understand the social, political and cultural milieu of Pre-independent India explored in literary works.

CO4: Explore different issues in Indian Writing in English depicted in poetry, plays, novels, and essays.

**Unit I**

Anglicists and Orientalists Debates, *Macaulay's Minute*, Rajaram Mohan Roy's *Letter to Lord Amherst*, The Rise of the Indian English Novel, Novel as a Social Act.

**Unit II: Poetry**

1. Toru Dutt: Prahlad; Our Casuarina Tree;
2. R. Tagore: Gitanjali: First five and last five poems
3. Sarojini Naidu: Coromandel Fishers, Indian Weavers
4. Aurobindo: *Savitri* Canto-I

**Unit III: Drama**

1. Girish Karnad: *Hayavadana*
2. Vijay Tendulkar: *Silence! The Court is in Session*
3. Mahesh Dattani: *The Final Solution*

**Unit IV: Fiction**

1. Mulk Raj Anand: *Untouchable*
2. Raja Rao: *Kanthapura*
3. R.K. Narayan: *A Tiger for Malgudi*

**Unit IV: Criticism**

1. Hiriyanna: *Art Experience*: Indian Aesthetics (Chs. 1 and 2)
2. Ananda Coomaraswamy: "The Dance of Shiva"
3. Aurobindo: The Poets of Dawn -1&2 (From Future Poetry)

**Books/Texts for Reference and Further Reading:**

K.R. Srinivasa Iyengar: *Indian Writing in English*

C.D. Narasimhaiah: "Towards an Understanding of the Species Called Indian Writing in English"

Meenakshi Mukherjee: *The Perishable Empire* Chapter on: "The Anxiety of Indianness"

**Course IV – (HC-IV) 20<sup>th</sup> CENTURY WOMEN’S WRITING: THEORY AND PRACTICE**

**Course Code: ENB-040**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Learn history and growth of feminism as a movement, and the waves of feminism.

CO2: Understand the phrases such as Sex and Gender, women’s rights.

CO3: Explore feminist issues in the novels of Buchi Emecheta, Margaret Atwood and Mahasweta Devi.

CO4: Read and understand the feminist ideas in the works of Simone de Beauvoir, Virginia Woolf and Showalter.

CO5: Appreciate and analyse the poems of Kamala Das and Maya Angelou.

**Unit I (Background Study)**

Feminism, History of Feminism, Feminist Movements, Sex and Gender, Society and Gender, Women’s rights

**Unit II (Novel)**

Buchi Emecheta: *The Joys of Motherhood*

Mahasweta Devi: *Imaginary Maps* (A Collection of Short Stories)

Margaret Atwood: *Edible Woman*

**Unit III (Prose)**

Simone de Beauvoir: *The Second Sex*

Virginia Woolf: *A Room of One’s Own*

Showalter Elaine: “*Feminist Criticism in Wilderness*”

**Unit IV (Poetry)**

Kamala Das: *An Introduction, My Grandmother’s House, The Old Playhouse, Suicide*

Maya Angelou: *Phenomenal Woman, Caged Bird, Human Family, Women Work*

**Books for Reference and Further Reading:**

1. The Female Imagination: Patricia Mayor Spack
2. Gender Trouble: Feminism and Subversion of Identity: Judith Butler
3. The Feminine Mystique: Betty Friedan
4. Feminism and Recent Fiction in English: Sushila Singh
5. The New Feminist Criticism: Essays on Women’s Literature and Theory: Elaine Showalter
6. Sexual / Textual Politics: Toril Moi



**Any one of the soft cores to be chosen for earning 4 credits**

**Course IV – (SOFT CORE-II) DALIT LITERATURE**

**Course Code: ENB-230**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Understand the origin and growth of Dalit literature in India.

CO2: Understand the sufferings of marginalised in Dalit writings.

CO3: Compare and analyse the life of oppressed in the works various languages translated into English like Kannada, Gujarathi, Punjabi, Tamil and Telugu.

CO4: Compare and analyse the different forms of Dalit Literature based on different experiences.

**UNIT I: Introduction to Dalit Literature**

**Essays:**

1. Movements of Dalit identity- K C Das
2. Indian Dalits (Introduction- Sharankumar Limbale. (Dalit Literature and Aesthetics)
3. Dalit Literature- B Krishnappa (The Exercise of Freedom)
4. We Too Are Human-B R Ambedkar (The Exercise of Freedom)

**Unit II: Poetry**

1. H Govindaiah. "In The Soil of Tears" and "A Letter to Father Searching For Me"
2. Challapalli Swaroopa Rani: "Water" and "Forbidden Theory"
3. Sukirtharani: "Paraia God" and "Untitled Poem"
4. Jyoti Lanjewar: "Cave" and "Mother"
5. Gurudas Alam: "For Freedom" and "Treatment of Untouchables" (From The *Core Of Untouchable's*)
6. Bipin Gohel: "To The Fading Man I Sing" and "To A Poet At Mushaira"

**Unit III: Short Stories**

1. Devanoora Mahadeva: "Odallala"
2. Pathik Parmar : "Naked Feet"
3. M.M. Vinodini: "The Parable of Lost Daughter –Luke15"

**Unit IV: Autobiographies**

1. Dr. Siddalingaiah – "Ooru Keri-I"
2. Urmila Pawar – "The Weave of My Life: A Dalit Woman's Memoirs"
3. Bama Faustina- "Karukku"

**Books for Reference and Further Reading:**

- D.R. Nagaraj *The Flaming Feet*  
Eleanor Zelliott *From Untouchable To Dalit*  
Mulik Raj Anand *Apology For Heroism*  
Arjun Dangle *Poisoned Bread*  
Encyclopedia of Dalits in India: Literature  
Sathyanarayana: *The Exercise of Freedom*  
K. Singh: *Dalitism and Feminism: Locating Woman in Dalit Literature*

## (SOFT CORE-II) ENGLISH ESSAYISTS

**Course Code: ENB-220**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

### **Course Outcomes**

**At the end of the Course, student able to**

CO1: Understand the genre of prose essays and appreciate the essayist's artistic statements.

CO2: Learn to appreciate the literary devices employed by the essayists.

CO3: Understand the importance of essays as a genre to bring social change based on close reading of the essayist's observations on society.

CO4: Appreciate and analyse the views in Bacon, Hazlitt, Charles Lamb, Bertrand Russell, Mathew Arnold and Orwell's essays.

### **Unit I**

General Introduction to Essay as a genre of literary art, Notable Essayists of British Literature

### **Unit II**

1. Francis Bacon:     a) Of Studies  
                              b) Of Ambition
  
2. Hazlitt:             a) On Going a Journey  
                              b) On the Ignorance of the Learned

### **Unit III**

3. Charles Lamb:     a) Poor Relations  
                              b) Chimney Sweepers
  
4. Bertrand Russell: a) Behaviorism and Values  
                              b) Freedom versus Authority in Education

### **Unit IV**

5. Mathew Arnold:    a) Wordsworth  
                              b) John Keats
  
6. George Orwell:    a) Charles Dickens  
                              b) Politics and English Language

### **Books/Texts for Reference and Further Reading:**

1. The English Critical Tradition: An Anthology of English Literary Criticism, Vol-2, Edited by S. Ramaswamy & V.S. Sethuraman
2. Wimsatt and Brook, Literary Criticism: A Short History
3. G. Tillostone, Criticism and the Nineteenth Century

### III SEMESTER

#### Course I – (HARD CORE-I) THE MODERN AGE – II

Course Code: ENC 010

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

#### Course Outcomes

##### At the end of the Course, student able to

CO1: Understand the social, political and cultural milieu of the age.

CO2: Learn and analyse the impact of World War I and II on 20<sup>th</sup> Century fiction.

CO3: Appreciate the use of various literary devices and postmodern techniques such as Stream of Consciousness, Dark Humour in modern writings.

CO4: Understand and write about the new theatres evolved in modern age.

#### UNIT – I

Post-World War Scenario, Twentieth Century Social Milieu, Twentieth Century Theatre, Twentieth Century Novel, Great Economic Depression, Stream of Consciousness, Postmodernism

#### UNIT – II

DH Lawrence: *The Rainbow*

Virginia Woolf: *To the Lighthouse*

E.M. Forster: *A Passage to India*

Doris Lessing: *The Golden Notebook*

#### UNIT – III

Samuel Beckett- *Waiting for Godot*

John Osborne: *Look Back in Anger*

#### UNIT – IV

Virginia Woolf: “On Modern Fiction”

George Lukacs: “The Meaning of Contemporary Realism” (chapters on Kafka & Modernist Fiction)

Raymond Williams: “When was Modernity”

#### Books for Reference and Further Reading:

1. Norton Anthology of English Literature

2. Vasudevan. *Perspectives: Selection from Modern English Prose and Fiction*

## Course II – (HARD CORE-II) INDIAN WRITING IN ENGLISH - II

Course Code: ENC 020

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

### Course Outcomes

#### At the end of the Course, student able to

CO1: Understand characteristic features of post-independent Indian Writing in English.

CO2: Read, compare and critically analyse essays of Indian critics.

CO3: Describe the Indianness in Indian Writing in English.

CO4: Write about the use of various literary devices by Indian writers, such as Arundati Roy, Amitav Ghosh, Shanta Gokhale and RK Narayan.

### UNIT – I

Colonization and its aftermath, Culture Vs Modernity: The Indian Context, The Modern Indian Psyche vis a vis Indian Writing in English and in Translation,

### UNIT – II

1. Arundhati Roy: *God of Small Things*
2. Amitav Ghosh: *Shadow Lines*
3. Jahnvi Barua: *Next Door*

### UNIT – III

1. M. K. Gandhi: *My Experiments with Truth*
2. Shanta Gokhale: *One Foot on the Ground*
3. R K Narayan: *My Days*

### UNIT – IV

1. Gayathri Spivak: “Can the Subaltern Speak?”
2. Meenakshi Mukherjee: “The Anxiety of Indianness”
3. Aijaz Ahamed: *In Theory (Chapter 8 on Indian Literature)*

### Books for Reference and Further Reading:

1. K R Srinivasa Iyengar – *Indian Writing in English*
2. M. K Naik – *Critical Essays in Indian Writing in English*
3. Ramakrishnan E V- *Locating Indian Literature*
4. A K Mehrotra (ed): *A Concise History of Indian Literature in English,*
5. Saleem Peeradina (ed): *Contemporary Indian Poetry in English*
6. Makarand Paranjape (ed): *Indian Poetry in English*
7. Girish Karnad – *Fire and Rain*

## Course III – (HARD CORE-III) NEW LITERATURES IN ENGLISH

Course Code: ENC 030

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

### Course Outcomes

**At the end of the Course, student able to**

CO1: Learn the emergence of New Literatures from Commonwealth literature.

CO2: Learn the thematic concerns in New Literatures.

CO3 Read and analyse the cultural conflict in New literatures such as African, Australian, Canadian and Caribbean and the impact of colonisation on native cultures.

CO4: Write focused analytical essays on the novels of Chinua Achebe, Wole Soyinka, Alice Munro, Patrick White, and V S Naipaul.

CO5: Appreciate the use of various literary devices in the poetry of Dennis Brutus, David Diop, AJM Smith, Judith Wright, Derek Walcott, and Braithwaite.

CO6: Learn and write critical analysis on the essays of Ngugi, Northrop Frye and Wilson Harris.

### UNIT 1

Philosophy and Aesthetics of Commonwealth Literature, paradigm shifts from commonwealth to New Literatures

### UNIT II- African Literature

Chinua Achebe: *A Man of the People*

Ngugi Wa Thiong'o: *Homecoming* Part-II (a) The Writer and His Past (b) The Writer in a Changing Society

Wole Soyinka: *The Lion and the Jewel*

Denis Brutus: If This Life is All That We Have, I am the tree...

*I must conjure from my Past*

2) David Diop: *Africa, Vultures*

3) Gabriel Okara: *Piano and Drums, Once Upon A Time*

### UNIT III- Canadian and Australian Literature

Alice Munro: *Lives of Girls and Women*

Northrop Frye: "Conclusion" to *Literary History of Canada*

AJM Smith: *The Lonely Land* E.J. Pratt: *The Dying Eagle*

Patrick White: *Voss*

Judith Wright: *Preoccupations in Australian Poetry* (Chapter 13 on A.D. Hope)

Judith Wright: *Woman to Man, A.D. Hope: Australia*

### UNIT- IV- Caribbean Literature

V S Naipaul: *Guerrillas*

Wilson Harris: *Tradition and the West Indian Novel*

Derek Walcott: *Almond Trees, A Far Cry from Africa*

Braithwaite: *Starvation, Caliban*

### Books/Texts for Reference and Further Reading:

1. Anna Rutherford. Commonwealth
2. Oxford Companion to Canadian Literature
3. Macaulay. *A Map of Australian Verse*
4. Arnold. *Companion to Postcolonial Literature*
5. Helen Tiffin et al. *The Empire Writes Back*

**Any one of the soft cores to be chosen for earning 4 credits**

**Course IV – (SOFT CORE-I) INDIAN ENGLISH POETRY AFTER INDEPENDENCE**

**Course Code: ENC 230**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Learn and appreciate the use of Indianness in the modern Indian poetry.

CO2: Analyse the themes, imagery, symbolism in the poems of Ezekiel, Ramanujan, Daruwalla, de Souza, Mahapatra, Parthasarathy, Anita Nair and Vikram Seth.

CO3: Understand and appreciate the human values and human predicament in modern Indian poetry.

CO4: Analyse the trend setting themes explored in contemporary Indian poetry.

**Unit-I**

1. **Nissim Ezekiel:** Night of the Scorpion; Enterprise  
Urban; Poet, Lover, Birdwatcher
2. **A K Ramanujan:** Obituary, A River  
Love Poem for a Wife II, Small Reflections on a Great House

**Unit II**

3. **Keki N Daruwalla:** Death of a Bird, The Mistress, The Ghaghra in Spate
4. **Eunice de Souza:** Bequest, Advice to Women, Women in Dutch Paintings,  
Feeding the Poor on Christmas

**Unit III**

5. **Jayanta Mahapatra:** Hunger, Freedom, Grandfather, Dhauli
6. **R Parthasarathy:** Rough Passage: a. Exile b. Trial c. Homecoming

**Unit IV**

7. **Anita Nair:** Happenings On the London Underground, The Last Rites  
Hello Lust How Men Eat
8. **Vikram Seth:** How rarely all these few years, From California, The Wind

**\*Note:** Two lectures to introduce new themes and techniques of recent Indian poetry in English

**Books/Texts for Reference and Further Reading:**

1. King Bruce (ed): *Modern Indian Poetry in English*
2. *The Oxford Anthology of Modern Indian Poetry*
3. Saleem Peeradina (ed): *Contemporary Indian Poetry*
4. Zenia Mitra (ed): *Indian Poetry in English: Critical Essays*
5. R. Parthasarathy (ed): *Ten Twentieth Century Indian Poets*

**Course V – (SOFT CORE-II) FEMINISM**

**Course Code: ENC 220**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Analyse the texts critically and write the main ideas given in the prescribed texts.

CO2: Write logically the feelings expressed by the feminists.

CO3: Learn to appreciate the literary theories employed by the feminists to bring gender justice in the society and in literary representation.

CO4: Analyse the critical ideas expressed by Shoshona Felman, Elaine Showalter, Toril Moi and Susie Tharu in their prescribed essays or prose works.

**1. Shoshona Felman: "Women and Madness: The Critical Fallacy"**

**2. Elaine Showalter: "The Female Tradition"**

**3. Toril Moi: Feminist, Female, Feminine**

**4. Susie Tharu: Problems for a Contemporary Theory of Gender**

**Books for Reference and Further Reading:**

The Female Imagination: Patricia Mayor Spack

Gender Trouble: Feminism and Subversion of Identity: Judith Butler

The Feminine Mystique: Betty Friedan

Feminism and Recent Fiction in English: Sushila Singh

The New Feminist Criticism: Essays on Women's Literature and Theory: Elaine Showalter

Sexual / Textual Politics: Toril Moi

**OPEN ELECTIVES COURSE**  
**A COURSE ON WRITTEN AND SPOKEN ENGLISH**

**Dept. code 570**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Learn the correct use of parts of speech and English grammar.

CO2: Understand grammar rules and apply them in conversation and communication.

CO3: Write effectively describing impressions, feelings and experiences.

CO4: Talk about familiar topics and give explanations and reasons for opinions, past actions and future plans.

CO5: Understand comprehension passages and answer the implied questions rightly.

### **UNIT I**

#### **Basic Grammar**

##### **Definition of Parts of Speech and correct usage**

1. Noun
2. Pronoun
3. Adjectives: Degrees of comparison and correct usage.
4. Verb, Tenses: Present, Past and Future and their correct usage.
5. Adverb: Kinds of Adverbs and their correct usage
6. Conjunction
7. Preposition
8. Articles
9. Active and Passive voice
10. Direct and Indirect Speech
11. Punctuation

### **UNIT II**

**Oral communication** is the ability to explain and present one's ideas in clear English, to diverse audiences; speaking effectively, Effective **Listening** and **Reading skills** to be taught.

Short and long conversation involving two or more people: Greeting, introducing, making an enquiry, casual/formal telephone conversation, Conversation at the bank, at the department store, at the post office, at the doctor's, at the travel agent, at the railway station/bus stop etc.

Informal conversation between friends.

**Reading Skills** with a focus on Idioms, Phrases, Antonyms, Homophones, Homonyms and Figures of Speech

### **Unit-III**

**Written communication:** The ability to write effectively in a range of contexts and for different audiences and purposes, with a good command of the English language is taught.

#### 1. Letter Writing:

Personal letters

Leave note

Application for a job

Letter to the editor



- Letters of complaints  
Placing orders  
2. Precise Writing  
3. Short Essay writing

#### **Unit - IV**

#### **Writing skills to be taught through:**

- A. Guided Composition  
B. Expansion of an Idea/ Proverb  
C. Comprehension

Comprehension of Poetry/ Prose/ Short Story/ Essay of selected texts

- Comprehension of Poetry:** 1. Robert Frost: **Stopping by Woods on a Snowy Evening**  
2. Wole Soyinka: **Telephone Conversation**

**Comprehension of Prose:** Radhakrishnan: **Humanities V/S Science**

**Comprehension of Short Story:** Maxim Gorky: **One Autumn Night**

#### **Books for Reference and Further Reading:**

1. Sidney Green Baum, The Oxford English Grammar, Oxford University Press,
2. Cowie, A.P. & R. Macklin, Oxford Dictionary of Phrasal verbs, Oxford University Press,
3. Cowie, A.P. & R. Macklin & I.R. Mc Caig, Oxford Dictionary of Phrasal English Idioms, Oxford University Press,
4. Stuart Redman, English Vocabulary in Use pre-intermediate and intermediate; low price editions, Oxford University Press,
5. Rosemary T., Fruehling & Joan M. Lacombe, Communication for Results, A.I.T.B.S. Publishers and Distributors,
6. How to write and speak better, Reader's Digest
7. Modern Grammar with Practical Exercises, Vikas Publishing House Pvt. Ltd.

## IV SEMESTER

### Course I – (HARD CORE-I) LITERARY CRITICISM-II

Course Code: END 010

Credits: 4

Teaching Hours: 60 (4 Hours/Week)

#### Course Outcomes

At the end of the Course, student able to

CO1: Learn the meaning, elements and characteristics of contemporary literary criticism.

CO2: Writes the essays using the skills of literary critical analysis.

CO3: Learn to write analytical essays on the literary texts of the prescribed critics.

CO4: Articulate and discuss the latest developments in the specific field of practice of literary theories.

#### Unit I

Russian Formalism, Psychoanalysis, Structuralism, Deconstruction, Post colonialism, Phenomenology and certain other forms of Hermeneutics. The Archetypes of Literature“ Marx, Nietzsche, Freud, Gramsci

#### Unit II:

1. T.S. Eliot: Tradition and Individual Talent
2. F.R. Leavis: Literature and Society, Tragedy and the Medium (From The Common Pursuit)
3. Carl Jung: “Psychology and Literature”

#### Unit III:

1. Northrop Frye: Architypes of Literature
2. G. Genette: “Structuralism and Literary Criticism
3. J. Derrida: “Structure, Sign and Play in the Discourse of Human Sciences”

#### Unit IV:

1. Elaine Showalter: Towards a Feminist Poetics
2. Helene Cixous: The Laugh of the Medusa
3. Sara Suleri: Woman Skin Deep: Feminism and Postcolonial Condition

#### Books for Reference and Further Reading:

Eagleton, Terry: *Theory – An Introduction*

Selden, Raman: *A Reader’s Guide to Contemporary Literary Theory* Belsey, Catherine.

*Critical Practice:* Culler, Jonathan.

*Structuralist Poetics: Structuralism, Linguistics and the Study of Literature* Newton,

K.M. *Twentieth Century Literary Theory: A Reader*

**Course II – (HARD CORE-II) AMERICAN LITERATURE**

**Course Code: END 020**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Understand the significance of Renaissance, Transcendentalism and journey metaphor in American literature.

CO2: Appreciate and analyse the poems of Emily Dickinson, Wallace Stevens, Walt Whitman and Robert Frost.

CO3: Understand and write critically about the themes, narrative techniques, character analysis in the novels of Mark Twain, Douglas, Toni Morrison and Ray Bradbury.

CO4: Acquire the ability to understand and explore the human condition in the plays of Arthur Miller, Eugene O'Neill and Edward Albee.

**UNIT –I**

American Renaissance, Journey as Metaphor, Westward Movement, Transcendentalism

**UNIT – II**

Emerson: American Scholar

Thoreau: Walden (Chapters on Economy & Where I Lived and What I Lived For)

Emily Dickinson: Because I Could Not Stop for Death, The Soul Selects her Own Society  
I Heard a Fly Buzz

Wallace Stevens: Emperor of Ice-Cream, Anecdote of The Jar

Walt Whitman: When Lilacs Last in the Dooryard Bloomed, A Noiseless Patient Spider,

Robert Frost: Mending Wall, The Road Not Taken, Birches

**UNIT III**

Mark Twain: Huckleberry Finn

Fredrick Douglas: Narrative of the Life of an American Slave

Toni Morrison: The Bluest Eye

Ray Bradbury: Fahrenheit 451

**UNIT – IV**

Arthur Miller: Death of a Salesman

Eugene O'Neill: The Hairy Ape

Edward Albee: The Zoo Story

**Books for Reference and Further Reading:**

Norton Anthology of American Literature

Richard J Gray. *A History of American Literature*

The Cambridge History of American Literature. Vol. 1 to 4

**Any one of the soft cores to be chosen for earning 4 credits**

**COURSE - III: SOFTCORE Elective I: INDIAN DIASPORA FICTION**

**Course Code: END 240**

**Credits: 4**

**Course Outcomes:**

**At the end of the Course, student able to**  
**Course Outcomes**

CO1: Learn the background of Diaspora Literature & major themes of Diaspora Literature

CO2: Compare and Contrast authors' treatment of themes, characters, subject matter etc.

CO3: Identify and analyse literary elements like plot, setting, tone, point of view, style, image, symbols, etc.

CO4: Trace the role of partition, corruption, fantasy, migration, etc. and psychological aspects behind human behaviour in the novels prescribed.

**Unit I:**

1. Salman Rushdie: *Midnight Children*
2. Tanuja Desai Hidier: *Born Confused*

**Unit II:**

1. Jhumpa Lahiri: *The Namesake*
2. Chitra Banerjee Divakaruni: *The Mistress of Spices*

**Unit III:**

1. Kiran Desai: *Inheritance of Loss*
2. Rohinton Mistry: *A Fine Balance*

**Unit IV:**

1. Aravind Adiga: *White Tiger*
2. Hari Kunzru: *Gods without Men*

**\*Note: Two lectures to introduce India Diaspora**

**Books for Reference and Further Reading:**

1. Avtar Brah. *Cartographies of Diaspora: Contesting Identities*. London: Routledge, 1996.
2. Homi K. Bhabha. *The Location of Culture*, 1994.
3. Edward W. Said. *Orientalism*. New Delhi: Penguin, 2001.

**COURSE - III (SOFTCORE Elective-II) AFRICAN FICTION**

**Course Code: END-230**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Learn the social, political and cultural milieu of the African society represented in fiction.

CO2: Understand and write critical essays on contemporary African novels such as *Anthills of the Savannah*, *Purple Hibiscus*, *The Bride Price* and *Changes: A Love Story*.

CO3: Articulate and discuss the latest developments in the specific fields of postcolonial African writings to bring gender justice in the society.

CO4: Write critically on the role of the characters in the novels of Achebe, Adichie, Emecheta and Aidoo.

**Unit I:** Chinua Achebe: *Anthills of the Savannah*

**Unit II:** Chimamanda Adichie Ngozi: *Purple Hibiscus*

**Unit III:** Buchi Emecheta: *The Bride Price*

**Unit IV:** Ama Ata Aidoo: *Changes: A Love Story*

**Suggested Reading:**

1. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. New York: Routledge, 1990.
2. Ogundipe-Leslie, Omolara. *Re-Creating Ourselves African Women and Critical Transformations*. Trenton, NJ: Africa World P, 1994.
3. Palmer, Eustace (ed.). *An Introduction to the African Novel. A Critical Study of Twelve Books*. London: Heinemann, 1979.
4. Ashcroft, Bill. *Post-Colonial Transformation*. London and New York: Routledge, 2001.
5. Ashcroft, Bill, Gareth Griffiths, and Helen Tiffin. Eds. *The Post-Colonial Studies Reader*. London and New York: Routledge, 2002.

**Course – IV – (HARDCORE - III) Major Project Work Leading to a Dissertation**

**Course Code: END 030**

**Credits: 4**

**Teaching Hours: 60 (4 Hours/Week)**

**Course Outcomes**

**At the end of the Course, student able to**

CO1: Learn to investigate the area of topic chosen for project work in detail.

CO2: Learn research skills and demonstrate scholarly expertise in exploring the subject to prepare the dissertation for the project work.

CO3: Learn the skills of research analysis in writing thesis.

CO4: Able to think logically and relate the issues and findings to real life scenario.

Students will be encouraged to undertake a major project work in disciplines related to literature of contemporary interest.

Suggested Areas:

Folklore

Performing Arts

Popular Culture

Gender and Sexuality

Dalit and Subaltern Discourses

Media Studies

World Literatures in English

General Survey of Poetic Works of Classical Writers

General Survey of Poetic Works of Modern Writers

The distribution of marks for The Project Work will be as per the stipulations laid down by the university.

## SOFTCORES OFFERED

1. Cross Cultural Women Writers
2. Caribbean Literature
3. Novels of Childhood
4. Indian Classics in Translation
5. Folklore and Literature-I
6. Folklore and Drama
7. Myth and Drama-I
8. Myth and Drama-II
9. Cultural Theory
10. Canada and the World
11. Feminist Theory-I
12. Australian Poetry
13. Folk Epics of Karnataka
14. Postcolonial Theory
15. Writers from African Diaspora
16. Canadian Science Fiction by Women
17. Theories on Culture: An Introduction
18. Postcolonial Criticism
19. Travel Literature
20. Popular Culture and Censorship
21. Adventure Novels
22. Novels and Metropolis
23. Short Fictions of Russia and USA
24. Contemporary Indian Novels in English
25. Translations
26. Dalit Literature-I
27. Recent Indian Poetry in English
28. Dalit Literature-II
29. Women Writings from the Margins
30. English Essayists
31. Post 1990 Indian Women Narratives
32. Indian Novels in English: 2000 and after
33. Twentieth Century Indian Poets in English
34. Contemporary Indian Regional Poetry in English Translation
35. Realism and Fiction
36. Indian Women Novelists
37. African Fiction in English
38. Jewish American Fiction
39. Introduction to Canadian Literature
40. South Asian Immigrant Literature in Canada
41. Introduction to Australian Literature.
42. Feminist Theory-II
43. Indian Classics in Translation
44. Shakespeare Criticism
45. Literature and Popular Culture
46. Postcolonial African Fiction
47. Arab Women Short Stories
48. Indian Diaspora Fiction

**POSTGRADUATE DEPARTMENT OF ENGLISH**  
**Question Paper Pattern**

**END SEMESTER EXAM (C 3)**

**Course Code      Title of the Course (HC/ SC)**

Max Marks: 70

Time: 3 Hours

**Instruction:** Answer all sections.

SECTION – I

I. Answer the following questions in **one or two** sentences

10X1= 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

SECTION-II (from Unit-I)

II. Answer any one of the following.

1x15=15

- 1.
- 2.
- 3.

SECTION-III (from Unit-II)

III. Answer any one of the following.

1x15=15

- 1.
- 2.
- 3.

SECTION-IV (from Unit-III)

IV. Answer any one of the following.

1x15=15

- 1.
- 2.
- 3.

SECTION-V (from Unit-IV)

V. Answer any one of the following.

1x15=15

- 1.
- 2.
- 3.



## Credit Matrix, Course of Study and Scheme of Examination for M.Sc. Degree Programme in Biochemistry

(With effect from 2021-22)

**Programme Code: BIC**

Course Type	Credits to be earned				Total Credits
	I Semester	II Semester	III Semester	IV Semester	
Hard Core Course	12	12	12	16	<b>52</b>
Soft Core Course	08	08	04	–	<b>20</b>
Open Elective Course*	–	–	04	–	<b>04</b>
<b>Semester Total</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>16</b>	<b>76</b>

\*An Open Elective course offered by PG Dept. of Biochemistry to the students of other Depts.

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
<b>Semester – I</b>				
BCA040	HC	Analytical Biochemistry–I	3:1:0	4
BCA050	HC	Chemistry and Metabolism of Proteins and Nucleic Acids	3:1:0	4
BCA060	HC	Experiments in Biochemical Techniques and Enzymology** and Seminar	0:0:4	4
BCA230	SC	Enzymology	3:1:0	4
BCA250	<b>Choose any ONE from the following</b>		3:1:0	4
	SC	(i) Chemical Principles and Biochemical Reactions (ii) Plant Biochemistry (iii) Microbial Biochemistry		
<b>Semester Total Credits</b>				<b>20</b>

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
<b>Semester – II</b>				
BCB040	HC	Analytical Biochemistry–II	3:1:0	4
BCB050	HC	Chemistry and Metabolism of Carbohydrates and Lipids	3:1:0	4
BCB060	HC	Experiments in Immunology and Biochemical Estimations** and Seminar	0:0:4	4
BCB250	SC	Immunology and Microbiology	3:1:0	4
BCB260	<b>Choose any ONE from the following</b>		3:1:0	4
	SC	(i) Human Physiology and Nutrition (ii) Research Methodology and Biostatistics (iii) Clinical Research Methods and Industrial Biochemistry		
<b>Semester Total Credits</b>				<b>20</b>

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
<b>Semester – III</b>				
BCC070	HC	Cell Biology, Endocrinology and Cell Signaling	3:1:0	4
BCC050	HC	Clinical Biochemistry	3:1:0	4
BCC060	HC	Experiments in Clinical Biochemistry and Molecular Biology** and Research Paper Presentation	0:0:4	4
BCC220	<b>Choose any ONE from the following</b>		4:0:0	4
	SC	(i) Genomics, Proteomics and Bioinformatics (ii) Biotechnology and Research Methodology (iii) Pharmaceutical Biochemistry		
BCC630	OE	Nutrition and Health	4:0:0	4
<b>Semester Total Credits</b>				<b>20</b>

Course Code	Course Type	Course Title	Credit Pattern (L:T:P)	Credits
<b>Semester – IV</b>				
BCD010	HC	Molecular Biology and Gene Regulation	3:1:0	4
BCD070	HC	Genetics and Genetic Engineering	3:1:0	4
BCD060	HC	Project Work OR Dissertation***	0:4:4	8*
<b>Semester Total Credits</b>				<b>16</b>
<b>Total CREDITS to be earned for M.Sc. BIOCHEMISTRY</b>				<b>76</b>

\* Grade Point will be calculated with respect to the allotted credits

HC	Hard Core Course
SC	Soft Core Course
OE	Open Elective Course
C1	Component 1 of Internal Assessment (IA)
C2	Component 2 of Internal Assessment (IA)
C3	Component 3 (Semester-end Exam)
L	Lecture (1 Credit=1 hr)
T	Tutorial (1 Credit=2 hrs)
P	Practical (1 Credit=2 hrs)

\*\* Weekly Four hrs of practical for Two days

\*\*\* Project work OR Dissertation should be in-house only and may be allotted to the students in the 2<sup>nd</sup>/3<sup>rd</sup> semester

Note: Two Practical examinations of four hrs duration each for C3 (component 3) of Hardcore Course with Practical Component Only.

## SCHEME OF ASSESSMENT

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
<b>Semester - I</b>							
BCA040	HC	Analytical Biochemistry–I	3	15	15	70	100
BCA050	HC	Chemistry and Metabolism of Proteins and Nucleic Acids	3	15	15	70	100
BCA060	HC	Experiments in Biochemical Techniques and Enzymology ** and Seminar	4	15	15	70	100
BCA230	SC	Enzymology	3	15	15	70	100
BCA250	<b>Choose any ONE from the following</b>		3	15	15	70	100
	SC	(i) Chemical Principles and Biochemical Reactions (ii) Plant Biochemistry (iii) Microbial Biochemistry					
<b>Semester Total Marks</b>							<b>500</b>

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
<b>Semester - II</b>							
BCB040	HC	Analytical Biochemistry–II	3	15	15	70	100
BCB050	HC	Chemistry and Metabolism of Carbohydrates and Lipids	3	15	15	70	100
BCB060	HC	Experiments in Immunology and Biochemical Estimations** and Seminar	4	15	15	70	100
BCB250	SC	Immunology and Microbiology	3	15	15	70	100
BCB260	<b>Choose any ONE from the following</b>		3	15	15	70	100
	SC	(i) Human Physiology and Nutrition (ii) Research Methodology and Biostatistics (iii) Clinical Research Methods and Industrial Biochemistry					
<b>Semester Total Marks</b>							<b>500</b>

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
<b>Semester - III</b>							
BCC070	HC	Cell Biology, Endocrinology and Cell Signaling	3	15	15	70	100
BCC050	HC	Clinical Biochemistry	3	15	15	70	100
BCC060	HC	Experiments in Clinical Biochemistry and Molecular Biology** and Research Paper Presentation	4	15	15	70	100
<b>Choose any ONE from the following</b>							
BCC220	SC	(i) Genomics, Proteomics and Bioinformatics	3	15	15	70	100
		(ii) Biotechnology and Research Methodology					
		(iii) Pharmaceutical Biochemistry					
BCC630	OE	Nutrition and Health	3	15	15	70	100
<b>Semester Total Marks</b>							<b>500</b>

Course Code	Course Type	Course Title	Exam Hrs	Max. Marks			
				IA		Exam C3	Total
				C1*	C2*		
<b>Semester - IV</b>							
BCD010	HC	Molecular Biology and Gene Regulation	3	15	15	70	100
BCD070	HC	Genetics and Genetic Engineering	3	15	15	70	100
BCD060	HC	Project Work OR Dissertation***	–	15	15	70	100
<b>Semester Total Marks</b>							<b>300</b>

- C1 & C2 Internal test will be conducted for 20 marks (if MCQs are used as assessment pattern, then there will be 30 MCQs carrying one mark each conducted through LMS of one hour duration and in both the cases the scored marks is reduced to 10 marks and 5 marks for continuous assessment is added, making a total of 15 marks each for C1 and C2.
- Continuous assessment comprise of assignments, group discussions, seminars and tutorials
- \*\* The Project evaluation is as below
  - Component 1 (C1): Periodic Progress Report (15%)
  - Component 2 (C2): Periodic Progress Report (15%)
  - Component 3 (C3): Final Viva-Voce and Evaluation (70%)
  - (The report evaluation is for 40% and the Viva-Voce examination is for 30%)

**Program Outcome(s):**

**PO1:** Provides with the necessary knowledge and skills to undertake a career in research, either in industry or in an academic setting

**PO2:** Provides the breadth and depth of scientific knowledge in Biochemistry and allied areas

**PO3:** Equips to apply for a PhD or to gain employment in biochemistry and allied areas

**PO4:** Provides a substantial element of hands-on research experience, with enhanced experimental skills

**PO5:** Demonstrates detailed knowledge and understanding of the principles and theories of biochemistry

**PO6:** Helps to understand the principle techniques of biomolecular structural characterization, including spectroscopy

**Program Specific Outcome(s):** The Specific Outcome of this programme is to train and provide the candidate with knowledge related to

**PSO1:** Global level research opportunities to pursue PhD programme targeted approach of CSIR-NET examination

**PSO2:** Enormous job opportunities at all level of chemical, pharmaceutical, food products, life oriented material industries

**PSO3:** Specific placements in R&D and quality control or analysis division of nutraceutical, pharmaceutical industries and allied division

<b>Course Code</b>	<b>Title of the Course</b>	<b>Credits</b>
<b>BCA040</b>	<b>ANALYTICAL BIOCHEMISTRY–I</b>	<b>4</b>

**COURSE OUTCOME(S):**

- CO1 Specify in depth cell fractionation techniques
- CO2 Write down in details with application, if applicable, chromatography and spectroscopy
- CO3 Write down in details with application, if applicable, principle and applications of electrophoresis
- CO4 Understand the classification and characteristics of centrifugation and microscopy

		<b>No. of Lectures</b>
<b>Unit I:</b>		<b>08</b>
<b>1.1</b>	<b>Cell Fractionation</b>	
1.1.1	<u>Cell fractionation techniques</u> : Preparation of extracts for biochemical investigations. Physico-chemical properties of solvents, solubility and miscibility, salting-in and salting-out.	
1.1.2	Choice of solvent for solvent extraction, mixed solvents, solid phase extraction. Cell lysis, dialysis, precipitation and ultra filtration.	

<b>Unit II:</b>		<b>14</b>
<b>2.1</b>	<b>Chromatography and Spectroscopy</b>	
2.1.1	Adsorption <u>vs.</u> Partition chromatography. Paper, TLC, Ion exchange, Reverse phase, Gel filtration, Affinity, HPLC, and Gas chromatographic techniques.	
2.1.2	Beer-Lamberts Law, Its verifications and Deviations, Concept of Absorptions, Transmission, Scattering, Phosphorescence, Fluorescence, Luminescence, Diffraction Spectra.	
2.1.3	Principle, instrumentation, working and applications of-UV and Visible Spectroscopy,	
2.1.4	Turbidometry and Nephelometry.	

<b>Unit III:</b>		<b>12</b>
<b>3.1</b>	<b>Electrophoresis</b>	
3.1.1	Theory of electrophoresis, continuous and discontinuous PAGE, SDS-PAGE.	
3.1.2	Other electrophoretic methods-Isoelectric focusing, 2-dimensional gel electrophoresis, Capillary electrophoresis and PFGE.	
3.1.3	Agarose gel electrophoresis of nucleic acids. Isotachopheresis.	
3.1.4	Separation of proteins, lipoproteins, visualizing separated	

	components–staining, fluorescence, PAS staining, zymogram and reverse zymogram,	
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<b>Unit IV:</b>		
<b>4.1</b>	<b>Centrifugation and Microscopy</b>	
4.1.1	Analytical and Preparative Ultracentrifuge–Principle, instrumentation and applications.	<b>14</b>
4.1.2	Analysis of subcellular fractions, marker enzymes and determination of relative molecular mass–Svedberg's constant, sedimentation velocity and sedimentation equilibrium.	
4.1.3	Theories of Tissue Fixation and Staining Techniques. Principles of Transmission and Scanning Electron Microscopy.	
4.1.4	Principles of Phase Contrast and Fluorescence Microscopy, Confocal Microscopy	

#### References

- [1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011)
- [2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).
- [3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).
- [4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),
- [5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)
- [6] Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work Vol. I & II, North Holland, (1969).
- [7] Basic Mathematics for Biochemists; Cornish Bowden, Oxford University Press (1998),.
- [8] Biophysical Tools for Biologists *In Vivo* Techniques; John Correia H. Detrich, III Elsevier (2008).
- [9] Practical Biochemistry by Keith Wilson and Walker 5th ed. Cambridge.
- [10] Biophysical chemistry, Upadhyaya, A., Upadhyaya, K. and Nath, N. Himalayan Publishing House.
- [11] Practical biochemistry- Principles and Techniques. Wilson and Walker. J.Cambridge Uni. Press.
- [12] Physical Biochemistry-David Freifelder, 2nd Edition.
- [13] Principles of Instrumental Analysis. 5th Ed. Douglas A Skoog, James Holler and Timothy A Nieman.
- [14] Introduction to Electron Microscopy for Biologists; Terry Allen, Academic Press (2008).

Course Code	Title of the Course	Credits
BCA050	CHEMISTRY AND METABOLISM OF PROTEINS AND NUCLEIC ACIDS	4

### COURSE OUTCOME(S):

- CO1 Identify the details of amino acids and proteins
- CO2 Understand in details with application, if applicable, nitrogen metabolism and degradation
- CO3 Write down the classification and characteristics of synthesis of amino acids and proteins
- CO4 Write down in details with application, if applicable, metabolism of nucleic acids

		No. of Lectures
<b>Unit I:</b>		
<b>1.1</b>	<b>Chemistry of Amino acids and Proteins</b>	
1.1.1	Classification and structure of 20 amino acids, newly discovered amino acids, essential, non-essential, unusual and non-protein	
1.1.2	General properties of aa, acid-base titrations, pKa Peptide bond-stability and formation, chemical synthesis of peptide. Primary structure and determination, GN Ramachandran plots	
1.1.3	Secondary structure and motifs, $\alpha$ helix, $\beta$ sheet, Leucine zipper, Zinc finger	
1.1.4	Tertiary & Quaternary structure (myoglobin, hemoglobin) Protein-protein interactions (actin, tubulin) Small peptides (glutathione, peptide hormones), Cyclic peptides (Gramicidin)	
1.1.5	Classification of proteins-globular, fibrous, membrane, metallo-proteins, Denaturation (pH, temperature, chaotropic agents), refolding, Role of chaperones in folding	<b>10</b>
<b>Unit II:</b>		
<b>2.1</b>	<b>Nitrogen Metabolism and Degradation of Amino Acids</b>	
2.1.1	Nitrogen cycle, Nitrogen fixation – symbiotic and non-symbiotic, Nitrogenase complex. Assimilation of ammonia	
2.1.2	Metabolic fate of dietary proteins and amino acids Degradations to glucose and ketone bodies	
2.1.3	Amino acids degraded to Pyruvate, Oxaloacetate	
2.1.4	Amino acids degraded to Acetyl-CoA, Succinyl-CoA Metabolism of branched chain amino acids, urea cycle, regulation of urea cycle	
2.1.5	Genetic defects in metabolism of amino acids (albinism, Phenylketonuria, maple syrup urine disease, homocystinuria, alkaptonuria, methyl malonic Acidemia)	<b>14</b>



<b>Unit III:</b>		
<b>3.1</b>	<b>Biosynthesis of Amino Acids and Protein Degradation</b>	
3.1.1	Biosynthesis of amino acids and regulation of amino acid metabolism	<b>08</b>
3.1.2	Biosynthesis and degradation of heme	
3.1.3	Biosynthesis of polyamines, creatine, gramicidine and glutathione	
3.1.4	Biosynthesis and degradation of glycoproteins and proteoglycans	
3.1.5	Protein degradation pathway–Ubiquitin–Proteosome pathway, lysosomal pathway	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Chemistry and Metabolism of Nucleic Acids</b>	
4.1.1	Purines, pyrimidines, nucleosides, nucleotides, unusual bases. Structure of DNA – Watson Crick Model, A- and Z- forms.	<b>16</b>
4.1.2	Supercoiling of DNA – negative and positive, linking number	
4.1.3	Structure of RNA, tRNA, rRNA, siRNA / miRNA Denaturation and renaturation, T <sub>m</sub> (factors affecting T <sub>m</sub> ) and Cot curves, Isolation and purification of nucleic acids from biological sources.	
4.1.4	Biosynthesis of purines and pyrimidines, Degradation of purines and pyrimidines, Regulation: de novo, salvation, nucleotide analogs, conversion of nucleotides to deoxynucleotides, mechanism of action of methotrexate, 5-fluorouridine, azathymidine.	
4.1.5	Gout and Lesch–Nyhan syndrome	
4.1.6	Biosynthesis of NAD, FAD and Co–enzyme A	

#### References

- [1] Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- [2] Biochemistry by Lubert Stryer. WH Freeman and Co.
- [3] Biochemistry: The Molecular Basis of Life by Trudy McKee and James R McKee. Publisher: McGraw-Hill Higher education.
- [4] Biochemistry and Molecular biology By William H. Elliott and Daphne C. Elliott. Oxford University Press.
- [5] Biochemistry 3rd Ed. By Donald J. Voet and Judith G. Voet. John Wiley and Sons.
- [6] Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 by D Voet. John Wiley and Sons.

Course Code	Title of the Course	Credits
BCA060	EXPERIMENTS IN BIOCHEMICAL TECHNIQUES AND ENZYMOLOGY AND SEMINAR	4

### COURSE OUTCOME(S):

- CO1 Identify the details of spectrophotometer  
CO2 Identify the details of specific activity of enzymes  
CO3 Deliberate the characteristics of gel electrophoresis  
CO4 Deliberate the characteristics of use of pipettes

<b>Group I:</b>	<ol style="list-style-type: none"> <li>1. Determination of Normality, Molarity and Molality of solutions</li> <li>2. Preparation of buffers: Acetate, Phosphate and Tris buffer</li> <li>3. Colorimetry–Beer's law and its applications</li> <li>4. Determination of Molar Extinction Coefficient</li> <li>5. Chromatography–Separation of amino acids by ascending, descending, circular paper chromatography</li> <li>6. TLC of amino acids</li> <li>7. Gel filtration, Ion exchange chromatography</li> </ol>	
<b>Group II:</b>	<ol style="list-style-type: none"> <li>8. Estimation of protein by Lowry's method.</li> <li>9. Estimation of protein by Biuret reagent method.</li> <li>10. Estimation of amino acids by Ninhydrin method</li> <li>11. Isolation of casein from milk and its quantification</li> <li>12. Electrophoresis–Separation of proteins by Native and SDS-PAGE</li> <li>13. Determination of <math>pK_a</math> and <math>pI</math> of amino acid, formal titration.</li> <li>14. Separation of nucleic acids by agarose gel electrophoresis</li> </ol>	
<b>Group III:</b>	<ol style="list-style-type: none"> <li>15. Isolation of microbes from air, soil and water</li> <li>16. Gram's staining</li> <li>17. Determination of growth curve of bacteria</li> <li>18. Antibiotic sensitivity tests</li> <li>19. Determination of specific activity of <ol style="list-style-type: none"> <li>(i) Acid Phosphatase</li> <li>(ii) Alkaline Phosphatase</li> <li>(iii) Salivary Amylase</li> <li>(iv) Protease</li> <li>(v) Invertase</li> <li>(vi) Aminotransferase</li> </ol> </li> </ol>	
<b>Group Study</b>	Extraction, Isolation, Purification and enzyme characterization. Determination of specific activity, optimum pH, temperature, time and energy of activation. Determination of $K_m$ and $V_{max}$ Enzyme inhibition studies	

## References

- [1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011).
- [2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).
- [3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).
- [4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),
- [5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)
- [6] Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work Vol. I & II, North Holland, (1969).
- [7] Physical Biochemistry, Kansal Edward Van Halde. Prentice Hall.
- [8] Modern Experimental Biochemistry R.F.Boyer [Ed.] (1986) Addition Wesley.
- [9] Analytical Biochemistry; D.J. Holme and H. Pick Longman (1983).
- [10] Principles and techniques of Biochemistry and Molecular Biology; Keith Wilson and John Walker; 6th Edn. (2005) Cambridge University Press.
- [11] Biochemical Calculations, Irwin H. Segel (1976) 2nd Ed. John Wiley and Sons.

<b>Course Code</b>	<b>Title of the Course</b>	<b>Credits</b>
BCA230	ENZYMOLGY	4

**COURSE OUTCOME(S):**

- CO1 Write down in details with examples enzyme kinetics
- CO2 Identify in details with examples enzyme catalysed reactions
- CO3 Identify the characteristics of cooperativity reactions
- CO4 Learn the classification and characteristics of multienzyme complex reactions

		No. of Lectures
<b>Unit I:</b>		
<b>1.1</b>	<b>Enzyme Kinetics and Inhibition</b>	
1.1.1	Nature of enzymes, Nomenclature and IUB classification of enzymes, Units of enzyme activity, IU and activity and specific activity. Localization, isolation, purification and characterization of enzymes. Criteria of purity of enzymes. Assay methods–coupled enzyme assays, continuous, end point and kinetic assay.	<b>16</b>
1.1.2	<u>Enzyme Kinetics</u> : Rate of a reaction, order and molecularity. Michaelis Menten equation, initial velocity approach, steady state approach. Vmax, Km and their significance. Linear transformation of Michaelis Menten equation–Lineweaver Burk plot, Eadie Hofstee, Haynes–Wolf and Cornish–Bowden.	
1.1.3	<u>Inhibition</u> : Reversible inhibition–Competitive, Non competitive and Uncompetitive, product inhibition, irreversible inhibition–suicide inhibition. Determination of <i>K<sub>i</sub></i> . Fast reactions–Stopped flow, temperature jump method with examples of enzymes.	
<b>Unit II:</b>		
<b>2.1</b>	<b>Enzyme Catalyzed Reactions</b>	
2.1.1	Bisubstrate enzyme catalysed reactions–Cleland’s notation with examples for ordered, ping pong, and random.	<b>08</b>
2.1.2	General rate equation. Primary and secondary plots. Mechanisms of enzyme catalysis–Active site structure and its investigation.	
2.1.3	Methods of determining active site structure–isolation of ES/EI complex, affinity labeling, chemical modification studies.	

<b>Unit III:</b>		
<b>3.1</b>	<b>Enzyme Catalysis and Cooperativity</b>	
3.1.1	<u>Nature of enzyme catalysis:</u> Transition state theory, proximity and orientation, orbital steering, acid base catalysis, covalent catalysis, metal ion catalysis, nucleophilic and electrophilic catalysis, intramolecular catalyses, entropy effects.	<b>12</b>
3.1.2	Effect of temperature and pH on enzyme catalyzed reactions.	
3.1.3	<u>Oligomeric proteins and Cooperativity:</u> Binding of ligands to macromolecules–Scatchard plot, Positive and Negative cooperativity. Oxygen binding to hemoglobin.	
3.1.4	Hill equation, homotropic and heterotropic effectors. Allosteric enzyme–Aspartyl transcarbamylase.	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Multienzyme Complex and Coenzymes</b>	
4.1.1	<u>Mechanisms of action of specific enzyme:</u> Chymotrypsin zymogen activation, acid–base catalysis, charge relay net work. Lysozyme, alcohol dehydrogenase, ribonuclease, Carboxypeptidase–A, RNA as enzyme, coenzymic action of NAD+ FAD, TPP, PLP, biotin, CoA, folic acid and lipoic acid.	<b>12</b>
4.1.2	<u>Multienzyme complexes:</u> Isoenzymes, eg. LDH. Multifunctional enzyme (DNA polymerase) multi enzyme complex (PDC)	
4.1.3	Metabolic regulation of enzyme activity–Feedback regulation.	

#### References

- [1] Fundamentals of Enzymology; 3rd Edn. Nicholas C. Price and Lewis Stevens, Oxford University Press (2012).
- [2] Enzymes; Trevor Palmer, East – West Press Pvt. Ltd., Delhi (2004).
- [3] Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis; Robert A. Copeland, Wiley-VCH Publishers (2000).
- [4] Enzyme Kinetics and Mechanism; Paul F. Cook, W. W. Cleland, Garland Science (2007).
- [5] Enzyme Kinetics; Roberts, D.V. (1977), Cambridge University Press.
- [6] The Enzymes; Boyer, Academic Press, (1982).
- [7] Principles of Enzymology for Food Sciences; Whitaker, Marcel Dekker (1972) Academic Press.
- [8] Introduction to Enzyme and Co-enzyme Chemistry. Ed. T. Bugg, (2000), Blackwell Science.

Course Code	Title of the Course	Credits
BCA250	CHEMICAL PRINCIPLES AND BIOCHEMICAL REACTIONS	4

### COURSE OUTCOME(S):

- CO1 Specify in details with examples chemical principles and bonding  
 CO2 Write down in depth thermodynamics  
 CO3 Learn in details with application, if applicable, stereochemistry  
 CO4 Deliberate in depth secondary metabolites

		No. of Lectures
<b>Unit I:</b>		<b>16</b>
<b>1.1</b>	<b>Chemical Principles and Bonding</b>	
1.1.1	<u>Chemical principles</u> : Acids and bases, Buffers. Buffering capacity. Ionic strength- Molarity, Normality, Mole concept, Avogadro number, structure and special properties of water.	
1.1.2	<u>Bonding</u> : Covalent bond, ionic bond, Coordinate bond. Coordinate bond formation by transition metals in biological complex structures.	
1.1.3	Crystal field theory, ligand field theory, valence bond theory.	
1.1.4	Bonding of iron in hemoglobin and cytochromes, cobalt in Vit B12, and Mg <sup>2+</sup> in chlorophyll. Chelates and complexes.	

<b>Unit II:</b>		<b>08</b>
<b>2.1</b>	<b>Thermodynamics</b>	
2.1.1	<u>Physiological importance of electrolytes</u> : Osmotic pressure, vapour pressure, vapour pressure osmometer, Donnan membrane equilibrium.	
2.1.2	<u>Introduction to thermodynamics</u> : I, II and III law. Enthalpy, entropy and free energy. Free energy and chemical equilibrium	
2.1.3	<u>Electrodes</u> : Hydrogen electrode, oxygen electrode, oxidation and reduction reactions, redox potential.	

<b>Unit III:</b>		<b>12</b>
<b>3.1</b>	<b>Stereochemistry and Heterocyclic Compounds</b>	
3.1.1	Importance of Stereochemistry, position and order of groups around carbon. Geometric and optical isomerism, absolute and relative configuration. Symmetry view of chirality, relation between chirality and optical activity, representation of chiral structures by Fischer.	
3.1.2	Structure and stereochemistry of glucose—anomers, epimers and stereoisomers, D and L, + and – R and S notations.	
3.1.3	Heterocyclic Compounds: Chemistry, biological	

	occurrence of furan, indole, thiazole, pterine, pteridine, isoalloxazine, pyrrole.	
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<b>Unit IV:</b>		
<b>4.1</b>	<b>Organic Reactions and Secondary Metabolites</b>	
4.1.1	Mechanism of Organic Reactions: Classification of organic reactions. Reaction intermediates, reaction energetics, rate, order and molecularity of reactions.	<b>12</b>
4.1.2	Mechanisms and stereochemistry of substitution, addition, and elimination. Rearrangements reactions. Mechanisms of ester hydrolysis. Aromaticity and resonance structure. Hydrogenation- homogenous and heterogenous hydrogenation	
4.1.3	Secondary metabolites: Phytochemicals, terpenes, polyphenols, procyanidins, flavonoids, xanthones, alkaloids and pigments.	

#### References

- [1] Basic principles of organic chemistry- Robers and Caserio
- [2] Organic chemistry, Hendrickson, Cram and Hammonal.
- [3] Organic chemistry, I. L. Finar, Longman group Ltd.
- [4] Organic chemistry, Morrison and Boyd, 4th edition Allyn and Bacon Inc.

Course Code	Title of the Course	Credits
BCA250	PLANT BIOCHEMISTRY	4

**COURSE OUTCOME(S):**

- CO1 Specify in details with examples Photosynthetic pathways and its regulations  
CO2 Write down in depth plant growth hormones in the agriculture  
CO3 Learn in details with application, if applicable, Medicinal plants  
CO4 Deliberate in depth secondary metabolites of plants and its significance

		No. of Lectures
<b>Unit I:</b>		<b>12</b>
<b>1.1</b>	<b>Plant Cell and Photosynthesis</b>	
1.1.1	Plant cell–Structure and functions of subcellular organelles, plant cell wall, Mechanism of water absorption, Ascent of sap. Transpiration - types, stomatal opening, Mechanism and factors affecting transpiration.	
1.1.2	Photosynthesis–Photosynthetic pigments, Photo synthetic apparatus, Light reactions, cyclic and non cyclic Phosphorylation. Calvin cycle, Hatch–Slack cycle, CAM plants.	
1.1.3	Regulation of photosynthesis, Photorespiration. □	

<b>Unit II:</b>		<b>12</b>
<b>2.1</b>	<b>Cycles of elements</b>	
2.1.1	Nitrogen cycle, Biochemistry of symbiotic and non symbiotic nitrogen fixation, Sulphur cycle, Phosphorus cycle.	
2.1.2	Plant nutrition–Biological functions of micro and macro nutrients in plants and their deficiency symptoms.	

<b>Unit III:</b>		<b>16</b>
<b>3.1</b>	<b>Growth Regulators</b>	
3.1.1	Plant growth regulators–chemistry, biosynthesis, mode of action, distribution and physiological effects of Auxins, Gibberellins, Cytokinins, ABA and Ethylene.	
3.1.2	Biochemistry of seed dormancy, Seed germination,	
3.1.3	Fruit ripening and Senescence.	



<b>Unit IV:</b>		<b>08</b>
<b>4.1</b>	<b>Medicinal Importance</b>	
4.1.1	Medicinal value of different parts of plants.	
4.1.2	Basic methods to identify the secondary metabolites. Role of secondary metabolites in Ayurvedha and Siddha treatment.	
4.1.3	Medicinal value of Amla, Stevia, Aswagandha, Turmeric and other Indian medicinal plants. □	

#### **References**

- [1] Plant physiology, Verma, 7th Revised edition, Emkay Publications 2001.
- [2] Plant Physiology, S. N. Pandey and B.K. Sinha, Vikas Publishing House Pvt. Ltd, 3rd edition, 1999.
- [3] Plant Biochemistry and Molecular Biology, Peter Jhea, Richard C. Leegood,
- [4] Introduction to plant physiology, William. G.Hopkins, Norman. P.A. Hunger, 3rd edition
- [5] A Handbook of Medicinal Plants –Prajapathi, Purohit, Sharma, Kumar
- [6] Medicinal Plants –a compendium of 500 species.

<b>Course Code</b>	<b>Title of the Course</b>	<b>Credits</b>
<b>BCA250</b>	<b>MICROBIAL BIOCHEMISTRY</b>	<b>4</b>

**COURSE OUTCOME(S):**

- CO1 Specify in details with examples staining techniques used for the identification of microbes
- CO2 Write down in depth Molecular biology of prokaryotes
- CO3 Learn in details with application, if applicable, Operon systems in gene regulation of bacteria
- CO4 Deliberate in depth antimicrobial drugs are used for the microbial infections

		<b>No. of Lectures</b>
<b>Unit I:</b>		<b>10</b>
<b>1.1</b>	<b>Pure Culture, Staining Technique and Growth</b>	
1.1.1	Principles of microbial nutrition: Nutritional requirements, different kinds of media, factors affecting growth.	
1.1.2	Enrichment culture techniques for isolation of chemoautotroph's, chemoheterotroph's and photosynthetic microorganisms. Modes of reproduction,	
1.1.3	Biosynthesis of cell wall components, enumeration, growth curve, generation time, synchronous growth, Chemostat. Adaptation to stationary phase, heat and cold shock, osmolarity and salinity, oxidative stress.	
1.1.4	Gram, Acid fast & flagellar staining. Mechanism of bacterial motility.	

<b>Unit II:</b>		<b>14</b>
<b>2.1</b>	<b>Regulation of Genes in Bacteria</b>	
2.1.1	Nucleic Acids as Carriers of Genetics Information, Arrangement and Organization of Gene in Prokaryotes:	
2.1.2	Operon Concept, Catabolite Repression, Instability of Bacterial RNA, Inducers and Co repressors E. coli Lac Operon: Negative Regulation and Positive Regulation, E. Coli Arabinose Operon: Regulation by Attenuation, His and Trp Operons: Anti-termination,	
2.1.3	Genetic Transfer: Conjugation, Transformation and Transduction.	

<b>Unit III:</b>		
<b>3.1</b>	<b>Virology and Biological Nitrogen Fixation</b>	
3.1.1	Introduction to Virus, Classification, Assay Methods, Properties and Characteristic of Bacterial, Plant and Animal Viruses	<b>16</b>
3.1.2	Virus Host Interaction, Acute Virus Infections, Persistent of Virus Infection, Influenza, Herpes, Hepatitis A and B.	
3.1.3	<u>Nitrogen Metabolism</u> : Mechanism and Regulation of Utilization of Ammonia, Nitrate and other Nitrogen Source	
3.1.4	<u>Nitrogen Fixation</u> : Mechanism and Regulation of Nitrogen Fixation, Symbiotic and Asymbiotic Nitrogen Fixation and Biochemistry of Nitrogenase.	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Antimicrobial Agents</b>	
4.1.1	The Development of Antimicrobial Agents, Past, Present and Future, Selection of Antimicrobial Agents	<b>08</b>
4.1.2	Synthetic Organic Antimicrobials, $\beta$ -Lactam Antibiotics, Amino glycoside Antibiotics, Antifungal Drugs, Antiviral Drugs	
4.1.3	Resistance to Antimicrobial Drugs	

#### References

- [1] Microbial physiology, 2nd Edn. I.W. Dawes and I.W. Sutherland (1991) Blackwell Scientific.
- [2] Microbial physiology, 4th Edn. Albert G. Moat, John W. Foster and Michael P. Spector, Wiley-Liss (2002).
- [3] Biology of Microorganisms, Brock Prentice Hall (1996).
- [4] Microbiology: Lansing M. Prescott, Hartley and Klein, 5th Edn. McGraw Hill (2002).
- [5] General Microbiology, Stainer *et al.*, 4th Edn. McMillan (1975).
- [6] Microbiology, Pelczer, Reid and Kreig Tata McGraw Hill (1996).

Course Code	Title of the Course	Credits
BCB040	ANALYTICAL BIOCHEMISTRY-II	4

### COURSE OUTCOME(S):

- CO1 Identify in details with application, if applicable, flow cytometry  
CO2 Specify the characteristics of biosensor technology  
CO3 Understand in details with examples spectroscopy  
CO4 Write down the details of x-ray crystallography

		No. of Lectures
<b>Unit I:</b>		<b>08</b>
<b>1.1</b>	<b>Flow Cytometry and Model Systems</b>	
1.1.1	<u>Flow Cytometry</u> : Principle and design of flow cytometer, cell sorting.	
1.1.2	<u>Animal models</u> : Choice of animals, types of studies, mutant organisms, cultured cells, plant as models and tissue culture models.	

<b>Unit II:</b>		<b>16</b>
<b>2.1</b>	<b>Biosensor Technology and Radioactivity</b>	
2.1.1	Concept and design of biosensors, types and uses of biosensors.	
2.1.2	Principle and applications of biosensors for glucose, triglyceride, uric acid, cholesterol and oxalate.	
2.1.3	Units of radioactivity. Detection and measurement of radioactivity—solid and liquid scintillation counting, scintillation cocktails and sample preparation. Cerenkov counting. Applications of radioisotopes in biology. Radiation hazards.	
2.1.4	Principle and Applications of Autoradiography	

<b>Unit III:</b>		<b>10</b>
<b>3.1</b>	<b>Spectroscopy</b>	
3.1.1	Principle, instrumentation, working and application of—Spectrofluorimetry, Flame Spectrophotometry, Atomic Absorption Spectrometry.	
3.1.2	<u>IR spectroscopy</u> : Physical basis of IR spectroscopy. Instrumentation, use of IR in structure determination, Fourier Transfer—IR spectroscopy.	
3.1.3	<u>NMR</u> : Principle, effect of atomic, identity on NMR, chemical shift, spin coupling NMR, measurement of NMR spectra, biochemical application of NMR.	
3.1.4	<u>ESR</u> : Principle, measurement of ESR spectra, biochemical application of ESR.	
3.1.5	Principle, instrumentation and applications of ORD and CD	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Mass spectroscopy, X-ray Crystallography and Nanoparticles</b>	
4.1.1	Theory and construction of mass spectrometer. Ionization, fragmentation, $m/z$ , time of flight, MALDI and ESI.	<b>14</b>
4.1.2	<u>Other methods</u> : MS/MS, LC/MS, GC/MS, Peptide mapping, post translation modification analysis, determination of disulfide bridges	
4.1.3	X-ray crystallography–Bragg's law, Unit cell, Isomorphous replacement, Fibre pattern of DNA.	
4.1.4	<u>Introduction to Nanoscience</u> : Importance and fundamental science behind nanotechnology.	
4.1.5	<u>Applications of Nanoparticles</u> : Tools to make nanostructures, Nanoscale lithography, E–beam lithography, molecular synthesis, self assembly. Drug and Gene delivery for human health, Biosensors and sensors, cleaning environment (for heavy metal & Bioremediation).	

#### References

- [1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011)
- [2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).
- [3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).
- [4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),
- [5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)
- [6] Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work Vol. I & II, North Holland, (1969).
- [7] Basic Mathematics for Biochemists; Cornish Bowden, Oxford University Press (1998),.
- [8] Biophysical Tools for Biologists *In Vivo* Techniques; John Correia H. Detrich, III Elsevier (2008).
- [9] Practical Biochemistry by Keith Wilson and Walker 5th ed. Cambridge.
- [10] Biophysical chemistry, Upadhyaya, A., Upadhyaya, K. and Nath, N. Himalayan Publishing House.
- [11] Practical biochemistry- Principles and Techniques. Wilson and Walker. J.Cambride Uni. Press.
- [12] Physical Biochemistry-David Freifelder, 2nd Edition.
- [13] Principles of Instrumental Analysis. 5th Ed. Douglas A Skoog, James Holler and Timothy A Nieman.

Course Code	Title of the Course	Credits
BCB050	CHEMISTRY AND METABOLISM OF CARBOHYDRATES AND LIPIDS	4

### COURSE OUTCOME(S):

- CO1 Understand the classification and characteristics of chemistry of carbohydrates  
CO2 Deliberate the classification and characteristics of bioenergetics  
CO3 Write down the characteristics of chemistry of lipids  
CO4 Learn in depth metabolism of lipids

		No. of Lectures
<b>Unit I:</b>		<b>10</b>
<b>1.1</b>	<b>Chemistry of Carbohydrates</b>	
1.1.1	Classification, monosaccharides (aldoses & ketoses) Configuration and conformation of monosaccharides (pyranose & furanose, chair & boat).	
1.1.2	Reducing and optical properties of sugars. Stability of glycosidic bond disaccharides, oligosaccharides.	
1.1.3	Structural polysaccharides—cellulose, hemicellulose, pectin, lignin, chitin, chitosan	
1.1.4	Storage polysaccharides: starch, glycogen, inulin Steric factors in polysaccharides folding, blood group polysaccharides and lectins. Glycosaminoglycans, mucopolysaccharides, hyaluronic acid Chondroitin sulfate, keratan sulfate, dermatan sulfate. Bacterial cell wall polysaccharides, proteoglycans (syndecan and agrecan)	

<b>Unit II:</b>		<b>14</b>
<b>2.1</b>	<b>Metabolism of Carbohydrates and Bioenergetics</b>	
2.1.1	Reactions and energy balance in Glycolysis, Gluconeogenesis, TCA cycle, HMP Shunt pathway, Pasteur and Crabtree effect, Anapleurotic reactions	
2.1.2	Glyoxylate cycle, Glucuronic acid cycle, Glycogen metabolism.	
2.1.3	Photosynthesis reactions for biosynthesis of glucose C3 and C4 cycle in plants	
2.1.4	Mitochondrial ETC—Organization of respiratory chain complexes, P/O ratio, ATP synthesis, Mitchell's hypothesis, uncouplers and inhibitors.	

<b>Unit III:</b>		<b>12</b>
<b>3.1</b>	<b>Chemistry of Lipids</b>	
3.1.1	Classification & biological significance of lipids, fatty acids and Steroids	
3.1.2	Bile acids and salts, Phospholipids, Oils, waxes, isoprene units, Lipoproteins, Glycolipids, Sphingolipids	

3.1.3	Cerebrosides, Gangliosides, Prostaglandins, Prostacyclins, Thromboxanes, Leukotrienes, cysteinyl leukotrienes	
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<b>Unit IV:</b>		
<b>4.1</b>	<b>Metabolism of Lipids</b>	
4.1.1	Fate of dietary lipids and Apo-lipoproteins Fatty acid biosynthesis, Desaturation of fatty acids Beta oxidation, breakdown of odd chain fatty acids, energy yields	<b>12</b>
4.1.2	Regulation of $\beta$ -oxidation, $\omega$ -oxidation & $\alpha$ -oxidation Metabolism of phospholipids & Sphingolipids Regulation and Biosynthesis of cholesterol, action of statins	
4.1.3	Fate of acetyl CoA, formation of ketone bodies and ketosis	
4.1.4	Biosynthesis of prostaglandins, Prostacyclins, Thromboxanes, Leukotrienes, Action of aspirin	
4.1.5	Genetic defects in lipid metabolism, Medium chain acyl coenzyme A dehydrogenase deficiency MCAD, Long-chain 3-hydroxyacyl-CoA dehydrogenase (LCHAD) deficiency, Familial hypercholesterolemia	

#### References

- [1] Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- [2] Biochemistry by Lubert Stryer. WH Freeman and Co.
- [3] Biochemistry: The Molecular Basis of Life by Trudy McKee and James R McKee. Publisher: McGraw-Hill Higher education.
- [4] Biochemistry and Molecular biology By William H. Elliott and Daphne C. Elliott. Oxford University Press.
- [5] Biochemistry 3rd Ed. By Donald J. Voet and Judith G. Voet. John Wiley and Sons.
- [6] Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 by D Voet. John Wiley and Sons.

Course Code	Title of the Course	Credits
BCB060	<b>EXPERIMENTS IN IMMUNOLOGY AND BIOCHEMICAL ESTIMATIONS</b>	4

**COURSE OUTCOME(S):**

- CO1 Understand in details with examples antigen antibody reactions  
CO2 Specify in details with application, if applicable, oils and fats estimation  
CO3 Understand in depth acid value principle and determination  
CO4 Identify in details with examples mitosis and meiosis

<b>Group I:</b>	<ol style="list-style-type: none"> <li>1. Demonstration of Ag-Ab interaction: Radial immunodiffusion and ODD.</li> <li>2. Demonstration of direct agglutination reaction using human blood group antigens.</li> <li>3. Demonstration of indirect agglutination reaction– latex agglutination.</li> <li>4. Fluorescence emission of proteins and vitamins</li> <li>5. UV–Vis spectra of proteins, nucleic acids and other aromatic compounds</li> <li>6. Extraction of neutral lipids, phospholipids</li> <li>7. TLC of lipids and estimation of phospholipids</li> </ol>	
<b>Group II:</b>	<ol style="list-style-type: none"> <li>8. Iodine No. of Oils/Fats</li> <li>9. Saponification Value of Oils/Fats</li> <li>10. Acid Value/Peroxide Value of Oils/Fats</li> <li>11. Estimation of <math>\alpha</math>-Keto-acid</li> <li>12. Estimation of ascorbic acid</li> <li>13. Estimation of Iron</li> <li>14. Estimation of Calcium</li> </ol>	
<b>Group III:</b>	<ol style="list-style-type: none"> <li>15. Isolation of Starch from potato and purity determination</li> <li>16. Colorimetric estimation of reducing sugars (DNS reagent method)</li> <li>17. Estimation of reducing sugar: Hegedorn and Jensen Method</li> <li>18. Estimation of Phosphate</li> <li>19. Mitosis in onion root tips</li> <li>20. Meiosis in <i>tradescantia</i>/grasshopper testis</li> <li>21. Total and Differential Cell Counting of blood</li> </ol>	
<b>Group Study</b>	Preparation of antigen adjuvant mixture, injection and raising antibodies in rat. Purification of antibodies Antibody titer and ELISA	



## References

- [1] Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011).
- [2] Basic Methods for the Biochemical Lab; Martin Holtzhauer, Springer, (2007).
- [3] Principles and Techniques of Biochemistry and Molecular Biology 7th Edn. Keith Wilson and John Walker, Cambridge University Press, (2010).
- [4] Biochemistry LabFax, Ed. J.A.A. Chambers and D. Rickwood,, Blackwell Science, (1993),
- [5] Protein Purification Applications, S.L.V. Harris and Angal IRL Press, (1990)
- [6] Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work Vol. I & II, North Holland, (1969).
- [7] Physical Biochemistry. Kansal Edward Van Halde. Prentice Hall.
- [8] Modern Experimental Biochemistry R.F. Boyer [Ed.] (1986) Addition Wesley.
- [9] Analytical Biochemistry; D.J. Holme and H. Pick Longman (1983).
- [10] Principles and techniques of Biochemistry and Molecular Biology; Keith Wilson and John Walker; 6th Edn. (2005) Cambridge University Press.
- [11] Biochemical Calculations, Irwin H. Segel (1976) 2nd Ed. John Wiley and Sons.
- [12] Methods in Immunology and Immunochemistry; Curtis Williams, Academic Press (1971).
- [13] Immuno Assay Hand Book; David Wild, Elsevier (2013).

Course Code	Title of the Course	Credits
BCB250	IMMUNOLOGY AND MICROBIOLOGY	4

**COURSE OUTCOME(S):**

- CO1 Identify in details with examples antigens and antibodies
- CO2 Understand the details of cellular basis of immunity
- CO4 Identify the classification and characteristics of MHC Complex
- CO4 Learn in depth basic concepts of microbiology

		No. of Lectures
<b>Unit I:</b>		
<b>1.1</b>	<b>Antigens and Antibodies</b>	
1.1.1	<u>Introduction</u> : Historical development and milestones in immunology. Barriers to infection–skin, mucous membrane, Definitions–Antigenicity, Immunogenicity, primary and secondary lymphoid organs, self and non self discrimination. Innate and acquired immunity.	<b>12</b>
1.1.2	<u>Antigens and Antibodies</u> : Haptens and determinants–Epitopes and paratopes. Antigenicity, carbohydrates, proteins, nucleic acids, and cells as antigens. Valency of antigen.	
1.1.3	Classes and subclasses of immunoglobulins, structure of immunoglobulins, hyper variable region, isotypic, allotypic and idiotypic variations.	
<b>Unit II:</b>		
<b>2.1</b>	<b>Complement and Cellular Basis of Immunity</b>	
2.1.1	<u>Complement</u> : Structure, components, properties and functions of complement pathways, biological consequences of complement activation.	<b>12</b>
2.1.2	Hyper sensitivity reactions (Type I, II, III and IV).	
2.1.3	<u>Cellular basis of immunity</u> : Primary and secondary immune response. Reticuloendothelial system. T, B and accessory cells. Subsets of T (T–helper cells, T–killer cells, T–suppressor cells) and B cells. Development of T and B cells. T and B cell receptors, antigen processing and presentation.	
2.1.4	Cytokines and co–stimulatory molecules–Lymphokines, interleukins structure and function of IL-2, TNF $\alpha$ . T and B interaction. Suppression of immune response, immunoglobulin, diversity of gene rearrangement, factors affecting diversity, class switching and clonal selection theory of Burnet.	

<b>Unit III:</b>		<b>16</b>
<b>3.1</b>	<b>MHC, Transplantation, Tumor Immunology and Vaccines</b>	
3.1.1	<u>MHC</u> : MHC gene and its polymorphism, role of MHC in immune response.	
3.1.2	<u>Transplantation</u> : Autograft, isograft, allograft and xenograft, Graft rejection, graft Vs host reaction, MHC in transplantation.	
3.1.3	<u>Immunochemical techniques</u> : Precipitation, agglutination, complement fixation, immunodiffusion, immunoelectrophoresis, immunofluorescence, RIA, ELISA.	
3.1.4	<u>Tumor immunology</u> : Tumor associated antigens, factors favoring tumor growth, immune surveillance. Tumor necrosis factors $\alpha$ and $\beta$ Disorders of immunity: Immunological tolerance, auto immune disorders, AIDS, SCID, lupus erythematosus <u>Vaccines</u> : Adjuvants; vaccines and their preparations. Polyclonal and monoclonal antibodies–hybridoma technique.	
<b>Unit IV:</b>		<b>08</b>
<b>4.1</b>	<b>Microbiology</b>	
4.1.1	Historical aspects - Discovery of microorganisms. Theory of spontaneous generation. Era of Louis Pasteur. Microbes and fermentation. Microbes and diseases-Koch's Postulates.	
4.1.2	General characteristics: Morphology, nomenclature and classification of bacteria, virus, yeasts and fungi.	
4.1.3	Microbial nutrition-Factors influencing growth, growth curve of bacteria. Measurement of growth, continuous culture, synchronous culture and chemostat. Auxotrophs, autotrophs, heterotrophs. Methods of cultivations and preservation of microorganisms.	
4.1.4	Methods of control of microorganisms-Sterilization Techniques: Definitions of physical methods, heat (dry & moist) filtration, radiation; chemical agents-phenols, alcohols, halogens, heavy metals, aldehydes, quaternary ammonium compounds & gases.	

## References

- [1] Antibodies—A Laboratory Manual; E. D. Harlow, David Lane, 2nd Edn. CSHL Press (2014).
- [2] Basic and Clinical Immunology; Stites *et al.*, [Ed] (1982) Lange.
- [3] Roitt's Essential Immunology; Ivan, M. Roitt & Peter J Delves (2001) Blackwell Science.
- [4] Immunology: Roitt *et al.*, Mosby (2001),
- [5] Kuby Immunology; Owen, Punt, Stranford, 7th Edn. W. H. Freeman (2013).
- [6] Immune System; M. C. Connel *et al.*, Eds. (1981) Blackwell Science.
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- [8] Immunology; Jan Klein [Ed.], Blackwell Science (1990).
- [9] Introduction to Immunology; Kim Bell [Ed.], 3rd Edn. McMillan (1990).

<b>Course Code</b>	<b>Title of the Course</b>	<b>Credits</b>
<b>BCB260</b>	<b>HUMAN PHYSIOLOGY AND NUTRITION</b>	<b>4</b>

**COURSE OUTCOME(S):**

- CO1 Specify the classification and characteristics of blood and respiratory systems  
CO2 Identify in depth digestive and excretory systems  
CO3 Learn in details with application, if applicable, concepts of nutrition  
CO4 Specify the details of vitamins and minerals

		<b>No. of Lectures</b>
<b>Unit I:</b>		<b>12</b>
<b>1.1</b>	<b>Blood and Respiratory System</b>	
1.1.1	<u>Blood</u> –Composition, cells. Erythrocytes–structure and function, WBC–types and functions.	
1.1.2	Platelets and their function. Buffer systems; hemostasis–blood volume, blood pressure and its regulation. Blood clotting, Dissolution of clot; anticoagulants. CSF–composition and function.	
1.1.3	<u>Respiratory System</u> –Mechanism of gas exchange, oxygen binding by hemoglobin and factors affecting oxygenation. Acid–base balance and its regulation.	

<b>Unit II:</b>		<b>12</b>
<b>2.1</b>	<b>Hepatobiliary, Digestive and Excretory System</b>	
2.1.1	<u>Hepatobiliary system</u> –Anatomy of the liver, blood supply; cells–hepatocytes, endothelial cells, Kupffer cells and paranchymal cells.	
2.1.2	Secretory and excretory function; detoxification and formation of bile	
2.1.3	<u>Digestive system</u> –GI tract, digestion and absorption of carbohydrates, proteins and lipids. Mechanism of HCl production in the stomach. Gastrointestinal hormones.	
2.1.4	<u>Excretory System</u> –Ultra structure of the nephron, glomerular filtration, tubular reabsorption and tubular secretion, formation of urine.	

<b>Unit III:</b>		<b>16</b>
<b>3.1</b>	<b>Nutrition, Carbohydrates, Proteins and Fats</b>	
3.1.1	<u>Nutrition</u> –Concepts of macro and micro nutrients, essential nutrients and their classification. Food groups, proximate analysis of foods, chemical and biological analysis for nutrients.	
3.1.2	Food as source of energy, methods of determining energy value of foods, calorimetry, physiological fuel values and daily requirement of energy, high and low	

	calorie diets. Basal metabolic rate (BMR), factors affecting BMR, specific dynamic action of foods.	
3.1.3	<u>Carbohydrates</u> –dietary sources, dietary fiber essentiality of carbohydrates.	
3.1.4	<u>Proteins</u> –Evaluation of nutritive value of dietary protein PER, BV, essential amino acids, nutritional classification of proteins, supplementary value of proteins, protein calorie malnutrition–Kwashiorkor and Marasmus.	
3.1.4	<u>Fats</u> –Sources, invisible fat, essential fatty acids, PUFA.	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Vitamins and Minerals</b>	
4.1.1	<u>Vitamins</u> –Fat soluble and water soluble vitamins, provitamins, antivitamins, dietary sources, structure, daily requirements and functions.	<b>08</b>
4.1.2	Deficiency symptoms of B complex members and fat soluble vitamins, hypervitaminosis, vitamin like compounds.	
4.1.3	<u>Minerals</u> –Macro and micronutrients, sources, requirements, functions and deficiency symptoms.	
4.1.4	Water metabolism–distribution in body, function and factors affecting water balance.	
4.1.5	Recommended daily allowances, special nutrition for infants, children, during pregnancy, lactation and old age.	

## References

- [1] The Cell, Copper, Geoffery, M., Oxford University Press, (2001)
- [2] Text Book f Biochemistry with Clinical correlations; Thomas Devlin [Ed.] (1997), Wiley –Liss.
- [3] Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications (2012).
- [4] Principles of Human Physiology; 4th Edn. Cindy L. Stanfield Pearson, (2010).
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- [13] Introduction to Human Nutrition, 2nd Edn. Michael J. Gibney, Susan A. Lanham-New, Aedin Cassidy, Hester H. Vorster, Wiley-Blackwell (2009).
- [14] Nutrition: Everyday Choices, 1st Edition; Mary B. Grosvenor, Lori A. Smolin Wiley (2006).
- [15] Bioactive Food as Dietary Interventions for Liver and Gastrointestinal Disease; Watson Elsevier (2012).
- [16] Nutrition and Metabolism, 2nd Edn., Lanham S, Mac Donald I and Roche H. The Nutrition Society, London, UK, (2012).
- [17] Introduction to Human Nutrition, 2nd Edn., Gibney M, Lanham S, Cassidy A and Vorster H. The Nutrition Society, London, UK, (2012).

Course Code	Title of the Course	Credits
BCB260	RESEARCH METHODOLOGY AND BIostatISTICS	4

**COURSE OUTCOME(S):**

- CO1 Specify the classification and characteristics of research methodologies and the experimental designs
- CO2 Identify in depth statistical analysis
- CO3 Learn in details with application, if applicable, scientific write-up
- CO4 Specify the details of Interpretation of data

		No. of Lectures
<b>Unit I:</b>		<b>12</b>
<b>1.1</b>	<b>Research Methodology and Design</b>	
1.1.1	<u>Research Methodology</u> : Meaning of research, Objectives of research, Motivation in Research, Types of Research, and Research approaches.	
1.1.2	Research methods vs. Research Methodology, Research process–scientific method, Criteria for good research, Defining the research problem.	
1.1.3	<u>Research Design</u> : Meaning and need for research design, features of good design. Preparation of Scientific report, presentation of a review.	

<b>Unit II:</b>		<b>12</b>
<b>2.1</b>	<b>Scientific Writing</b>	
2.1.1	Mechanical and stylistic aspects of scientific writing–Precision and clarity of language, writing style, writing process, presentation of numerical data and scientific figures.	
2.1.2	Constraints on scientific writing–audience, format and mechanics (grammar, word choice, punctuation, tenses).	
2.1.3	Objectives and design of experiment–experimental unit, identifying variables, replications & controls, power analysis in planning experiments, treatment structure and design structure.	
2.1.4	Graphical analysis of data and presentation of results.	

<b>Unit III:</b>		<b>16</b>
<b>3.1</b>	<b>Statistical Significance Analysis</b>	
3.1.1	Significance and limitations of statistical calculations, Sampling techniques.	
3.1.2	Probability theory, random variables and distribution functions, Point and interval estimation, linear regression. Statistical evaluation of results–Hypothesis testing, interpretation of statistic for analysis of error.	
3.1.3	Measures of central tendency and dispersion	



<b>Unit IV:</b>		<b>08</b>
<b>4.1</b>	<b>Testing Methods</b>	
4.1.1	ANOVA, F-test, t-test, z-test, chi-square, correlation coefficient.	

### References

- [1] Research Methodology: Methods & Techniques By CR Kothari. Publisher: New Age International
- [2] From Research to Manuscript: A Guide to Scientific Writing (Paperback) By Michael Jay Katz. Publisher: Springer
- [3] The Craft of Scientific Writing (3rd Edition) By Michael Alley. Publisher: Springer-Verlag.
- [4] Writing Scientific Research Articles: Strategy and Steps (Hardcover) By Margaret Cargill and Patrick O.Connor. Publisher: WileyBlackwell.
- [5] The Mayfield Handbook of Technical and Scientific Writing By Leslie Perelman and Edward Barrett. McGraw-Hill NY
- [6] Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers(Hardcover) 6th Ed By Edward J. Huth. Publisher: Cambridge University Press.
- [7] The Handbook of Technical Writing, Eighth Edition (Handbook of Technical Writing Practices) (Hardcover) By Gerald J. Alred, Charles T. Brusaw and Walter E. Oliu, St. Martin's Press.
- [8] Science and Technical Writing: A Manual of Style (2nd Ed.) By Philip Rubens. Publisher: Routledge, London.
- [9] The Elements of Technical Writing (Elements of Series) (Paperback) By Gary Blake and Robert W. Bly. Publisher: Longman.
- [10] Technical Writing: Principles, strategies and readings (7th Edition) By Diana C. Reep. Publisher: Longman.
- [11] Biostatistics By PN Arora and PK Malhan, Himalaya Publishing House.
- [12] Experimental Design and Data Analysis for Biologists By Gerry P. Quinn and Michael J. Keough. Publisher: Cambridge University Press.
- [13] Principles of Biostatistics (with CD-ROM) (Hardcover) By Marcello Pagano and Kimberlee Gauvreau. Publishers: Duxbury Press
- [14] Biostatistics: Experimental Design and Statistical Inference (Hardcover) By James F. Zolman. Oxford University Press.
- [15] Intuitive Biostatistics By Harvey Motulsky. Publisher: Oxford University Press

Course Code	Title of the Course	Credits
BCB260	CLINICAL RESEARCH METHODS AND INDUSTRIAL BIOCHEMISTRY	4

### COURSE OUTCOME(S):

- CO1 Specify the classification and characteristics of clinical practice and clinical research
- CO2 Identify in depth fermentation technology and downstream processing
- CO3 Learn in details with application, if applicable, clinical research methods
- CO4 Specify the details of steps involved in drug discovery

		No. of Lectures
<b>Unit I:</b>		<b>10</b>
<b>1.1</b>	<b>Introduction to Clinical Research</b>	
1.1.1	Introduction to Clinical Research, Terminologies and definition in Clinical Research, Origin and History of Clinical Research	
1.1.2	Difference between Clinical Research and Clinical Practice, Types of Clinical Research, Phases of clinical research	
1.1.3	Clinical Trials in India–The National Perspective, Post marketing surveillance	
1.1.4	Pharmaceutical Industry–Global and Indian Perspective Clinical Trial market, Career in Clinical Research	

<b>Unit II:</b>		<b>14</b>
<b>2.1</b>	<b>Clinical Research Methods</b>	
2.1.1	Design of experiments, factorial experiments, randomization, interaction among factors.	
2.1.2	Types of studies: Cohort studies, double blind, placebo control, cross over and double dummy.	
2.1.3	Introduction to Good Clinical Practices, Clinical Trial Development: Protocol Design and Development, Case Report Form Design and Development, Principals of Data Management, Clinical Trial Management: Maintaining and Managing Essential Documents, Recording and Reporting Non–Serious and Serious Adverse Events.	

<b>Unit III:</b>		<b>12</b>
<b>3.1</b>	<b>Drug Discovery Concepts and Biostatistics</b>	
3.1.1	Proof of concept, target identification and validation. Identifying the lead compound, optimization of lead compound, mechanism of action, drug target and validation of target.	
3.1.2	Safety pharmacology, pharmaco–kinetics and	

	pharmaco–dynamics, acute and chronic toxicity Development of new drug/molecules and elucidation of their mechanisms of actions, formulations, factors affecting drug efficacy, drug resistance, traditional medicines; biotransformation.	
3.1.3	Statistical concept: Data structure, sampling methods, collection, classification and tabulation of data, graphical and diagrammatic representation, histogram, frequency polygon, frequency curve, bar graph, pie chart.	
3.1.4	Measure of central tendency: Mean, median, mode, mean deviation, standard deviation, standard error Types of distribution of data: Normal, binomial, Poisson,	
3.1.4	Z-test, t-test and ANOVA. Correlation and regression.	
<b>Unit IV:</b>		
<b>4.1</b>	<b>Bioprocess Methods</b>	
4.1.1	Basics of chemical engineering, mass transfer, heat generation and removal, fluid dynamics:	<b>12</b>
4.1.2	Bernoulli's principle, viscosity, hydraulic conductivity, capillary flow, control and applications of industrial processes, process evaluation and development, over production of metabolites and methods;	
4.1.3	Fermentation–Submerged and solid state fermentation Fermentor design, Industrial use of microbes. Strain improvement, Inocula preparation, Downstream processing–Recovery and purification of intracellular and extra cellular products. Methods to maximize the yield.	

#### References

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- [2] Who Expert Committee on Specification for Pharmaceutical Preparation WHO-GENEVA, 2005 edition
- [3] Who Expert Committee on Biological Standardization WHO-GENEVA 2003 edition
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- [8] A Comprehensive Clinical Research Manual-Samir Malhotra, Nusrat Shafiq, Promila Pandhi Jaypee Brothers Medical Publishers (P) Ltd, 2008 edition
- [9] Industrial microbiology, A.H. Patel
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- [11] Biotechnology–U. Sathyanarayana. □YLL

Course Code	Title of the Course	Credits
BCC070	CELL BIOLOGY, ENDOCRINOLOGY AND CELL SIGNALING	4

### COURSE OUTCOME(S):

- CO1 Specify in details with examples cellular organization  
CO2 Learn the characteristics of endocrinology  
CO3 Learn in depth cell signaling  
CO4 Write down the characteristics of membrane biology

		No. of Lectures
<b>Unit I:</b>		<b>12</b>
<b>1.1</b>	<b>Cellular Organization, Division and Cytoskeletons</b>	
1.1.1	Cell types–organization of prokaryotic and eukaryotic cells.	
1.1.2	Cell division–mitosis and meiosis, cell cycle–phases of cell cycle, cyclins and cdks. Regulation of cell growth and cell cycle.	
1.1.3	Cell motility–molecular motors, microtubules, structure and composition. Microtubular associated proteins–role in intracellular motility.	
1.1.4	Cellular organelles–Nucleus–internal organization, traffic between the nucleus the nucleolus, and cytoplasm. Endoplasmic reticulum–protein sorting and transport, golgi apparatus and lysosomes, morphology and function of mitochondria, chloroplasts and peroxisomes, glyoxysomes.	

<b>Unit II:</b>		<b>12</b>
<b>2.1</b>	<b>Membrane Biology</b>	
2.1.1	Organization of lipid monolayer, bilayer, Physicochemical properties of biological membranes - compositions, supra molecular organization - Singer and Nicolson's model.	
2.1.2	Membrane asymmetry-lipids proteins and carbohydrates, lateral diffusion, biogenesis of lipids and proteins. Polarized cells, membrane domains- caveolae, rafts, Membrane lipid and protein turnover, intracellular targeting of proteins. Factors influencing fluidity of membrane	
2.1.3	Membrane transport - Laws of diffusion across membranes, simple diffusion, facilitated diffusion and active transport - glucose transporter Na <sup>+</sup> K <sup>+</sup> ATPase (Structure and mechanism of action), bacterial phosphotransferase system. Endocytosis, receptor mediated endocytosis, exocytosis, ion channels, aquaporin channel, ionophores. Patch clamp technique.	

<b>Unit III:</b>		
<b>3.1</b>	<b>ENDOCRINOLOGY</b>	
3.1.1	<u>Endocrine System</u> –Endocrine organs in man. Hierarchy and regulation of hormone release.	<b>12</b>
3.1.2	Structure and control of hypothalamus, GRH, somatostatin, TRH, CRH, GnRH. Pituitary-anatomy and structure.	
3.1.3	Hormones of anterior, posterior and median lobes. Pro-opiomelanocortin. Thyroid, parathyroid, adrenals, gonads–Testes and ovaries. Menstrual cycle. Hypothalamus–pituitary target organ axis and regulation by feedback mechanism, Pineal gland, melatonin and circadian rhythm	
3.1.4	Classification of hormones based on solubility and structure, mechanism of action of water soluble and lipid soluble hormones.	
<b>Unit IV:</b>		
<b>4.1</b>	<b>Cell Signaling</b>	
4.1.1	Nerve transmission–Central and peripheral nervous systems. Structure of neuron, axon, dendrites, synapse neuromuscular junction. Neurotransmitters- mechanisms of nerve conduction. $\alpha$ and $\beta$ adrenergic neurons, nicotinic and muscarinic neurons.	<b>12</b>
4.1.2	Muscle contraction–Skeletal muscle and smooth muscle contraction, muscle proteins–actin, myosin, tropomyosine, troponins, mechanisms of muscle contraction, role of calcium and calmodulin Biochemistry of vision	
4.1.3	Cellular signaling: Extra cellular signaling–G Protein linked receptors ,Role of cyclic AMP, IP3, DAG, $Ca^{2+}$ as a second messenger, receptor tyrosine kinases , MAP kinase pathway, NF $\kappa$ B pathway, apoptosis, Cell survival pathway, Jak/Stat pathway, TGF $\beta$ Signaling. Multiple signaling path ways–Insulin receptor (regulation of blood glucose)	
4.1.4	Steroid hormone receptors, structural organization of receptor protein, hormone binding domain, antigenic domain and DNA binding domain.	

**References**

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- [2] The Cell: A Molecular Approach, Fourth Edition by Geoffrey M. Cooper and Robert E. Hausman.
- [3] Cell and Molecular Biology by concepts and experiments by Gerald Karp (2005) John Wiley sons & Inc.
- [4] Molecular cell Biology by Harvey Lodish. W. H. Freeman; 6th edition (2007)
- [5] The Cell–Biochemistry, physiology and morphology by J. Brachet and A. E. Mirsky, Academic Press (1963)

Course Code	Title of the Course	Credits
BCC050	CLINICAL BIOCHEMISTRY	4

**COURSE OUTCOME(S):**

- CO1 Identify in details with application, if applicable, specimen collection and analysis  
CO2 Specify in details with application, if applicable, metabolic disorders  
CO3 Write down the characteristics of hormonal disorders  
CO4 Write down in details with application, if applicable, hematology

		No. of Lectures
<b>Unit I:</b>		<b>10</b>
<b>1.1</b>	<b>Specimen Collection and Analysis</b>	
1.1.1	Concepts of accuracy, precision, reproducibility, reliability, and other factors in quality control.	
1.1.2	Normal values. Specimen collection and Processing: Collection of blood–venipuncture, skin puncture, arterial puncture. Anticoagulants. Collection and analysis of normal and abnormal urine–timed urine specimens, preservatives.	
1.1.3	Clinical significance of sugars, proteins, ketone bodies, bilirubin and porphyrins. CSF–collection, composition and analysis. Amniotic fluid–Origin, collection, composition.	

<b>Unit II:</b>		<b>14</b>
<b>2.1</b>	<b>Disorders</b>	
2.1.1	Disorders of carbohydrate metabolism: Diabetes mellitus, glycohemoglobins, hypoglycemias, galactosemia and ketone bodies.	
2.1.2	Various types of glucose tolerance tests. Glycogen storage diseases.	
2.1.3	Lipid profile, lipidosis and multiple sclerosis. Causes and diagnosis of the disorders of HDL–cholesterol, LDL–cholesterol and triglycerides.	
2.1.4	Cancer: Etiology, diagnosis, treatment and prognosis. Carcinogens, oncogens, mechanism.	
2.1.5	Biochemistry of ageing: Cellular senescence, Role of Telomerase in aging, Alzheimer’s disease, Parkinson’s disease.	

<b>Unit III:</b>		<b>12</b>
<b>3.1</b>	<b>Enzymes and Hormonal Disorders</b>	
3.1.1	<u>Evaluation of organ function tests:</u> Clinical assessment of renal, hepatic, pancreatic, gastric, intestinal and thyroid functions. Clinical importance of bilirubin.	
3.1.2	<u>Diagnostic enzymes:</u> Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine	

3.1.3	kinase, aldolase and lactate dehydrogenase. Enzyme tests in determination of myocardial infarction. Enzymes of pancreatic origin and biliary tract.	
3.1.4	<u>Hormonal disorders</u> : Protein hormones (anterior pituitary hormones, posterior pituitary hormones), steroid hormones, adrenocorticosteroids, and reproductive endocrinology. Disorders of thyroid hormones.	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Hematology</b>	
4.1.1	<u>Biochemical aspects of hematology</u> : Total cell count, differential count, hematocrit.	<b>12</b>
4.1.2	Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias, thrombosis, porphyrias and anemias. Laboratory tests to measure coagulation and thrombolysis.	
4.1.3	Doping	
4.1.4	<u>Detoxification in the body</u> : Enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion.	
4.1.5	Test for lung function: Chest X-ray, Spirometry. Test for Brain function: EEG, MRI, CT.	

#### References

- [1] Textbook of Medical Biochemistry by MN Chatterjea and Rana Shinde, Jaypee Brothers.
- [2] Lehninger Principles of Biochemistry 5th Ed by David L. Nelson and Michael M. Cox, WH Freeman and Company.
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- [7] Harper's Biochemistry (Lange Medical Books) (Paperback) By Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.
- [8] Clinical Biochemistry by Richard Luxton. Scion Publishing Ltd.
- [9] Principles of Medical Biochemistry: With STUDENT CONSULT Online Access (Paperback) by Gerhard Meisenberg and William H. Simmons. Publisher: Mosby.



Course Code	Title of the Course	Credits
BCC060	EXPERIMENTS IN CLINICAL BIOCHEMISTRY AND MOLECULAR BIOLOGY	4

**COURSE OUTCOME(S):**

- CO1 Specify the details of urine and blood analysis  
CO2 Specify the characteristics of determination of enzyme activity  
CO3 Identify the classification and characteristics of DNA quantification and analysis  
CO4 Deliberate the details of isolation of nucleic acids from plant, animal and microbial sources

<b>Group I:</b>	<p><b>Urine analysis</b></p> <ol style="list-style-type: none"> <li>1. Qualitative analysis of urine for normal organic and inorganic constituents</li> <li>2. Qualitative analysis of urine for abnormal constituents- Glucose, albumin, Ketone bodies.</li> <li>3. Quantitative estimation of Creatine and Creatinine, Urea, Uric acid, Sulphate, Chloride</li> <li>4. Titrable acidity</li> </ol> <p><b>Blood analysis</b></p> <ol style="list-style-type: none"> <li>5. Quantitative estimation of Urea, Uric acid, Creatine, Cholesterol HDL-C and LDL-C</li> <li>6. Blood glucose and GTT</li> </ol>	
<b>Group II:</b>	<p><b>Determination of Enzyme activity of</b></p> <ol style="list-style-type: none"> <li>7. Alkaline phosphatase</li> <li>8. SGOT</li> <li>9. SGPT</li> <li>10. LDH</li> <li>11. Electrophoresis of lipoproteins: Serum proteins.</li> <li>12. Albumin/Globulin Ratio.</li> <li>13. Fractionation of serum proteins-Ammonium sulphate precipitation.</li> <li>14. Isolation of DNA and RNA from biological sources.</li> <li>15. Quantitative determination of DNA and RNA.</li> </ol>	
<b>Group III:</b>	<ol style="list-style-type: none"> <li>16. Determination of melting temperature of DNA (T<sub>m</sub>)</li> <li>17. Sub-cellular fractionation of rat liver by differential centrifugation and marker analysis</li> <li>18. Determination of activities of marker enzymes</li> <li>19. Preparation of erythrocyte ghosts</li> <li>20. Kinetics of uptake of glucose by erythrocytes</li> <li>21. Viability of cells by trypan blue dye exclusion</li> <li>22. Study of morphology of <i>Drosophila melanogaster</i></li> </ol>	

	23. Study of mutants of <i>Drosophila melanogaster</i> 24. Study of polytene chromosomes of <i>Drosophila melanogaster</i>	
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<b>Group Study</b>	Isolation of plasmid DNA, Restriction digestion of plasmid DNA, ligation of DNA fragment into a plasmid vector, preparation of competent cells, <i>E.Coli</i> transformation and amplification of DNA by PCR.	
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### References

- [1] Practical Clinical Biochemistry, ed. Harold Varley, 4th edn. CBS Publishers (1988).
- [2] Practical Clinical Biochemistry: Methods and Interpretation, ed. Ranjna Chawla, Jaypee Brothers Medical Publishers (1996).
- [3] Practical and Clinical Biochemistry for Medical Students, ed. T.N. Pattabhiraman, Gajana Publishers (1994).
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- [9] Gene Cloning and DNA analysis- An Introduction; T. A. Brown, 5th Edition, Wiley-Blackwell (2006).
- [10] Laboratory methods in Enzymology; Part-A; Jon Lorsch, Academic Press (2014).
- [11] Gene Cloning Laboratory Manual 4th Edn. Michael R. Green and Joseph Sambrook, CSHL Press (2014).
- [12] Current Protocols in Molecular Biology; S Gallagher, Wiley Interscience (2008).

Course Code	Title of the Course	Credits
BCC220	GENOMICS, PROTEOMICS AND BIOINFORMATICS	4

**COURSE OUTCOME(S):**

- CO1 Specify the details of DNA sequencing methods
- CO2 Specify the characteristics of determination of Proteins
- CO3 Identify the classification and characteristics of microarray data
- CO4 Deliberate the details of bioinformatics in biological databases and sequencing analysis

		No. of Lectures
<b>Unit I:</b>		<b>12</b>
<b>1.1</b>	<b>Structural Organization of Genome and Sequencing</b>	
1.1.1	Structural organization of genome in Prokaryotes and Eukaryotes, Organelle DNA–mitochondrial, chloroplast,	
1.1.2	DNA sequencing–principles and translation to large scale projects, Recognition of coding and non–coding sequences and gene annotation. Tools for genome analysis–RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis–physical and genetic mapping.	
1.1.3	Microbes, plants and animals, Accessing and retrieving genome project information from web, Comparative genomics, ESTs and SNPs.	

<b>Unit II:</b>		<b>12</b>
<b>2.1</b>	<b>Proteomics</b>	
2.1.1	Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing),	
2.1.2	2–D electrophoresis of proteins, Microscale solution isoelectricfocusing, Peptide fingerprinting,	
2.1.3	LC/MS-MS for identification of proteins and modified proteins, MALDI-TOF	
2.1.4	SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid systems.	

<b>Unit III:</b>		<b>08</b>
<b>3.1</b>	<b>Functional Genomics, Proteomics and Metabolomics</b>	
3.1.1	Analysis of microarray data, Protein and peptide microarray–based technology; PCR–directed protein <i>in situ</i> arrays	
3.1.2	Structural proteomics	
3.1.3	Metabolomics	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Biological Databases and Sequence Analysis</b>	
4.1.1	<u>Introduction biological databases</u> : Types (relational & object-oriented). Primary, secondary & specialized databases.	<b>16</b>
4.1.2	Types of databases–Nucleotide sequence database, EMBL, Genbank, Unigene, Genome biology, Protein dBase (Swiss-prot & Trembl and Motif) and 3D structure databases (PDB, SCOP, Cath, Genecards, SRS & Entrez).	
4.1.3	Computational approaches for gene identification, ORF and Human Genome Project.	
4.1.4	<u>Basics of sequence analysis</u> : Alignments using BLAST and FASTA, Multiple Sequence Alignment (CLUSTAL-X and CLUSTAL-W), Application of multiple sequence alignment	
4.1.5	Protein Structure Prediction in Bioinformatics– <i>Ab initio</i> based methods, Homology based methods, secondary structure prediction.	
4.1.6	Protein structure comparison–intermolecular and intramolecular methods. Phylogenetic construction by distance based methods	

#### References

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- [2] Brown TA, Genomes, 3rd Edition. Garland Science 2006
- [3] Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007
- [4] Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006.
- [5] Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.
- [6] Essential Bioinformatics (Paperback) by Jin Xiong. Cambridge University Press.
- [7] Bioinformatics: Methods & Protocols by Stephen Misener and Stephen A. Krawetz,  
[8] Humana Press.
- [9] Essentials of Bioinformatics by Irfan Ali Khan and Atiya Khanum. Publisher: Ukaaz Publications.
- [10] Bioinformatics: Sequence and Genome Analysis (Hardcover) by David W. Mount. Cold Spring Harbor Laboratory Press
- [11] Introduction to Bioinformatics (Paperback) by Arthur M. Lesk. Oxford Univ Press.
- [12] Introduction to Bioinformatics: A Theoretical and Practical Approach (Paperback) by David Womble, Stephen A. Krawetz and David D. Womble. Humana Press Inc., U.S.
- [13] Applied Bioinformatics: An Introduction (Paperback) by Paul M. Selzer, Richard
- [14] Marhofer and Andreas Rohwer. Publisher: Springer-Verlag Berlin and Heidelberg GmbH & Co. K.

<b>Course Code</b>	<b>Title of the Course</b>	<b>Credits</b>
	<b>BIOTECHNOLOGY AND RESEARCH METHODOLOGY</b>	<b>4</b>

**COURSE OUTCOME(S):**

Upon completion of the course, the student is able to

<b>CO1</b>	Understand the concepts of biotechnology
<b>CO2</b>	Provide examples of current applications of biotechnology
<b>CO3</b>	Explain the concept and application of enzyme technology
<b>CO4</b>	Explain the general principles of generating transgenic plants, animals and microbes
<b>CO5</b>	Understand the concepts of research methods, tools and ethics

		<b>No. of Lectures</b>
<b>Unit I:</b>		<b>12</b>
<b>1.1</b>	<b>Tissue culture and transgenesis</b>	
1.1.1	Techniques of tissue culture—culturing explants and haploids, protoplasts fusion and embryoids.	
1.1.2	Methods of gene transfer to plants, animals and bacteria—Ca transfection, electroporation, shotgun and others.	
1.1.3	Transgenic plants, gene knockouts and transgenic animals.	

<b>Unit II:</b>		<b>16</b>
<b>2.1</b>	<b>Industrial Biotechnology</b>	
2.1.1	Fermentors: principle, types product recovery and purification of ethanol, citric acid, vitamin B12, streptomycin.	
2.1.2	Enzyme biotechnology—production and uses of industrially important enzymes such as protease, immobilization of enzymes and their applications	
2.1.3	Waste treatment, bioenergy, biogas production, biopesticides and bioleaching.	

<b>Unit III:</b>		<b>08</b>
<b>3.1</b>	<b>Biosafety and Bioethics</b>	
3.1.1	Biotechnology–potential hazards, biological weapons, biosafety of GM foods and GMOs–substantial equivalence and safety testing.	
3.1.2	Human genome research–the objectives and approaches, genomics and genome prospecting–the controversies, issues of biotechnology-social and scientific, technology protecting systems and the terminator.	
3.1.3	IPR, its concepts and conditions–patenting of genes, cells and life forms, evaluation of life patenting.	

<b>Unit IV:</b>		<b>12</b>
<b>4.1</b>	<b>Research Methodology</b>	
4.1.1	Types of Research: Academic, Industrial, Clinical, Basic and Applied research. Research objectives, review of literature and hypothesis formulation.	
4.1.2	Information, types and sources. PubMed as a resource. Research Design: Types of studies-cohort, double blind, placebo and cross-over.	
4.1.3	Statistical Methods: Error and significance, sample size and data collection, presentation of data, parametric and non-parametric tests	
4.1.4	Ethical issues: ICMR guidelines of ethical issues, IPR and Plagiarism	

### References

- [1] Fermentation Biotechnology O.P. Ward. 1989 Prentice Hall.
- [2] Biotechnology J.E. Smith Cambridge University Press 1996.
- [3] Introduction to Biotechnology Brown, Campbell and Priest Blackwell Science 1987.
- [4] A Textbook on Biotechnology H.D. Kumar 2nd edition East West Press 1998.
- [5] Molecular Biotechnology Glick and Pasternak, Panima Publ.
- [6] From Genes to clones Winnaecker VCH Publication.
- [7] Elements of Biotechnology P.K. Gupta, Rastogi Publication, 1998.
- [8] Molecular Biology and Biotechnology. Walker and Gingold. 3rd ed. Panima Publ. 1999.
- [9] Plant Biotechnology. Ignacimuthu, Oxford, IBH.
- [10] Recombinant DNA Technology, Watson, Scientific American Publ.
- [11] Principles of Genome analysis, Primrose, Oxford University Press, 1998.
- [12] [Handbook of Research Methodology: A compendium for scholars and researchers, Dr. Shanti Bhushan Mishra Dr. Shashi Alok, EDUCREATION PUBLISHING, 2019](#)
- [13] [Research Methodology: A step-by-step Guide for Beginners, 3rd Edition, Ranjit Kumar, SAGE Publications, 2011](#)

Course Code	Title of the Course	Credits
BCC220	PHARMACEUTICAL BIOCHEMISTRY	4

### COURSE OUTCOME(S):

- CO1 Identify the details of ADME mechanism of drugs
- CO2 Learn in details with application, if applicable, Drug receptor interactions
- CO3 Deliberate in details with application, if applicable, Mode of action of anti cancer drugs
- CO4 Write down in depth Drug tolerance and abuse

		No. of Lectures
<b>Unit I:</b>		<b>10</b>
<b>1.1</b>	<b>Drugs</b>	
1.1.1	Drugs: History of Drugs Classification of drugs, routes of drug administration, absorption and distribution of drugs.	
1.1.2	Factors influencing drug absorption and elimination of drugs. □	

<b>Unit II:</b>		<b>14</b>
<b>2.1</b>	<b>Drug Receptor and Metabolism</b>	
2.1.1	Drug-Receptor interactions involvements of binding forces in drug receptor interaction, drug action not mediated by receptors.	
2.1.2	Drug metabolism: Mechanism of phase I and II enzyme reactions, biochemical importance of xenobiotic metabolism. □	

<b>Unit III:</b>		<b>12</b>
<b>3.1</b>	<b>Anticancer Drugs</b>	
3.1.1	Cancer: Cancer and principles of cancer chemotherapy, mode of action of anti cancer drugs.	
3.1.2	Antimetabolites, antibiotics, alkylating agents and other agents, □	

<b>Unit IV:</b>		<b>12</b>
<b>4.1</b>	<b>Adverse Drug Reactions</b>	
4.1.1	Adverse drug reactions and drug induced side effects.	
4.1.2	Biological effects of drug abuse and drug dependence.	
4.1.3	Drug tolerance and intolerance. □	

**References**

- [1] The Pharmacology volume I and II –Goodman and Gillman
- [2] Basic Pharmacology –Foxter Cox
- [3] Oxford text book of Clinical Pharmacology and Drug Therapy ,D.G Grahme Smith and J.K.Aronson
- [4] Pharmacology and Pharmatherapeutics – R.S.Satoskar,S.D.Bhandhakarand
- [5] Essentials of Pharmacotherapeutics ,Barav.F.S.K
- [6] Lippincotts illustrated review Pharmacology, Mary.J.Mycek,Richards ,Pamela



<b>Course Code</b>	<b>Title of the Course (Open Elective)</b>	<b>Credits</b>
<b>BCC630</b>	<b>NUTRITION AND HEALTH</b>	<b>4</b>

**COURSE OUTCOME(S):**

- CO1 Identify the details of basic concepts of nutrition  
CO2 Learn in details with application, if applicable, nutrients  
CO3 Deliberate in details with application, if applicable, nutrition associated problems  
CO4 Write down in depth social health problems

		<b>No. of Lectures</b>
<b>Unit I:</b>		<b>10</b>
<b>1.1</b>	<b>Basic Concepts in Nutrition</b>	
1.1.1	Understanding relationship between food, nutrition, health and food pyramid.	
1.1.2	Functions of food: Physiological, psychological and social Basic food groups and concept of balanced diet	
1.1.3	Energy: Functions, sources and concept of energy balance.	
1.1.4	Nutritional requirements: Physiological considerations and nutritional concerns for the following life stages: Adult man / woman Preschool children Adolescent children Pregnant woman, Nursing woman and infant Geriatrics	

<b>Unit II:</b>		<b>14</b>
<b>2.1</b>	<b>Nutrients</b>	
2.1.1	Functions, Recommended Dietary Allowances, dietary sources, effects of deficiency and/ or excess consumption on health of the following nutrients: Carbohydrates and dietary fibre Lipids Proteins Fat soluble vitamins: A, D, E and K Water soluble vitamins: Thiamin, Riboflavin, Niacin, Pyridoxine, Folate, Vitamin B12 and Vitamin C Minerals: Calcium, Iron, Zinc and Iodine	
2.1.2	Gut Microbiome	

<b>Unit III:</b>		
<b>3.1</b>	<b>Nutritional problems, their implications and related nutrition programmes</b>	
3.1.1	Etiology, prevalence, clinical features and preventive strategies of <u>Undernutrition:</u> Protein energy malnutrition, nutritional anemia's, vitamin A deficiency and iodine deficiency disorders <u>Overnutrition:</u> Obesity, Coronary Heart Disease and Diabetes	<b>14</b>
3.1.2	<u>National Nutrition Policy and Programmes:</u> Integrated Child Development Services (ICDS) Scheme Mid day Meal Programme (MDMP) National programmes for prevention of Anemia Vitamin A deficiency and Iodine Deficiency Disorders	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Social health problems</b>	
4.1.1	Smoking Alcoholism AIDS including AIDS Control Programme	<b>10</b>
4.1.2	<u>Nutrition for special conditions:</u> Nutrition for physical fitness and sport, BMI Feeding problems in children with special needs Considerations during natural and man-made disasters e.g. floods, war. Basic guidelines in disaster management	

## References

- [1] Text Book of Biochemistry with Clinical correlations; Thomas Devlin [Ed.] (1997), Wiley –Liss.
- [2] Harper's Review of Biochemistry, Murray et. al., (1997) 24th Edn., Lange
- [3] Bryan Derrickson, Gerard J Tortora Principles of Anatomy and Physiology , twelfth Ed, 2011, Wiley & Sons Limited.
- [4] Bamji MS, Krishnaswamy K and Brahmam GNV (Eds) (2009). Textbook of Human Nutrition, 3rd edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- [5] Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; 2012; New Age International Publishers
- [6] Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.
- [7] Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.
- [8] Suri S. and Malhotra A. Food Science, Nutrition & Food Safety Pearson India Ltd. 2014.
- [9] Edelstein S, Sharlin J (ed). Life Cycle Nutrition- An Evidence Based Approach; 2009; Jones and Barlett Publishers.
- [10] ICMR (1989) Nutritive Value of Indian Foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad.
- [11] ICMR (2011) Dietary Guidelines for Indians – A Manual. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad
- [12] World Health Organization (2006). WHO Child Growth Standards: Methods and development: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age (d).
- [13] Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic 14 Excellence

Course Code	Title of the Course	Credits
BCD010	MOLECULAR BIOLOGY AND GENE REGULATION	4

**COURSE OUTCOME(S):**

- CO1 Write down the characteristics of DNA characteristics and replication
- CO2 Write down in depth Transcription and regulation
- CO3 Learn in depth translation
- CO4 Identify in depth translational regulation

		No. of Lectures
<b>Unit I:</b>		
<b>1.1</b>	<b>DNA Replication and Gene Expression</b>	
1.1.1	<u>Introduction</u> : Historical perspective, types of RNA, Central dogma of molecular biology.	<b>14</b>
1.1.2	<u>DNA Replication</u> : Nearest neighbor base frequency analysis. Replication of DNA semiconservative model- Meselson and Stahl experiment. Direction of replication of <i>E.coli</i> , discontinuous replication-Okazaki fragments.	
1.1.3	Composition and properties of DNA polymerase I, II and III. of <i>E.coli</i> DNA ligase, fidelity of replication. DNA topoisomerases and gyrases.	
1.1.4	Replication in viruses single stranded DNA virus, $\phi$ X174, rolling circle model. Replication of mitochondrial DNA.	
1.1.5	Organization of prokaryotic and eukaryotic gene-promoters, introns, exons, other regulatory sequences, enhancers, silencers, function of introns.	
1.1.6	<u>Regulation of Gene expression in prokaryotes</u> : Operon model-Lac operon-structure and regulation; Galactose operon-role of two promoters; Arabinose operon-positive control; tryptophan operon-attenuation control.	
1.1.7	<u>Regulation of gene expression at the level of DNA structure</u> : Super coiling, DNA methylation, role of nucleosome structure of eukaryotic DNA in gene expression-eg. glucocorticoid gene, chromatin remodeling	

<b>Unit II:</b>		
<b>2.1</b>	<b>Transcription and Regulation</b>	
2.1.1	<u>Transcription</u> : RNA biosynthesis in prokaryotes and eukaryotes- initiation, elongation and termination. RNA polymerase I, II and III. RNA dependent RNA synthesis - RNA replicase of QB virus.	<b>10</b>
2.1.2	Processing of eukaryotic mRNA–cap addition, poly A tail addition, intron splicing, RNA editing. Processing of t–RNA.	
2.1.3	<u>Regulation at the level of transcription</u> : Transcription factors, TF II. Formation of initiation complex. Role of enhancers	
2.1.4	<u>Regulation at the level of RNA processing</u> : RNA export and RNA stability. Factors affecting RNA stability. RNA degradation.	
<b>Unit III:</b>		
<b>3.1</b>	<b>Translation</b>	
3.1.1	<u>Translation</u> : Genetic code, triplet codon, Universality features of the genetic code, assignment of codons studies of Khorana, Nirenberg, triplet binding techniques, degeneracy of codons, wobble hypothesis, evolution of genetic code and codon usage, variation in the codon usage.	<b>12</b>
3.1.2	<u>3D structure of prokaryotic and eukaryotic ribosomes</u> . <u>Translation</u> : initiation, elongation and termination. Role of m–RNA and t–RNA; aminoacyl t–RNA synthetase and its role in translation accuracy, signal sequence, translational proof-reading, translational inhibitors.	
3.1.3	<u>Post translational modification of proteins</u> –signal peptide cleavage, disulphide bond formation, O–and N–Glycosylation, folding of nascent protein, role of chaperones, attachment of glycosyl anchor, and other modifications.	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Translational Regulation</b>	
4.1.1	<u>Regulation at the level of translation</u> : Secondary structure in the 5' and 3' untranslated region–eg. Regulation of Ferritin and Transformation of m-RNA. Role of upstream AUG codons. (eg. GCN 4 gene regulation), transplicing and translational introns, protein splicing introns.	<b>12</b>
4.1.2	<u>Role of ribosomes in the regulation of translation</u> : Proof–reading mechanism. Ribosomal optimization of translation. Regulation at the level of ribosome assembly. Regulation at the level of post-translational modification, protein stability, N–end rule, PEST and other sequences	

## References

- [1] Molecular Biology of the Cell, Alberts et al., Garland Publications, (2012).
- [2] Molecular Biology, David Freifelder, Narosa Publishers, (1997).
- [3] Molecular Biology Robert F. Weaver, McGraw Hill (2012).
- [4] Molecular Biology of Gene; Watson, J.D. et al., 5th Edn. Pearson Education; (2004).
- [5] Principles of Virology; S.J. Flint et al., ASM Press (2000).
- [6] Biochemistry and Molecular Biology; 5th Edn. D.Papachristodoulou, A. Snape, W.H. Elliott, and D. C. Elliott Oxford University Press (2014)
- [7] Chromatin structure and Gene Expression; 2nd Edn. Sarah Elgin, Jerry Workman, Oxford University Press (2000)
- [8] Molecular Cell Biology; Harvey Lodish 5th Edn. (2010)
- [9] Biochemistry 5th Edn. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer (2011).
- [10] Genome Stability: DNA Repair and Recombination; James Haber, Garland Science (2013)

<b>Course Code</b>	<b>Title of the Course</b>	<b>Credits</b>
<b>BCD070</b>	<b>GENETICS AND GENETIC ENGINEERING</b>	<b>4</b>

**COURSE OUTCOME(S):**

Upon completion of the course, the student is able to

<b>CO1</b>	Understand the importance of plasmids and viruses to genetic engineering.
<b>CO2</b>	Understand the principle of Mendelism and gene development
<b>CO3</b>	Describe how mutations occur and scope of population genetics
<b>CO4</b>	Explain the principle of genetic engineering
<b>CO5</b>	Understand the value of and the processes involved in the amplification of DNA

		<b>No. of Lectures</b>
<b>Unit I:</b>		<b>12</b>
<b>1.1</b>	<b>Mendelism and Gene Organization</b>	
1.1.1	Basic principles of Mendelism–Laws of inheritance, dominance, codominance, epistasis, (eg. Comb shape in chickens). Pleiotropism. Cytoplasmic inheritances (eg. Shell Coiling)	
1.1.2	Organisation of genes in chromosomes–Single copy gene, gene families, tandemly repeating genes, pseudo genes	
1.1.3	Chromosome number–Ploidy, karyotyping, sex chromosome and dosage compensation. Mobile genetic elements,	
1.1.4	Chromosomal basis of human diseases–Extra or missing chromosome, abnormality in chromosome structure–deletion duplication, inversion and translocation.	
1.1.5	Gene and development–Model systems for studying development in Drosophila, genetic control of development in Drosophila, anteroposterior axis, specification role of maternal genes, segmentation of larval body, gap genes, pair rule genes, homeotic genes, complex gene interaction in development, sequential gene action.	

<b>Unit II:</b>		
<b>2.1</b>	<b>Population Genetics and Mutations</b>	
2.1.1	Population Genetics–Genetic variation, Hardy–Weinberg Law, genetic frequency, migration, genetic equilibrium	<b>16</b>
2.1.2	Mutations- nature of mutations–spontaneous and induced mutation, conditional lethal (eg. Temperature sensitive) mutation. Biochemical basis of mutation. Point mutation, base substitution mutation, missense, nonsense and silent mutations. Mutation rates. Chemical mutagens, radiation induced mutation, reverse mutations and suppressor mutations–intergenic and intragenic suppression, reversion as a means of detecting mutagens - Ames test	
2.1.3	Repair Mechanism–DNA repair mechanisms. Reciprocal recombination, site specific recombination, <i>E. coli</i> rec system. Holliday model of recombination, SOS repair.	

<b>Unit III:</b>		
<b>3.1</b>	<b>Tools of Genetic Engineering</b>	
3.1.1	Basic principles–mechanism of natural gene transfer by <i>Agrobacterium</i> , generation of foreign DNA molecules.	<b>12</b>
3.1.2	Restriction enzymes, their types and target sites, cutting and joining DNA molecules, linkers, adapters, homopolymers, enzymes used in genetic engineering.	
3.1.3	Cloning vehicles and their properties, natural plasmids, in vitro vectors, cosmids and T-DNA based hybrid vectors.	
3.1.4	Cloning strategies–cloning with single strand DNA vectors, cDNA cloning and gene libraries, recombinant selection and screening methods, expression of cloned genes–problems and solutions, shuffle vectors.	
3.1.5	DNA sequencing strategies–Sanger's and Maxam–Gilbert's methods and NGS.	

<b>Unit IV:</b>		
<b>4.1</b>	<b>Amplification &amp; Applications of Genetic Engineering</b>	
4.1.1	Amplification of DNA by PCR technique and applications.	<b>8</b>
4.1.2	<i>In situ</i> hybridization, analysis of DNA, RNA and protein by blotting techniques.	
4.1.3	Marker and Reporter genes.	
4.1.4	Applications of genetic engineering: Transgenic plants and animals, DNA vaccines and Gene therapy	



## References

- [1] Singh, J.S., Singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi
- [2] Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth System Approach. Oxford.
- [3] Daubenmier, R.F. (1970). Plants and Environment: A text book of Plant Autoecology, Wiley Eastern Private Limited
- [4] Daubenmier, R.F. (1970), Plant Communities, Wiley Eastern Private Limited
- [5] Odum, E. (2008) Ecology. Oxford and IBH Publisher.
- [6] Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.
- [7] Tom Strachan & Andrew P.Read 1999. Human Molecular Genetics (2nd Edition), John Wiley & Sons.
- [8] Ricki Lewis, 1998. Human Genetics-Concepts & Applications (3rd Edition), McGraw-Hill.
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- [12] Watson, J.D., Hopkins, N. H., Roberts, J. W. Steitz & Weiner, A. M., 1987. Molecular Biology of the Genes, The Benjamin/Cummings Publishing Company Inc., Tokyo.

<b>Course Code</b>	<b>Title of the Course</b>	<b>Credits</b>
<b>BCD060</b>	<b>PROJECT WORK OR DISSERTATION</b>	<b>8</b>

**COURSE OUTCOME(S):**

- CO1 Identify the classification and characteristics of literature survey
- CO3 Learn in depth define of objective of project work
- CO3 Write down the classification and characteristics of design of experimental methods
- CO4 Understand the details of result analysis and interpretation

# BLUE PRINT OF QUESTION PAPER FOR C1 & C2 COMPONENT

JSS Mahavidyapeetha  
**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
(Autonomous) B N Road, Mysuru - 25

**M.Sc. Biochemistry**

I/II/III/IV Semester First/Second Internal Assessment Test (Component 1/2)

**Title of the Course & Code**

**Duration: 1hr**

**Max Marks: 20**

**A) Answer any FOUR of the following**

**4X2=08**

- 1.
- 2.
- 3.
- 4.
- 5

**B) Answer any ONE of the following**

**1X4=04**

- 1.
- 2.

**C) Answer any ONE of the following**

**1X8=08**

- 1.
- 2.

# BLUE PRINT OF QUESTION PAPER FOR C3 COMPONENT

JSS Mahavidyapeetha  
**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
(Autonomous), Ooty Road, Mysuru – 570025

**M.Sc Degree**  
I/II/III/IV Semester Examination, \_\_\_\_\_

## **BIOCHEMISTRY**

**Course Title & QP Code**

Time: 3 Hours

Max. Marks: 70

**Instructions to Candidates:**

**Answer any Five questions from Part – A**

**Any Four questions from Part – B**

**Any Three questions from Part – C**

### **Part – A**

**5X2=10**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

### **Part – B**

**4X6=24**

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

### **Part – C**

**3X12=36**

- 14.
- 15.
- 16.
- 17.
- 18.

**CHOICE BASED CREDIT SYSTEM AND  
CONTINUOUS ASSESSMENT AND GRADING PATTERN**

**SYLLABUS FOR**

**MASTER'S DEGREE PROGRAM  
IN  
BIO-TECHNOLOGY  
(2018-19 ONWARDS)**



**JSS COLLEGE OF ARTS COMMERCE AND SCIENCE**  
(An Autonomous College of University of Mysore; Re-Accredited by NAAC with 'A' Grade)

**POSTGRADUATE DEPARTMENT OF STUDIES IN BIO-TECHNOLOGY**  
Ooty Road, Mysore – 570 025, India

**POSTGRADUATE DEPARTMENT OF STUDIES IN BIOTECHNOLOGY**

**Choice Based Credit System and Continuous Assessment and Grading Pattern Syllabus**

**M.Sc., PROGRAM IN BIOTECHNOLOGY**

**Scheme of Study – 2018-19 onwards**

**Credit matrix for Master's Degree Program in Biotechnology**

<b>Credits to be earned</b>	<b>I Sem</b>	<b>II Sem</b>	<b>III Sem</b>	<b>IV Sem</b>	<b>Total Credits</b>
Hard Core Course	12	12	12	16	52
Soft Core Course	08	08	04	–	20
Open Elective Course	–	–	04	–	04
<b>Semester Total</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>16</b>	<b>76</b>

<b>I SEMESTER</b>			
<b>Course title</b>	<b>Hard Core(HC)/ Soft Core(SC)</b>	<b>Credit pattern (L:T:P)</b>	<b>Credits</b>
Biomolecules and Bioenergetics	HC	3:1:0	4
Bioanalytical Techniques	HC	3:1:0	4
Lab – I	HC	0:0:4	4
<b>Choose any TWO from the following</b>	SC	3:1:0	4
1. Molecular Genetics			
2. Microbiology	SC	3:1:0	4
3. Cancer Biology			
4. Cell Biology			
<b>NON CREDIT COURSES</b>			
<b>Communication Skills</b>			
<b>Total credits</b>			<b>20</b>
<b>II SEMESTER</b>			
<b>Course title</b>	<b>Hard Core(HC)/ Soft Core(SC)</b>	<b>Credit pattern (L:T:P)</b>	<b>Credits</b>
Molecular Biology	HC	3:1:0	4
Immunology and Immunotechnology	HC	3:1:0	4
Lab – II	HC	0:0:4	4
<b>Choose any TWO from the following</b>	SC	3:1:0	4
1. Cell Signalling and communication			
2. Metabolomics	SC	3:1:0	4
3. Food and Environmental Biotechnology			
4. Pharmaceutical Biotechnology			
<b>NON CREDIT COURSE</b>			
<b>Employability Skills</b>			
<b>Total credits</b>			<b>20</b>

<b>III SEMESTER</b>			
<b>Course title</b>	<b>Hard Core(HC)/ Soft Core(SC)/ Open Elective(OE)</b>	<b>Credit pattern (L:T:P)</b>	<b>Credits</b>
Bioprocess Engineering and Technology	HC	3:1:0	4
Genetic Engineering	HC	3:1:0	4
Lab – III	HC	0:0:4	4
<b>Choose any ONE from the following</b> 1. Biostatistics, Bioinformatics and Bioentrepreneurship 2. Clinical and Advanced Techniques in Biotechnology	SC	4:0:0	4
Applied Biotechnology * (For other discipline students)	OE	4:0:0	4
<b>Total credits</b>			<b>20</b>
<b>IV SEMESTER</b>			
<b>Course title</b>	<b>Hard Core(HC)</b>	<b>Credit pattern (L:T:P)</b>	<b>Credits</b>
Plant Biotechnology	HC	3:1:0	4
Animal Biotechnology	HC	3:1:0	4
<b>Project Work/Dissertation</b>	HC	0:4:4	8
<b>Total credits</b>			<b>16</b>
<b>Total credits to be earned for M.Sc. Biotechnology</b>			<b>76</b>

**\* Open Elective Course shall be from different discipline of study**

1. A student opting I, II and III semester has to appear for at least 12 credits. (Soft core course may be studied any time).
2. Minimum number of students per Soft core course is 15.

L – Lecture – 1 credit = 1 hour

T – Tutorial – 1 credit = 2 hours

P – Practical – 1 credit = 2 hours

#### **ASSESSMENT:**

**Continous Assessment: C1 – 15% & C2 – 15% (at the end of 8th and 16th week respectively)**

<b>Assessment</b>	<b>IA Test (20 Marks)</b>	<b>Assignment (5M)</b>		<b>Total (25 Marks)</b>	<b>Total reduced to 15 Marks</b>
		a - Collection of material - 2.5 Marks	b - Preparation of report - 2.5 Marks		
<b>C1</b>					
<b>C2</b>					

**Semester End Assessment: C3 – 70% – By written exam.**

Conversion of grades in to credits should be based on relative evaluation calculations.

## **Program: M.Sc. Biotechnology**

### **Program outcomes (PO):**

**PO1:** To make the students develop interpersonal skills, written and oral communication and also to improve their body language and eye contact during presentations.

**PO2:** To train the students in group discussions to develop leadership qualities and to respect the others idea and take the decisions for the welfare of society.

**PO3:** To teach the students not to demoralize the others ideas and not to differentiate the intelligent and the ignorant, poor and the rich and to uphold the moral values in the society.

**PO4:** Upon completion of course students will have the ability to design the experiments to solve the current problems in the society related to health, environment and industries.

**PO5:** To make the students competent enough to write the research papers, project proposals and application of mathematics in understanding biological science.

### **Program Specific Outcomes (PSO):**

**PSO1:** To make the students understand the nature, bio-molecules, their analysis and application in day to day life, so that we are transforming knowledge from nature to lab and lab to beside.

**PSO2:** Higher studies like M.Phil and Ph.D can be pursued to attain research positions.

**PSO3:** Various examinations such as CSIR-NET, ARS-NET GATE, ICMR, DBT and many other opens channels for career development.

**PSO4:** Students have various opportunities in different industrial sector.

**PSO5:** Several career opportunities are available for students with biotechnology background abroad

**PSO6:** In practical we teach the students to follow the standard operating procedures of the equipment, troubleshooting the problems and analyse and interpretation of data.

**PSO7:** To train the students regarding bio-safety in handling corrosive, explosive and radioactive and bio-hazardous compounds.



**I SEMESTER**  
**BIOMOLECULES AND BIOENERGETICS (HARD CORE) - 48 Hrs**

**COURSE CODE: BTA040**

**Course Outcome**

CO1-Study of different biomolecules

CO2-Metabolism and their regulation

CO3-Enzymes and their role in metabolism

CO4- Application of thermodynamics to understand the basic concepts of life.

**Unit – I**

**12 Hrs**

Chemical basis of life; Composition of living matter; Water – properties, pH, ionization and hydrophobicity; Emergent properties of biomolecules in water; Biomolecular hierarchy; Macromolecules; Molecular assemblies; Structure-function relationships

Amino acids – structure and functional group properties; Peptides and covalent structure of proteins; Ramchandran's plot; Elucidation of primary and higher order structures; Evolution of protein structure; Structure-function relationships in model proteins like ribonuclease A, myoglobin, hemoglobin and chymotrypsin.

**Unit – II**

**12 Hrs**

Enzyme catalysis – general principles of catalysis; Quantitation of enzyme activity and efficiency; Enzyme characterization and Michaelis-Menten kinetics; activation, inhibition (reversible & irreversible) and covalent modification; Single substrate enzymes; Bisubstrate reaction (ping-pong and sequential), Applications of enzymes (food& Pharmacy).

**Unit – III**

**12 Hrs**

Sugars - mono, di, and polysaccharides; Suitability in the context of their different functions-cellular structure, energy storage, signaling; Glycosylation of other biomolecules - glycoproteins and glycolipids; Lipids - structure and properties of important members of storage and membrane lipids; lipoproteins

**Unit – IV**

**12 Hrs**

Bioenergetics-basic principles; Equilibria and concept of free energy; Coupled processes; Glycolytic pathway; Kreb's cycle; Oxidative phosphorylation; Photophosphorylation; Elucidation of metabolic pathways; Logic and integration of central metabolism; entry/ exit of various biomolecules from central pathways; Principles of metabolic regulation; Regulatory steps; Nucleosides, nucleotides, nucleic acids - structure, diversity and function

**Texts/References**

1. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
2. A.L. Lehninger, Principles of Biochemistry, 4th edition, W.H Freeman and Company, 2004.
3. L. Stryer, Biochemistry, 5th edition, W.H. Freeman and Company, 2002.

## BIOANALYTICAL TECHNIQUES (HARD CORE) - 48 HRS

### COURSE CODE: BTA050

#### Course Outcome

CO1-To understand the separation of molecules by different chromatography, centrifugation and electrophoretic techniques

CO2-Analysis and characterization of molecules by spectroscopy techniques

CO3-Use of radioactive material in understanding metabolic pathways

#### Unit- I

12 Hrs

Basic Techniques

Buffers; Methods of cell disintegration; Enzyme assays and controls; Detergents and membrane proteins; Dialysis, Ultrafiltration and other membrane techniques

Spectroscopy Techniques

UV, Visible and Raman Spectroscopy; Theory and application of Circular Dichroism; Fluorescence; MS, MALDI-TOF; NMR and Plasma Emission spectroscopy; Protein crystallization; Theory and methods; API-electrospray; Peptide Synthesis.

**Imaging techniques:** Compound microscope, fluorescent, phase contrast, TEM, SEM, cryo-electron microscope

#### Unit-II

12 Hrs

Chromatography Techniques

TLC and Paper chromatography; Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC and FPLC; Criteria of protein purity

Electrophoretic techniques

Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; 2DElectrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis

#### Unit- III

12 Hrs

Centrifugation

Basic principles; (RCF, Sedimentation coefficient etc); Types of centrifuge -Microcentrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation; Applications (Isolation of cell components); Analytical centrifugation; Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods

#### Unit- IV

12 Hrs

Radioactivity

Radioactive & stable isotopes; Pattern and rate of radioactive decay; Units of radioactivity; Measurement of radioactivity; Geiger-Muller counter; Solid & Liquid scintillation counters (Basic principle, instrumentation & technique); Brief idea of radiation dosimetry; Cerenkov radiation; Autoradiography; Measurement of stable isotopes; Falling drop method; Applications of isotopes in biochemistry; Radiotracer techniques; Distribution studies; Isotope dilution technique; Metabolic studies; Clinical application; Radioimmunoassay

#### Texts/References

1. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman & Company, San Fransisco, 1982.
2. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5<sup>th</sup> Edition, Cambridge University Press, 2000.

3. D. Holme & H. Peck, Analytical Biochemistry, 3rd Edition, Longman, 1998.
4. R. Scopes, Protein Purification - Principles & Practices, 3rd Edition, Springer Verlag, 1994.
5. Selected readings from Methods in Enzymology, Academic Press.

## LAB – I (HARD CORE)

### COURSE CODE: BTA060

#### Course Outcome

CO1 - Course objective is to introduce the students to the fundamental experiments in the field of Biochemistry, Microbiology and Genetics.

CO2 - Students get the insight to operate simple equipments like colorimeter and spectrophotometer.

CO3 - Identification of microorganisms by morphology and staining techniques. Study of growth kinetics.

CO4 - In genetics students are exposed to know about culture and maintenance of *Drosophila melanogaster* (model organism), Study of mutants, salivary gland chromosome and karyotyping techniques.

#### Practicals/ Experiments

1. Good laboratory practices
2. Measurement of pH
3. Preparation buffers and solutions
4. Determination of pKavalues of amino acids
5. Estimation of reducing sugar by DNS method
6. Estimation of proteins by Lowry's method
7. Ascending, descending and circular paper chromatography for separation of amino acids (1D & 2D)
8. TLC of amino acids/lipids (1D & 2D)
9. HPLC
10. Estimation of ascorbic acid by DNPH method
11. Estimation of urea
12. Estimation of Phosphate
13. Gel electrophoresis- native and SDS-PAGE and determination of molecular weight of proteins
14. Salivary amylase assay, time kinetics, specific activity, determination of optimum temperature and pH; Effect chloride ions on salivary amylase activity
15. Determination of Km and Vmax. and activation energy for an acid phosphatase (from potato)
16. Effect of inhibitors on enzyme activity
17. Purification of amylase from sweet potatoes: Extraction, ammonium sulphate fractionation, gel filtration. Monitoring of enzyme activity, % activity and % recovery during purification
18. Preparation of liquid and solid media for growth of microorganisms
19. Isolation and maintenance of organisms by plating, streaking and serial dilution methods, slants and stab cultures, storage of microorganisms
20. Isolation of pure cultures from soil and water
21. Growth, growth curve; measurement of bacterial population by turbidometry and serial dilution methods. Effect of temperature, pH, carbon and nitrogen sources on growth.
22. Microscopic examination of bacteria, yeast and molds and study of organisms by gram stain, acid fast stain and staining for spores.
23. Assay of antibiotics and demonstration of antibiotic resistance.
24. Culture of *Drosophila melanogaster* and Observation of drosophila mutants
25. Isolation of salivary gland chromosomes
26. Biotech Industry and/ or R & D institution visit/s

## MOLECULAR GENETICS (SOFT CORE) – 48 Hrs

**COURSE CODE: BTA230**

### Course Outcome

**CO1-** To understand the molecular mechanism of inheritance

CO2-Mutation and DNA repair mechanism

CO3-Gene mapping and study of chromosomal abnormalities

CO4-Phylogenetics and micro-evolution

CO4-Development of an organism

### Unit- I

**12 Hrs**

Laws of inheritance in haploid organisms- *Chlamydomonas* and *Neurospora*, uniparental, maternal and cytoplasmic inheritance in yeast, *Neurospora*, paramecium and plants

Genomic organization: Prokaryotes, eukaryotes, viral genome, extrachromosomal genome-plasmids, mitochondria & chloroplast, repetitive elements- LINES and SINES, simple sequence repeats

Mobile genetic elements: discovery, insertion sequence in prokaryotes, complex transposons (Tn10, Tn5, Tn9 and Tn3 as examples), mechanisms, control, consequences and applications of transposition by simple and complex elements.

### Unit – II

**12 Hrs**

Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, Molecular basis of mutations, insertional mutagenesis

Recombination: Homologous and non-homologous recombination, Holliday model, site-specific recombination

DNA Repair: Mechanism of genetic repair- direct repair, photo reactivation, excision repair, mismatch repair, post-replicative recombination repair, SOS repair

### Unit-III

**12 Hrs**

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

**Microbial genetics:** Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.

Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.

### Unit-IV

**12 Hrs**

Genes and development: Model systems for studying development- *Drosophila*, *Caenorhabditis*, *Arabidopsis*. Genetic control of development in *Drosophila*: anterioposterior axis specification, role of maternal genes, segmentation of larval body, gap genes, pair rule genes, homeotic genes, complex gene interaction in development, sequential gene action. Floral meristems and floral development in *Arabidopsis*.

Human Genetics: Human chromosomes, karyotype – construction, characteristics, staining techniques and nomenclature; chromosomal abnormalities – sex chromosomal and autosomal, inherited disorders, genetic counselling, gene therapy; Human Genome Project, Human Genome Map.

Population Genetics: Genetic variation, Hardy-Weinberg Law, random mating, genetic frequency, natural selection, genetic drift, migration, genetic equilibrium.

Evolution: Molecular basis of evolution, Molecular clock, Molecular phylogenetics

## **Reference Books**

1. Genetics. Strickberger, M. W., Prentice Hall of India Pvt. Ltd.
2. Genetics – A Molecular Approach. Brown, T. A. Chapman and Hall.
3. Genes VII. Lewin, B. Pearson Education International. 2003.
4. Genetics- A Conceptual Approach. Benjamin A Pierce.

## CANCER BIOLOGY (SOFT CORE) – 48 Hrs

### COURSE CODE:

#### Course Outcome

CO1-Understanding the normal and cancerous cell

CO2-Protooncogenes, tumor suppressor genes and apoptotic genes – regulation

CO3-Diagnosis and treatment of cancer

#### Unit-I

Cancer Biology:

**12 Hrs**

Introduction, historical perspective, classification, Carcinogenesis, cancer initiation, promotion and progression, Cancer cell cycles, Genomic instability, Apoptosis, Genes and proteins as players in apoptosis, DNA viruses/ cell immortalization.

#### Unit-II

**12 Hrs**

Cancer Genes I: Oncogenes and signal transduction

Cellular proto-oncogenes, oncogene activation, Growth factors, growth factor receptors, signal transduction, Transcription, Transcription factors and cancer, Retroviral oncogenes, Tumor suppressor, Tumor suppressor gene pathways, DNA methylation, epigenetic silencing of suppressor genes.

#### Unit-III

**12 Hrs**

Understanding Cancer as a Disease: natural history of cancer development

Free radicals, antioxidants and metabolic oxidative stress and cancer, Epidemiology of selected cancers, Gene rearrangements, detecting oncogene abnormalities in clinical specimens, Cell: cell interactions, cell adhesion, angiogenesis, invasion and metastasis, Antiangiogenic therapy of cancer.

#### Unit-IV

**12 Hrs**

Current concepts in cancer therapy

Strategies of anticancer chemotherapy, Strategies of anticancer gene therapy/translating therapies from the laboratory to the clinic, Gene discovery in cancer research, cancer genome anatomy project, Cancer immunity and strategies of anticancer immunotherapy, stem cells and their applications in cancer therapy.

#### Reference Books

1. Molecular Biology of the Cell. Bruce Alberts

## MICROBIOLOGY (SOFT CORE) – 48 Hrs

### COURSE CODE: BTA240

#### Course Outcome

CO1- To understand the microbial taxonomy

CO2-Handling, preservation and sterilization of microbes

CO3-Microbial interactions with different hosts

CO4-Application of microorganisms in the field of agriculture, environment and health sciences

#### Unit-I

12 Hrs

##### Microbial Diversity & Systematics

The beginning of microbiology: The discovery of the microbial world – Hook, Anton van Leeuwenhoek and Cohn; Contribution of Pasteur and Koch. Development of pure culture methods; the enrichment culture methods. Methods in Microbiology: Pure culture techniques; the theory and practice of sterilization.

Classical and modern methods and concepts; Domain and Kingdom concepts in classification of microorganisms; Criteria for classification; Classification of Bacteria according to Bergey's manual; Molecular methods such as Denaturing Gradient Gel Electrophoresis (DGGE), Temperature Gradient Gel Electrophoresis (TGGE), Amplified rDNA Restriction Analysis and Terminal Restriction Fragment Length Polymorphism (T-RFLP) in assessing microbial diversity; 16S rDNA sequencing and Ribosomal Database Project.

#### Unit-II

12 Hrs

##### Microbial Growth & Physiology

Ultrastructure of Archaea (Methanococcus); Eubacteria (*E.coli*); Unicellular Eukaryotes (Yeast) and viruses (Bacterial, Plant, Animal and Tumor viruses); Microbial growth: Batch, fed-batch, continuous kinetics, synchronous growth, yield constants, methods of growth estimation, stringent response, death of a bacterial cell. Factors affecting growth like temperature, acidity, alkalinity, water availability and oxygen. Microbial physiology: Physiological adaptation and life style of Prokaryotes; Unicellular Eukaryotes and the Extremophiles (with classical example from each group)

#### Unit-III

12 Hrs

##### Microbial Interactions and Infection

Host-Pathogen interactions; Microbes infecting humans, veterinary animals and plants; Pathogenicity islands and their role in bacterial virulence. Chemotherapy/antibiotics: Types, mode of action, resistance to antibiotics.

#### Unit-IV

12 Hrs

##### Microbes and Environment

Role of microorganisms in natural system and artificial system; Influence of Microbes on the Earth's Environment and Inhabitants; Ecological impacts of microbes; Symbiosis (Nitrogen fixation and ruminant symbiosis); Microbes and Nutrient cycles; Microbial communication system; Quorum sensing; Microbial fuel cells; Prebiotics and Probiotics.

#### Texts/References

1. Pelczar MJ Jr., Chan ECS and Kreig NR., Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. Maloy SR, Cronan JE Jr., and Freifelder D, Microbial Genetics, Jones Bartlett Publishers, Sudbury, Massachusetts, 2006.



3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industrial Microbiology, Sinaeur Associates, 1990.
4. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987.
5. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11th Edition, Pearson Prentice Hall, USA, 2006.

## CELL BIOLOGY (SOFT CORE) – 48 Hrs

### COURSE CODE:

### Course Outcome

CO1-Understanding the structure and function of bacterial, plant and animal cell

CO2-Cell signalling and communication

CO3-Study of growth factors and their function

CO4-Tumor biology of a cell

### Unit-I

12 Hrs

Membrane and membrane phenomenon: Membrane structure and principles of organization, Membrane proteins, glycoproteins and glycolipids, specialization of plasma membrane, transport across cell membrane – types of transport, ion channels, active transport and ion pumps, symport, antiport, plant and prokaryotic membrane transport proteins. Cell organelle and membrane proteins: Mechanism and regulation of vesicular transport, Golgi and post golgi storing, receptor mediated endocytosis.

### Unit-II

12 Hrs

Microfilament, cell motility and cell shape: actin, actin architecture and assembly, myosin, muscle contraction, microtubules structure and dynamics, microtubule associated protein, cilia, flagella, intermediate filaments.

Multicellularity: Extracellular matrix, hyaluronan and proteoglycan, matrix proteins and their receptors, adhesive proteins, cell junctions, structure and function of plant cell wall.

Cellular signaling: Extra cellular signaling, G-protein linked receptors, role of cAMP, receptor tyrosine kinases,  $Ca^{2+}$  as a second messenger, multiplex signaling pathways, insulin receptor and regulation of blood glucose, regulation of cell surface receptors and transcription factors in signaling pathways, Chemical messenger – peptide and steroid hormones, mechanism of hormone action.

### Unit-III

12 Hrs

Growth factor: Growth factor structure (PDGF, VEGF), mechanism of action (PDGF, VEGF), receptors, signal transduction, plant growth factors and hormones – auxins, cytokinins and other

Cell Cycle: General strategy of cell cycle, discrete cell cycle events, cell cycle control, early embryonic cell cycle, yeast cell cycle, molecular genetics of cell cycle control, cyclins, cyclin dependent kinase, inhibitors, cell division control in multicellular organism, apoptosis.

### Unit-IV

12 Hrs

Tumor biology: Retroviruses, retro viral transformation of host, development and causes of cancer, proto-oncogene, conversion from proto-oncogene to oncogene, tumor suppressor gene, role of p53 in cancer, cell culture uses in research, molecular medicine and cancer.

Nerve cells: Action potential, voltage gated ion channels, nicotinic acetylcholine receptor, other neurotransmitters and their transporters, sensory transduction – the visual and olfactory system.

### Reference Books

1. Molecular Biology of the Cell. Alberts, B., *et al.*, 4<sup>th</sup> Edition. Garland Publ. Inc.
2. Molecular Cell Biology. 5<sup>th</sup> Edn. Lodish, H., *et al.*, W H Freeman.
3. Genes VII. Lewin, B. Pearson Education International.
4. Cell and Molecular Biology. Karp, J. John Wiley and Sons Inc.

## NON CREDIT COURSE

### **COURSE CODE:**

#### **Course Outcome**

CO1-Interpersonal skills (body language, eye contact)

CO2-Presentation skills

CO3-Writing emails, research papers and proposals and business reports

### **Communication Skills Module**

**Business Etiquette – Video Conferencing (VC):** Introduction to Video Conferencing; Concept & uses of VC; VC Etiquette

**Business Communication:** Seven Cs of communication: Complete, Courteous, Considerate, Clear, Concise, Concrete, Correct; Verbal/ Nonverbal Communication

**Writing Process:** Identifying objective; Categorizing Information; Organizational Patterns; Designing document; Memo writing; Revision checklist; Releasing document

**Business Proposal & Report Writing:** Types of Proposals; Top-Down & Bottom-Up Approach; Study of Technical Bid & Cost Bid; Transmittal Letters; Formal Reports (Short and Long); Types of graphics & illustrations; Business Report Templates; Study of Sample Proposals;

**Project Report Writing:** Project Charter; Project Plan; Gant Chart; Activities List; Resources List; Risks List, Project Status Report; Project Closure Report; Types of graphics & illustrations; Study of Project Report Templates

**Email Writing:** Problems resulting out of emails; Contents of email, Importance of a good subject line; Dos and Don'ts; Using your email software to its maximum; Setting up signatures; Setting up accounts; Creating HTML stationary; Creating email templates for common emails; Using short mails for internal communication; Importance of acknowledging emails; Creating folder structure for easily accessing emails; Care to be taken while deleting emails, Archiving emails; Comparison of emails and letters; Writing typical emails, sending point-wise reply to emails

**Cross-Cultural Training:** Cross-Cultural Sensitivity; American, European, Australian, Middle-east and South-East Asian countries culture training; Cultural Foundations; Cross Cultural Communication; Communication Styles; Comparative Values (American – Indian); Regional Dialects; Cross-Cultural Customer Attitude & Expectations

**Interpersonal Skills:** Introduction & Importance of Interpersonal Skills; Cost of Poor interpersonal skills; Standing up for self assertiveness; Strategies to achieve self-assertiveness; Managing conflicts, disputes; Dealing with Diversity Interpersonal Relationship and influence

## II SEMESTER

### MOLECULAR BIOLOGY (HARD CORE) – 48 Hrs

**COURSE CODE: BTB020**

#### **Course Outcome**

**CO1-** The student will get an idea about the genomic organization of prokaryotes and eukaryotes.

**CO2-** Obtain in depth knowledge of genetic code, DNA replication and transcription.

**CO3-** Understand principles, concepts of translation, post translation mechanism

**CO4-** Regulation of gene expression in prokaryotes and eukaryotes

**CO5-** Gain the insight into molecular mechanism of antisense molecules, inhibition of splicing and application of antisense and ribozyme technologies.

#### **Unit-I**

**12 Hrs**

Genome organization: Organization of bacterial genome; Structure of eukaryotic chromosomes; Role of nuclear matrix in chromosome organization and function; Matrix binding proteins; Heterochromatin and Euchromatin; DNA reassociation kinetics (Cot curve analysis); Repetitive and unique sequences; Satellite DNA; DNA melting and buoyant density; Nucleosome phasing; DNase I hypersensitive regions

DNA topology: Closed and super coiled DNA, DNA topoisomerases,

DNA replication: Enzymes in DNA replication, DNA Pol I, II III, replication in single stranded DNA viruses, replication in prokaryotes, eukaryotic DNA replication, eukaryotic polymerases, role of other proteins and enzymes in replication, fidelity of replication, replication of mitochondrial DNA, inhibitors of replication.

#### **Unit- II**

**12 Hrs**

Genetic code: Elucidation, Contributions of Khorana and others, triple binding assay, Wobble hypothesis.

Transcription: Transcription unit, RNA polymerase in prokaryotes, mechanism of transcription- initiation, elongation and termination. Eukaryotic transcription - eukaryotic RNA polymerase, transcription factors, initiation, elongation and termination of transcription, inhibitors of transcription; post transcriptional modifications – capping, polyadenylation, splicing, introns and exons. Structural organization of mRNA, tRNA and rRNA, nuclear export of mRNA and mRNA stability

#### **Unit-III**

**12 Hrs**

Translation: Molecular anatomy and biogenesis of ribosome, partial reconstitution experiments; Amino acid activation- amino acylation of tRNA; prokaryotic and eukaryotic translation- mechanism of initiation, elongation and termination, inhibitors of translation, post translational modifications, protein glycosylation.

Protein localization: Synthesis of secretory proteins and membrane proteins; import into nucleus, mitochondria, chloroplast and peroxisomes.

Regulation of gene expression in Prokaryotes: Basic control circuits, positive and negative regulation; Operon concept – *lac*, *ara* and *trp* operons- catabolite repression, regulatory elements in prokaryotes, attenuation, antitermination, regulation of gene expression in Bacteriophage.

#### **Unit-IV**

**12 Hrs**

Regulation of gene expression in Eukaryotes: *cis* control elements – promoters, enhancers, *trans* acting factors, DNA binding motifs of transcription factors, mechanism of regulation by transcription factors, NFkB histone acetyl transferase and deacylase, hormonal regulation of gene expression, post transcriptional control.

Antisense RNA and ribozymes: Molecular mechanism of antisense molecules, inhibition of splicing, disruption of RNA structure, hammerhead, hairpin ribozymes, Application of antisense and ribozyme technologies. RNA interference, RNA induced gene silencing.

### **Reference Books**

1. Molecular Biology. Freifelder, D. Narosa Pub House.
2. Advance Molecular Biology. Twyman, R. M. Viva Book Pvt. Ltd.
3. Molecular Biology. JD Watson
4. Molecular Biology of the Cell. Bruce Alberts.
5. Genes, Benjamin XII ,2017

## **IMMUNOLOGY AND IMMUNOTECHNOLOGY (HARD CORE) – 48 Hrs**

### **COURSE CODE: BTB050**

#### **Course Outcome**

- CO1-** Study basic concepts of immunology
- CO2-** MHC and their role in transplantation
- CO3-** Cytokines and their role in immune system
- CO4-** Tumor immunology
- CO5-** Autoimmune diseases
- CO6-** Hypersensitivity
- CO7-** Vaccine production.

#### **Unit-I**

**12 Hrs**

Immune system: Structure, functions and organization of cells and organs involved in immune systems – T cells, B-cells, macrophages, Eosinophils, Neutrophils, Mast cells; bone marrow, spleen, thymus, lymph node, peyer's patch; Infections and immune responses – Innate immunity, acquired immunity; clonal nature of immune response; Immunohaematology – blood groups antigens, blood transfusion and Rh incompatibilities.

Antigens: Types, haptens, adjuvants, antigenic specificity.

Antibodies: Structure of immunoglobulins, heterogeneity, sub-types – iso-, allo- and idio- types and their properties

#### **Unit-II**

**12 Hrs**

Complements: Structure, components, properties and functions of complement pathways, biological consequences of complement activation; Immunological diversity;

Effector mechanism: T-cell cloning, mechanism of antigen recognition by T-cells and B-lymphocytes and their properties, receptors and related diseases.

Role of class II MHC molecules in T-cell cloning, antigen specific and alloreactive T-cell cloning, applications of T-cell cloning in understanding relevant antigens and T-cell subtypes; T-cell cloning in vaccine development

MHC and Tumor immunology: Structure and function of MHC and the HLA system; regulation of Ir-genes; Tumor immunology– Tumor specific antigens, Immune response to tumors, theory of surveillance, immune diagnosis of tumor; Tumor markers – Alpha fetofetal proteins, carcinoembryonic antigen

#### **Unit-III**

**12 Hrs**

Immune responses and Transplantation: HLA and tissue transplantation; Tissue typing methods for organ and tissue transplantation in humans; Graft versus host rejection, Host versus graft rejection; Xenotransplantation; Immunosuppression theory; Autoimmune diseases – Hashimoto's disease, Systemic lupus erythematosus, Multiple sclerosis, Myasthenia gravis, Rheumatoid arthritis and the remedies.

Allergy: Type I – Antibody mediated – Anaphylaxis, Type II – antibody dependent – Cytolytic and Cytotoxic, Type III – Immune complex mediated reactions– Arthus reaction, serum sickness, Type IV– Cell mediated hypersensitivity reaction– Tuberculin type.

#### **Unit-IV**

**12 Hrs**

Lymphokines and Cytokines– assay methods, related diseases; Immunological tolerance; production of interleukins and interferons– applications.

Immunizations: Conventional vaccines, sub-unit vaccines, DNA vaccines, toxoids, antisera; common immunization – small pox, DPT, hepatitis, polio, measles

### **Reference Books**

1. Immunology. Roitt, Gower Medical Publisher.
2. Fundamental Immunology. Paul W E Raven Press.
3. Immunology. Kuby
4. Immunology, JanewasTraves, Walpart, SHlomehik. Churchill Livingstone.
5. An introduction to Immunology. Rao, C. V. Nasora pub house.
6. Immunology – A short course. Coico, R., Sunshine, G. and Benjamini, E. John Wiley and sons.
7. Cellular Interactions and Immunobiology. BIOTOL series. Butterworth-Heinemann.

## LAB – II (HARD CORE)

### COURSE CODE: BTB060

#### Course Outcome

CO1-Students are trained to get the skills in the field of Molecular biology and Genetic engineering

CO2- , Isolation and purification of nucleic acids and their quantification

CO3-Study of antigen and antibody interactions.

CO4 -Preparation of wine and analysis of food samples

#### Practicals/ Experiments

1. Identification of normal and abnormal human karyotype
2. Localization of Barr bodies
3. Estimation of free fatty acids by titrametric method
4. Saponification value for commercial oil samples
5. Determination of iodine value of an oil
6. Determination of total carbohydrates by phenol-sulphuric acid method
7. Estimation of cholesterol
8. *In vitro* transcription
9. Total RNA extraction
10. Estimation of DNA by Diphenylamine (DPA) method
11. Estimation of RNA by orcinol method
12. Isolation of DNA different samples: plant leaves, coconut endosperm, yeast, animal tissues
13. Determination of purity and concentration of isolated DNA using spectrophotometer
14. Agarose gel electrophoresis of DNA
15. Analysis of microbial quality of foods – Litmus test, catalase test and dye reductase test in milk, estimation of lactic acid in milk
16. Preparation of wine
17. Estimation of percentage of alcohol in wine
18. Chemical method to differentiate between ethanol from methanol
19. Estimation of total acids in wine
20. Conjugation
21. Phage titration
22. Preparation of antigen and antibody production
23. Purification of IgG/IgY
24. Slide agglutination test/blood grouping
25. Antibody labeling
26. Immunoprecipitation test- ODD
27. ELISA for quantification of an antigen
28. Lymphocyte preparation
29. Rossette assay
30. Rocket immunoelectrophoresis

Biotech Industry and/ or R & D institution visit



## CELL SIGNALLING AND COMMUNICATION (SOFT CORE) – 48 Hrs

### COURSE CODE: BTB220

#### Course Outcome

CO1- Understanding the multi-cellularity of organisms

CO2-role of extracellular matrix in signalling

CO3-various signalling pathways from the cell surface to the nucleus

CO4-cell signalling in plants

CO5-microbe-plant and insect-plant interaction.

#### Unit-I

12 Hrs

Multicellularity: Role of Extracellular matrix - hyaluronan and proteoglycan. Matrix proteins and their receptors, adhesive proteins and cell junctions in multicellularity. Structure and function of plant cell wall

The importance of the matrix in signal transduction: Cell surface receptors as reception of extracellular signals, Amplification of signal during transmission - a quantitative study, Tyrosine kinase and tyrosine phosphatase, Cell membrane components and adapter proteins required for signal transmission, Upstream and downstream signal transduction without cell surface receptor activation, G-protein coupled signaling; the secondary messengers in signal transduction pathways cAMP, Ca<sup>2+</sup>, Reactive Oxygen Species and Hypoxia Signalling, Apoptosis Signaling Transduction Pathway, PI3K/AKT Cell Survival Pathway.

#### Unit-II

12 Hrs

Various signal transduction pathways from cell surface to nucleus: MAP kinase pathway, SAP/JNK pathway, p38 pathway, ERK pathway, NFκB pathway, Cell survival pathway, Wnt signaling pathway, Jak/Stat pathway, Smad pathway, TGF β Signaling, EGFR, VEGF And their Signalling, Cytoskeleton And Cell Signalling, Carbohydrate Recognition Signaling, MMPs And Cell Signalling, Cross talk among cell surface receptors, Cross talks among cytoplasmic components, Translocation of signal components during signal transmission, From cytoplasm to cell membrane, NF-κB Signaling from cytoplasm to nucleus, Cell cycle and its Signalling.

The end point of signal transduction--- gene transcription: Nuclear receptors and transcription factors in signalling, Signalling from single gene expression to multiple gene expression: Super array as a tool for the study of multiple gene transcription, Practical application of the signal transduction research, RNA Interference And Cell Signalling, Senescence and Its Signaling Pathways.

#### Unit-III

12 Hrs

Signal transduction in plants: Cross-talk with the environment- wound and mechanical signalling - fatty acid signalling, peptide signalling, oligosaccharide signalling; protein kinases and signal transduction. Abiotic stresses - Dehydration-stress, salt-stress, cold acclimation, heat-stress

Role of active oxygen species (AOS) in plant signal transduction: AOS in plants, AOS as signal molecules, AOS-part of a signalling network.

Action of phytohormones: Multiple signals regulating growth and development of plant organs and their adaption to environmental stresses.

#### Unit-IV

12 Hrs

Symbiotic plant-microbe interaction: Rhizospheric signals (PGPR) and early molecular events in the ectomycorrhizal symbiosis; Lipo-chito-oligosaccharides (LCO) signalling in the interaction between rhizobia and legumes; endophytes.

Recognition and defencesignalling in plant-microbe interaction: Resistance genes - gene-for-gene resistance; co-evolution and specificity of R genes; the TIR domain, the NBS domain; genetic organization of resistance genes; quorum sensing.

Plant-insect interaction: Induction of direct and indirect defence

### **Reference Books**

1. Animal Cell Biotechnology – Methods and Protocols. Nigel Tenkins.
2. Molecular biology of the Cell –Alberts et al.
3. Molecular Cell Biology. 5th Edn. Lodish, H, et al., W H Freeman
4. Cell and Molecular Biology. Karp, J.JohnWiley and Sons In.
5. The Cell-Molecular approach. 4th Ed. Geoffrey M Cooper and Robert E Hausman.
6. Cell Biology- A Laboratory Handbook. 3rd Ed, 4th Vol, Julio E Celis

## METABOLOMICS (SOFT CORE) – 48 Hrs

### COURSE CODE:

#### Course Outcome

CO1-Understanding the basic metabolism of plants

CO2-Different pathways involved in secondary metabolite production

CO3-Altering the metabolic pathways by changing the precursors

CO4-Purification of useful secondary metabolites and their kinetics and dynamics

CO5-Applications in food and pharmaceutical industries

#### Unit-I

12 Hrs

Plant Metabolomics: Developments and history of plant metabolomics, Nature and prospecting of metabolism-related secondary plant products, tools and techniques, production in culture: optimization; selection, hormonal kinetics for secondary metabolites, production, mechanism and control.

#### Unit-II

12 Hrs

Production of secondary metabolites: Induction, Alkaloids, antitumor compounds, food additives, steroids and saponins, detoxification of secondary metabolites, production of secondary metabolites by bioconversion, genetic transformation for production of secondary metabolites, large-scale production in bioreactors, Metabolomics-assisted breeding.

#### Unit-III

12 Hrs

Microbial metabolomics: Systems biology of microbial metabolism; microbe sensors, *In silico* metabolomes, Food and Applied metabolomics, Biomarker discovery. Experimental Approaches- Genome sequencing, Gene expression arrays, Nuclear Magnetic Resonance, Mass spectroscopy, Capillary electrophoresis, Two dimensional gel electrophoresis, Gene expression arrays, Pathway analysis, HPLC, Protein sequencing, Bench-scale fermentation, AFLP/RLFP analysis.

#### Unit-IV

12 Hrs

Pharmacometabolomics: personalized medicine and future of health system, Pathways discovery and disease pathophysiology, Bioinformatics analysis of targeted metabolomics; Environmental metabolomics, Bioactive compounds and Pharmacognosy, Clinical Applications of Metabolomics, Nutrigenomics and Metabolomics, Novel Technologies for Metabolomics, Data Handling for Metabolomics.

### Reference Books

1. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
2. A.L. Lehninger, Principles of Biochemistry, 4th edition, W.H Freeman and Company, 2004.

## FOOD AND ENVIRONMENTAL BIOTECHNOLOGY (SOFT CORE) – 48 Hrs

### COURSE CODE: BTB210

#### Course Outcome

CO1-Comprehensive insight into the fermented foods and enzymes in food industry

CO2-Obtain knowledge of functional foods, genetically modified foods and nutraceuticals.

CO3-Students will be able to understand current status of biotechnology in environment protection.

CO4-Understand the principles of bioremediation and significance of GMO to the environment.

#### Unit-I

12 Hrs

Fermented foods, milk-based products, fermented vegetables, fermented meats, fish, beverages, vinegar, mould fermentation - tempeh, soysauce, rice wine.

Enzymes in dairy industry, cheese making and whey processing, impact of enzyme technology (protein hydrolysates, bioactive peptides), Enzymatic processing of fruit juices; role of enzymes in baking, meat and meat processing, phytase in animal feeds, DNA-based methods for food authentication, comparative methods of toxicity testing in (novel) foods, biological approach to tailor-made foods, application of generic technologies in food and nutritional sciences; anti-cancer components in foods.

#### Unit-II

12 Hrs

Functional foods and Biotechnology: applying molecular, biochemical, cellular and bioprocessing concepts, use of specific phenolic metabolites from botanical species. Pre- and Pro-biotics, single cell protein, single cell lipids. Manipulation of fruit ripening process.

Food processing, principles and practices, food ingredients and processing aids from biotechnological processes, corn sweeteners, bacterial starter cultures, Food spoilage, preservation, mycotoxins in food commodities. Genetically modified foods, designer foods, Nutraceuticals, detection of GM foods.

#### Unit-III

12 Hrs

Renewable and non-renewable resources, current status of biotechnology in environment protection. Characterization of waste. Waste water management: Bioreactors for waste-water treatment, Aerobic biological treatments, anaerobic biological treatments, treatment of industrial effluents-dairy, distillery, paper and sugar industries. Membrane-based waste water treatment.

Oil pollution – treatment with microorganisms.

#### Unit-IV

12 Hrs

Bioremediation: Concepts and principles, bioremediation using microbes, in situ and ex situ bioremediation, biosorption and bioaccumulation of heavy metals.

Xenobiotics: Degradation capabilities of microorganisms with reference to toxicology, pesticides, herbicides, polyaromatic hydrocarbons.

Renewable energy: Relevance of GMO to the environment.

Solid waste management: Waste as a source of energy, biotechnology in paper and pulp industry, production of oil and fuels from wood waste, anaerobic and aerobic composting, vermiculture, biofuels.

#### Reference Books

1. Food Microbiology. Frazier, W. C. and Westhoff, D. C. Tata McGraw Hill.
2. Agriculture Bio-technology. Purohit. Agrobios India.
3. Food Bio-technology. Knorr, D. Marcel Dekker Inc.
4. Environmental Bio-technology. Jogand, S. N. Himalaya Publishing House, New Delhi.

## PHARMACEUTICAL BIOTECHNOLOGY (SOFT CORE) – 48 Hrs

### COURSE CODE:

#### Course Outcome

CO1-Rules and regulation regarding development of drugs

CO2- Study of Pharmacodynamics and pharmacokinetics of drugs

CO3-Different phases of clinical trials and drug toxicity studies.

CO4-GMP and GLP in production management and quality control and assessment

#### Unit- 1

12 Hrs

Introduction to pharmaceuticals and Drug development process: Introduction to pharma industry, history of the pharmaceutical industry, traditional pharmaceuticals of biological origin (animal, plant and microbial) biopharmaceuticals and pharmaceutical biotechnology, age of biopharmaceuticals, biopharmaceuticals: current status and future prospects.

Steps involved in drug development process, drug delivery systems, preclinical studies and principles practices, phases of clinical trials. Regulatory authorities in India, USA and Europe and Japan, prescription, non- prescription drugs and orphan drugs.-

#### Unit-II

12 Hrs

Drug Receptors, Pharmacodynamics and pharmacokinetics.: Different types of drug receptors, second messengers (cAMP, Ca<sup>2+</sup> and phosphoinositides) and their signalling mechanism, relation between drug concentration and response, concentration effect curves, concentration- effect curves, relation between drug dose and clinical responses. Volume of distribution of drug, clearance, drug accumulation, bioavailability, alternative routes of administration and the first pass effect, therapeutic drug monitoring

#### Unit-III

12 Hrs

Drug biotransformation and drug toxicity: The role of biotransformation in drug disposition, phase I metabolism (microsomal oxidation, hydroxylation, dealkylation), phase II metabolism (Drug conjugation pathway) CYP families, clinical relevance of drug metabolism, drug-drug interaction. Mechanisms of toxicity, production of toxic metabolites, harmful immune response, idiosyncratic toxicity, contexts of drug toxicity, drug overdose, drug- drug interactions, pathology of drug toxicity. Cellular toxicity, organ and tissue toxicity.

#### Unit-IV

12 Hrs

The drug manufacturing process and drugs of biopharmaceutical origin: Guides to good manufacturing practice, manufacturing facility. Clean rooms, cleaning, decontamination and sanitations (CDS), CDS of the general manufacturing area, CDS of the Process equipment, generation of purified water, water for injection, documentation, specifications, Concept and testing of pre- formulations & their parameters. Tablets: Compressed, granulation, coatings, pills and capsules, parenteral preparations, herbal extracts, oral liquids, Ointments. Processing and packing instructions.

Therapeutic enzymes: asparaginase, DNase, Glucocerebrosidase, galactosidase and urate oxidase, superoxide dismutase, Lactase.

## Reference Books

1. Textbook of Pharmaceutical Biotechnology. Chandrakant Kokate, Pramod H.J, SS Jalalpure. Elsevier Health Sciences, 2012
2. Pharmaceutical Biotechnology: Concepts and Applications. Gary Walsh. John Wiley & Sons, 2013
3. Pharmaceutical Biotechnology, Second Edition. Michael J. Groves. Taylor & Francis, 2005

## NON CREDIT COURSE

### EMPLOYABILITY SKILLS MODULE

#### **COURSE CODE:**

#### **Course Outcome**

CO1- Concepts of corporate communication

CO2- English grammar skills

CO3- Develop strategies for negotiation and marketing

CO4- Personality development and interview skills

CO5- This course will enable students to learn about the project management, entrepreneurship.

**Campus to Corporate:** Transition from College to Corporate world; Perceptions v/s Real Corporate life; Working in Teams; Basics of corporate communication

**Corporate & Office Etiquette:** Elements of a good handshake; Visiting cards exchange & How to manage business cards; Small Talk & Networking; Basics dining etiquette

**English Grammar:** A quick round up: Nouns, Pronouns, Adjectives, Verbs, Adverbs, Tenses, Prepositions, Clauses, Subject and Predicate, Punctuations, Subject- verb agreement, Confusing prepositions, Missing Articles, Editing paragraphs

**Negotiation Skills:** Introduction to Bargaining and Negotiation; The Negotiation Process: Four Stages; An Analytical framework of Negotiation; Bargaining Approaches; Strategy for Value Added Negotiation

**Selection & Interviewing Skills:** Current market for talent & methods for attracting & sourcing; Best practices for different hiring situations - Campus, Market, Head hunter agencies; Selection process design & assessment centers; Effective interview

**Personality Development:** Self assessment: SWOT; Understanding Personality - Identifying different personalities; Levels of Human Learning; Change v/s Transformation; Sensitivity - Sharpen your senses; Creativity and Lateral thinking; Developing Positive Mental Attitude; Emotional Quotient; Handling Criticism; Positive Health; Food habits and Meditation; Goal setting - Creative Visualization - Law of Attraction; Living a created life - Personal Leadership

## III Semester

### BIOPROCESS ENGINEERING AND TECHNOLOGY (HARD CORE) – 48 Hrs

#### COURSE CODE:

#### Course Outcome

CO1-To have the comprehensive insight into the different type of fermenter

CO2-To obtain knowledge of media design and industrial culture

CO3-Students will be able to understand different type of fermenter and bioreactor.

CO4-Understand the principles of downstream processing

CO5- To understand the enzyme technology and their applications in industry.

#### Unit-I

12 Hrs

#### Basic principle of Biochemical engineering and Microbial Growth Kinetics:

General Introduction to metabolic pathways involved in microbial products, concepts of over production, primary and secondary metabolites, estimation of biomass. Isolation, screening and maintenance of industrially important microbes; Microbial growth kinetics, Strain improvement for increased yield and other desirable characteristics.

Batch culture, continuous culture, fed batch culture, the growth cycle, effect of nutrients, growth rate and cell cycle.

#### Unit II

10 Hrs

**Media design and industrial cultures:** Introduction, typical media, Oxygen requirement, antifoams, media formulation, energy sources, carbon and nitrogen source, other components, media optimization, Media sterilization, Batch process (thermal death kinetics), continuous sterilization process. Sterilization of fermenter and other ancillaries, filter sterilization of air and media. Rheological properties of medium. Screening for industrial useful metabolites, maintenance of stock cultures

#### Unit III

10 Hrs

**Types of fermenters and bioreactors:** design, control system, operation, optimization, control and monitoring of variables such as temperature, agitation, pressure, pH, online measurements and control, Scale up of bioreactors. Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed, Membrane reactor, Photobioreactor, Solid state fermenter, Animal and plant cell bioreactors. Scale up and Scale down studies of bioreactors. Biosensor

#### Unit IV

16 Hrs

**Downstream processing (Recovery and purification of products) of biologicals:** Separation of cells, foam separation, disintegration of micro organism, mechanical and non mechanical methods, flocculation, filtration, plate filters, rotary vacuum filters, centrifugation, Stoke's law, continuous centrifugation, basket centrifuge, bowl centrifuge, membrane filtration, ultra filtration and reverse osmosis, chromatographic techniques, absorption, spray drying, drum drying, freeze drying.

**Enzyme Technology:** production, recovery, stability and formulation of bacterial and fungal enzymes-amylase, protease, penicillin acylase, glucose isomerase; Immobilised Enzyme and Cell based biotransformation steroids, antibiotics, alkaloids.

#### Texts/ References

1. Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall, Engelwood Cliffs, 1991.
2. Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2nd Edition, Prentice Hall, Engelwood, Cliffs, 2002.



3. Stanbury RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997.
4. Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York, 1986.
5. Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo press, Tokyo, 1973.
6. Comprehensive Biotechnology: The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Young M.M., Reed Elsevier India Private Ltd, India, 2004.
7. Mansi EMTEL, Bryle CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK, 2007.

## GENETIC ENGINEERING (HARD CORE) - 48 Hrs

### COURSE CODE:

#### Course Outcome

CO1-To have the comprehensive insight into the different enzymes used in Genetic engineering lab

CO2-To obtain knowledge of construction of vectors

CO3-Students will be able to understand different type of cloning methods.

CO4-Understand the principles of PCR & types

CO5- To know the different sequence methods

### Unit I

10 Hrs

**Basics Concepts:** DNA Structure and properties; Restriction Enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase; CRISPR- cas9, Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymeric tailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern and Colony hybridization, Fluorescence in situ hybridization; Chromatin Immunoprecipitation; DNA-Protein Interactions-Electromobility shift assay; DNaseI footprinting; Methyl interference assay

### Unit II

10 Hrs

**Cloning Vectors:** Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, Phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Animal Virus derived vectors-SV-40; vaccinia/baculo & retroviral vectors; Expression vectors; pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag etc.; Intein-based vectors; Inclusion bodies; Methodologies to reduce formation of inclusion bodies; Baculovirus and pichia vectors system, Plant based vectors, Ti and Ri as vectors, Yeast vectors, Shuttle vectors

### Unit III

6 Hrs

**Cloning Methodologies:** Insertion of Foreign DNA into Host Cells; Transformation; Construction of libraries; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; Southwestern and Far-western cloning; Protein-protein interactive cloning and Yeast two hybrid system; Phage display; Principles in maximizing gene expression

### Unit IV

22 Hrs

**PCR and Its Applications:** Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; T-vectors; Proof reading enzymes; PCR in gene recombination; Deletion; addition; Overlap extension; and SOEing; Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection; PCR based mutagenesis, Mutation detection: SSCP, DGGE, RFLP, Oligo Ligation Assay (OLA), MCC (Mismatch Chemical Cleavage, ASA (Allele-Specific Amplification), PTT (Protein Truncation Test)

**Sequencing methods:** Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; RNA sequencing; Chemical Synthesis of oligonucleotides; Introduction of DNA into mammalian cells; Transfection techniques; Gene silencing techniques; Introduction to siRNA; siRNA technology; Micro RNA; Construction of siRNA vectors; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knock out mice; Disease model; Somatic and germ-line therapy- in vivo and ex-vivo; Suicide gene therapy; Gene replacement; Gene targeting; Transgenics; cDNA and intragenic arrays; Differential gene expression and protein array.

**Text/References**

1. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.
2. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
3. Brown TA, Genomes, 3rd ed. Garland Science 2006
4. Selected papers from scientific journals.
5. Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.
6. Genes, Benjamin XII , 2017

## LAB-III (HARD CORE)

### COURSE CODE:

### Course Outcome

CO1 -

CO2 -

CO3 -

CO4 -

CO5 -

### Practicals/ Experiments

1. Animal cell culture: preparation of media, culture and maintenance of cell lines, trypsinization
2. Culture of transformed cells
3. MTT assay for cytotoxicity
4. Western blotting and detection
5. Study of fermenter (demo)
6. Immobilization of yeast by calcium alginate, gel entrapment and assay for enzyme *invertase*
7. Assay of catalase.
8. Study of alcohol fermentation – alcohol from different substrates – estimation of alcohol content
9. Solid state fermentation
10. Determination of the activity of enzyme protease
11. Determination of the activity of enzyme amylase
12. Estimation of Vitamin E
13. Estimation of Vitamin C
14. Estimation of aminoacid by ninhydrin method
15. Preparation of MS media
16. Induction of callus
17. Micropropagation
18. Suspension culture- production of secondary metabolites
19. Preparation of synthetic seeds
20. Database search for nucleotide and aminoacid sequences using BLAST
21. Study of sequence alignment
22. Construction of trees/dendrogram using sequence analysis
23. Structure prediction using homology searches
24. RAPD
25. Transformation
26. Bacterial gene expression
27. RFLP mapping
28. Isolation of plasmid DNA from *E.coli*
29. Restriction digestion of DNA
30. DNA ligation
31. production of citric acid by *A.niger* by submerged fermentation.
32. Estimation of citric acid by titrametric method
33. PCR
34. Isolation of antibiotic producing actinomycetes from soil sample

## CLINICAL AND ADVANCED TECHNIQUE IN BIOTECHNOLOGY (SOFT CORE) – 48 Hrs

### COURSE CODE:

#### Course Outcome

CO1-Diagnosis of diseases using enzymes as markers

CO2-analysis of blood and urine sample to interpret the diseases

CO3-Study of metabolic disorders and their diagnosis

CO4- Clinical trails of designed drugs/ biomolecules

CO5-Tools of Histopathology, Immunotechnology, microarray and DNA chips in understanding the diseases

### Unit I

16 Hrs

**Diagnostic Enzymology:** Mechanisms of elevated enzyme activities. Some important enzymes – alkaline phosphates, creatine kinase, LDH, AST, ALT – isozyme changes

**Blood:** Composition, cells, functions of plasma proteins and lipo proteins in diseases. Disorders of hemoglobin – Thalassemia, sickle cell anemia. Anemias – Microcytic, normocytic and macrocytic.

**Advanced methods in clinical analysis:** Blood, urine and quantitative determination of metal ions in body fluids

**Liver:** Biochemical indices of hepatobiliary diseases. Bile pigments – formation of bilirubin, urobilinogen bile acids, jaundice – pre-hepatic, hepatic and post-hepatic; liver function tests, diseases of the liver – hepatitis, cholestasis, cirrhosis, Gallstones.

### Unit II

8 Hrs

**Kidney:** Assessment of renal function – creatine clearance, renal calculi, uremia, laboratory investigation of kidney disorders.

**Cardiovascular Disorders:** major cardio vascular system – Atherosclerosis – risk factors, pathogenesis. Diagnosis and prognosis

**Disorders of Amino Acid and nucleotide metabolism:** Gout Lesch – Nyhan syndrome, orotic acid urea phenyl ketonuria, alkaptonuria, maple-syrup urine.

Clinical trails of designed drugs/biomolecules.

Molecular detection of diseases, Amniocentesis

### Unit III

12 Hrs

**Microscopy:** Phase Contrast Microscopy, Fluorescence Microscopy, Confocal and Inverted Microscopy), Electron Microscopy (Transmission Electron Microscopy, Scanning Electron Microscopy)

**Diagnostics and immunological techniques:** applications of immunological and molecular diagnostic methods (RIA, ELISA, PCR, DNA finger printing) in forensic science and disease diagnosis. *In vitro* antigen-antibody reactions, Coombs' test, complement titration test (Direct and indirect), Immunofluorescence, Immuno-enzymatic and ferritin technique, Immuno-electromicroscopy. Immuno-electrophoresis, Western blot analysis. Hybridoma technology – Monoclonal and polyclonal antibodies and their application

### Unit IV

12 Hrs

**Nanobio-technology:** Introduction, types and synthesis of nanomaterial, protein – based nano structures, DNA-based nano structures. Applications of nanomaterials, nano biosensors, drug and gene diversity, disease diagnostics, cancer therapy, risk potential of nanomaterials.

**DNA chip technology and micro arrays:** Types of DNA chips and their production, hybridization, application of micro arrays on DNA chips.

**Genomic research:** Methods for whole genome sequencing, genome sequence data, e-PCR, genome sequence to annotation- methods for annotation of genome sequence.

## Reference Books

1. Biochemistry – With Clinical Correlations. Devlin.
2. Clinical Biochemistry. Latner.
3. Principles of Instrumental Analysis. 5<sup>th</sup> Ed. Douglas A Skoog, James Holler and Timothy A Nieman.
4. Analytical and Preparative Separation Methods of Biomacromolecules. Hassan Y Aboul – Enein.
5. Microbiology – Principles and Explorations. 5<sup>th</sup> Ed. Jacquelyn G Black.
6. Genetic Engineering: Primose, S. B.
7. An introduction to molecular Bio-technology (Ed.) Wink.
8. Principles of gene manipulation and genomics. Primose, S. B. and Twyman, R. M.
9. Gene cloning and DNA analysis an Introduction. Brown, T. A. Blackwell Science Company.
10. Molecular Biology and Biotechnology. Walker, J. M. and Rapley, R. Panima Publishing Corporation.
11. Molecular Biotechnology – Principles and application of Recombinant DNA. Glicks, R. Bernard and Pasternak, J. Jack. Panima Publishing Corporation.
12. Molecular Biomethods Hand Book. Rapley, R and Walker, M. Jhon. Humana Press.
13. Genes (VIII edition) Benjamin Lewin, Pearson Education International

**BIOSTATISTICS, BIOINFORMATICS AND BIOENTREPRENEURSHIP (SOFT CORE)  
– 48 HRS**

**COURSE CODE:**

**Course Outcome**

CO1-Application of statistics to understand and analyse the experimental results of biological sciences

CO2-retrieval of biological data

CO3-phylogenetic analysis

CO4-primer designing

CO5-drug discovery and molecular docking

**Unit I**

**12 Hrs**

**Statistical concept:** Data structure, sampling methods, collection, classification and tabulation of data, graphical and diagrammatic representation, histogram, frequency polygon, frequency curve, bar graph, pie chart.

Measure of central frequency: **Mean, median, mode, mean deviation, standard deviation, standard error**

**Types of distribution of data:** Normal, binomial, Poisson, Z-test, t-test and ANOVA.

**Correlation and regression**

**Unit II**

**18 Hrs**

**Bioinformatics:** Introduction, history, internet and bioinformatics, knowledge, discovery and data mining, problems faced in bioinformatics area, opportunities in bioinformatics, human genome project.

**Biological databases and their management:** database concept, introduction, history of databases, databases management systems, types of database, Codd rules, data normalization biological databases – introduction, application and its importance, biological database and their functioning, types of biological database, microbiological database, primary sequence database, carbohydrate database, RNA database, genome database, organism database, biodiversity.

**Sequence database:** Introduction, nucleotide sequence database, protein sequence database, the EMBL nucleotide sequence database, structure databases.

**Bioinformatics software:** Clustal V Multiple sequence alignment, Clustal W Version 1.7, Ras Mol, Oligo, Mol script, TREEVIEW, ALSCRIPT, genetic analysis software, Phylip.

**Computational biology:** Introduction, data mining and sequence analysis, database similarities searches, practical aspects of multiple sequence alignment, phylogenetic analysis, predictive methods using nucleic acid and protein sequences, submitting DNA sequences to the databases.

**Unit III**

**10 Hrs**

**Innovation:** Idea to enter into business, Designing and development of new products as per market demands and their future prospective. Needs of customer, branding, distribution, promotion and advertising.

**Types of bio-industries and IPR:** biopharma, bioagri and bioservices. IP protection & commercialization strategies- freedom to operate.

**Accounting and Finance :** Business plan preparation, contracts, partnerships, business feasibility analysis by SWOT, socio-economic costs benefit analysis; funds/support from Government agencies like MSME/banks and private agencies like venture capitalists:/angel investors for bio entrepreneurship; business plan proposal for virtual start up company. statutory and legal requirements for starting a company/venture; basics in accounting practices: concepts of balance

sheet, profit and loss statement, Valuation, Cash flow, double entry. Information technology for business administration and expansion. Technology transfer.

**Incubation centres:** Govt. (C-CAMP, KBITS, CFTRI) and Private incubation centres for start-ups.

#### **Unit IV**

**8 Hrs**

**Marketing :** Market conditions, segments, prediction of market changes; identifying needs of customers; Market linkages, branding issues; developing distribution channels - franchising; policies, promotion, advertising; branding and market linkages for virtual start-up company.

**Business Strategy & HR:** Entry and exit strategy; pricing strategy; negotiations with financiers, bankers, government and law enforcement authorities; dispute resolution skills; external environment/ changes; avoiding/managing crisis; broader vision–global thinking; mergers & acquisitions.

**Regulatory understanding:-** GLP, GMP, GCP, PCB, IBSC, ISO

**Bioentrepreneurship and case study:** Importance of entrepreneurship; advantages of being entrepreneur - freedom to operate; introduction to bioentrepreneurship – biotechnology in a global scale; Scope in bioentrepreneurship; innovation – types, out of box thinking; skills for successful entrepreneur – creativity, leadership, managerial, team building, decision making, Risk assessment, opportunities for bioentrepreneurship- development programs of public and private agencies (MSME, DBT, BIRAC, Start-up & Make in India).

#### **References:**

1. Singh Narendra, Project management and control, (Himalaya publishing house)
2. Prasanna Chandra, Projects: Planning, Analysis, selection, implementation& review (Tata McGraw Hill)
3. P. GopalaKrishna& V.E. Rama Moorthy, Project management (Mac Millan India)
4. Chandra prasanna, proect preparation, Appraisal and Implementation (Tata Mcgrow Hill)
5. A. N. Desai, The dynamics of Entrepreneurial development and management (Himalaya publishing house)
6. Biostatistical Analysis. Zar J. H. Printice-Hall International.
7. Methods in Biostatistics. Mahajan, B. K. Smt. Hindu Mahajan
8. Bioinformatics. David W. Mount.
9. Bioinformatics A Practical Guide to the Analysis of Genes and Proteins Andreas D. Baxevanis and B. F. Francis Ouellette. A John Wiley & Sons, Inc., Publication.
10. Biostatistics. Daniel.
11. Handbook of Biostatistics A Review and Text. Christopher and Carvounis.



## APPLIED BIOTECHNOLOGY (OPEN ELECTIVE) – 48 Hrs

<b>Unit I</b> <b>Scope of Biotechnology in India and Karnataka.</b> Structure of plant, animal and bacterial cells. Biomolecules and their importance. <b>Enzyme Biotechnology</b> Introduction to application of enzymes in industry: Food & beverage, detergent, textile pharmaceutical and leather.	<b>12 Hrs</b>
<b>Unit II</b> <b>Applications of Plant Cell and tissue culture technology</b> Improvement of hybrids, encapsulated seeds, production of disease resistant, stress resistant plants, secondary metabolites from cell cultures Transgenic plants for crop improvement, molecular farming from transgenic plants, edible vaccines. Bioethics in plant genetic engineering.	<b>14 Hrs</b>
<b>Unit III</b> <b>Animal Cell Culture Techniques</b> <b>Manipulation of reproduction in animals:</b> Artificial insemination, embryo transfer, embryo splitting, embryo sexing <b>In vitro fertilization technology (IVF):</b> Embryo cloning, embryonic stem cells In vitro fertilization and embryo transfer in humans. Transgenic animals Valuable products from animal cell culture (Tissue plasminogen activator, Blood factor VIII, erythropoietin.) <b>Hybridoma technology:</b> Production of monoclonal and polyclonal antibodies and their applications. Bioethics in animal genetic engineering cryopreservation, quantitation of cells, cytotoxicity assays.	<b>10 Hrs</b>
<b>Unit IV</b> <b>Industrial and microbial biotechnology</b> Growth media, sources of nutrition, sterilization, design of fermenter, batch, fed batch and continuous culture. Production of primary metabolites (vitamins, organic acids, alcohols and amino acids). Production of secondary metabolites (antibiotics) Biopesticides (Biological control of plant pathogens, pests and weeds). Biofertilizers (microbial inoculants) <b>Food Biotechnology</b> – Genetically modified foods, Nutraceuticals, detection of genetically modified foods. Production of single cell proteins and mycoproteins.	<b>12 Hrs</b>

### Reference Books

1. Biotechnology. B. D. Singh
2. Biotechnology. R. C. Dubey



## OPEN ELECTIVE –FUNDAMENTALS OF BIOINFORMATICS

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Contact Hours/ Week	: 4	Credits	: 4
Total Lecture Hours	: 48		

### Course Outcomes:

- Ability to use popular bioinformatics tools to generate biologically meaningful results
- Ability to interpret biological results generated by a bioinformatics tool
- Application of some basic models and algorithms
- The students will gain an understanding of the computational challenges (and their solutions) in the analysis of large biological data sets; they will understand how some of the commonly used bioinformatics tools work, how to use these tools effectively

### Unit I

12 Hrs

Introduction to Bioinformatics and Biological Database:

Introduction to bioinformatics, Review of Central Dogma, Genome organization -Prokaryotic and Eukaryotic. Overview of Genome Projects – Human genome project. Introduction to DNA and protein databases and their classification, file formats, information retrieval tools – Entrez, SRS, ARSA. Nucleotide and Protein sequence and structure databases (NCBI, EMBL, DDBJ and PDB). Focus on GenBank, UniProt, and Gene Ontology.

### Unit II

12 Hrs

Sequence Alignment and Database Similarity Searching:

Pairwise alignment: Alignment algorithm: Pairwise: Dot matrix method, Dynamic programming Method (Needleman-Wunsch & Smith Waterman), Scoring Matrices – PAM and BLOSUM, Database Similarity Searching: FASTA and BLAST. BLAST variants, Statistical parameters for BLAST output – e value, p value and Bit Score.

### Unit III

12 Hrs

Multiple sequence alignment:

Iterative, Progressive alignment. Application of MSA – 1. Phylogenetics – Phylogenetics Basics, Terminologies, Gene versus species phylogeny, Forms of tree representation: Maximum Parsimony and Distance methods 2. Gene prediction: Gene prediction in prokaryotes and eukaryotic 3. Protein Motif and Domain Prediction: Identification of Motif and Domains in MSA – PSSM and Profile HMMs.

Protein sequence analysis:

Analysis of Scalar parameters: ProtParam and pepstats: Hydropathy analysis (Membrane protein prediction): Kyte-Doolittle plot, Helical Wheel representation. Secondary structure prediction, Protein structure building-Homology modelling (Comparative modelling only) – SWISS MODEL server and MODELLER, Protein Structure Visualization: Rasmol, Pymol, CN3D, Swiss PDB viewer, Chimera and Discovery studio visualizer

**Applications of Bioinformatics:** Bioinformatics in pharmacy: overview of drug discovery process, structure based and ligand-based drug design (CADD). Pharmacokinetics: absorption, distribution, metabolism, excretion and toxicity of drugs.

#### REFERENCE BOOKS:

1	David W Mount	“Bioinformatics sequence and Genome analysis”, Cold Spring Harbor Laboratory Press, 2 <sup>nd</sup> Edition, 2013, 9989332257358
2	Jin Xiong	Essentials Bioinformatics, Cambridge university press, 3 <sup>rd</sup> Edition, 2006, 9789335657325
3	Neil C. Jones and Pavel A. Pevzner	An Introduction to Bioinformatics Algorithms, MIT Press, 5 <sup>th</sup> Edition, 2005, 8789432449328
4	Steffen Schulze-Kremer	Molecular Bioinformatics: Algorithms and Applications, Walter de Gruyter, 4 <sup>th</sup> Edition, 1996, 9789432449327
5	Attwood T K, D J Parry-Smith	Introduction to Bioinformatics, Pearson Education, 3 <sup>rd</sup> Edition, 2005, 9789332447329
6	Michael R Barnes and Ian C grey	Bioinformatics for Geneticists, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England
7	Rui Jiang, Xuegong Zhang. Michael Q. Zhang	Basics of Bioinformatics, Springer Heidelberg New York Dordrecht London,
8	Supratim Choudhuri	Bioinformatics for Beginners, Academic Press.
9	Peter Lake and Paul Crowther	Concise Guide to Databases. Springer London Heidelberg New York Dordrecht
10	Arthur M. Lesk	Introduction to Bioinformatics, Oxford University Press Inc., New York
11	Mahmood A. Mahdavi	Bioinformatics –Trends and Methodologies, InTech Janeza Trdine 9, 51000 Rijeka, Croatia
12	Catherine Hack and Gary Kendal	Bioinformatics: Current Practice and Future Challenges for Life Science Education: Biochemistry and Molecular Biology Education Vol. 33, No. 2, pp. 82–85, 2005
13	Teresa K. Attwood	The Babel of Bioinformatics, SCIENCE, Volume 290, Number 5491, Issue of 27 Oct 2000, pp. 471-473.

## IV SEMESTER

### PLANT BIOTECHNOLOGY (HARD CORE) – 48 Hrs

#### Unit I

10 Hrs

Plant tissue culture-General: Historical background: Requirements for in-vitro culture- Tissue culture laboratory, Preparation of media, sterilization. Conventional plant breeding and plant tissue culture.

Cell and Tissue Culture Technology: **Role of hormones in growth and development of plants, tissue-specific hormones. Callus Induction, Organogenesis, Somatic embryogenesis, cell suspension culture and synthetic seeds**

**Somaclonal variations:** Isolation of somoclonal variants, Factors affecting somoclonal variants – applications

**Micropropagation:** Propagation from pre-existing meristem, shoot apical meristem, shoot and node culture, micropropagation stages and applications

#### Unit II

15 Hrs

**Germplasm preservation:** cryopreservation, cryoprotectant, warming rate and recovery, gene banks, applications.

#### Seed Health Technology

Introduction: Importance of Seed health, important seed-borne diseases; Seed Health diagnostics; Management of seed-borne diseases.

**Haploid Technology:** Methods of haploid culture, Factors affecting anther and microspore cultures, applications. Cytoplasmic male sterility in Indian Mustard.

**Protoplast Technology:** Isolation, purification and culture of protoplasts, protoplast fusion and somatic hybridization, applications of somatic hybrids/ cybrids.

**Secondary metabolite production:** Induction of secondary metabolites by plant cell culture, technology of plant cell culture for production of chemicals, biotransformation using plant cell culture. Bioreactor systems and models for mass cultivation of plant cells.

#### Unit III

7 Hrs

**Plant transformation techniques:** Methods of gene transfer in plants, *Agrobacterium* mediated transfer- mechanism of DNA transfer, general features of Ti and Ri plasmids, role of *vir* genes, design of expression vectors, use of promoters and reporter genes; viral vectors, direct gene transfer methods- electroporation, microinjection, particle bombardment, selection of transformants, screening and field trials.

#### Unit IV

16 Hrs

**Transgenic plants:** Herbicide resistance, resistance against biotic stress- bacterial, viral, fungal and insect resistance, abiotic stress, improved crop productivity, improved nutritional quality, transgenic plants for floriculture, Qualitative trait loci and marker studies.

**Growth- promoting bacteria in plants:** Biological nitrogen fixation, genetic manipulation for nitrogen fixation. Biocontrol of phytopathogens.

**Molecular farming:** Transgenic plants as production systems-production of alkaloids, steroids, colouring agents, flavoring agents, biodegradable plastics, industrial enzymes, therapeutic proteins, biopharmaceuticals, edible vaccines, plantibodies.

**Intellectual Property Rights (IPR):** IPRs and agricultural technology- implications for India, WTO, WIPO, GATT, TRIPS. Plant Breeder's Rights, legal implications, commercial exploitation of traditional knowledge, protection. Ethical issues associated with consumption of GM food, labelling of GM crops and foods.

#### Reference Books

1. Plant Signal Transduction. Scheel D and Wasterpack C. Oxford University Press.
2. Introduction to Plant Pathology. Strange R N. John Wiley and Sons Ltd.
3. Applied plant virology. Walkey. Chapman and Hall London.
4. Molecular Plant Pathology by Agrios.
5. Plant Tissue Culture Concepts and Laboratory Exercise. Trigiano R. N. and Gray, D. L. CRC Press.
6. Plant Tissue culture – Supplement-7. Lindsey, K. Springer International Edition.
7. Introduction to Plant Tissue Culture. Razdon, M. K. Oxford and IBH Publishing Co. Pvt Ltd.
8. Introductory to plant physiology. Noggle, R., Fritz, J. G. Prentice Hall of India Pvt. Ltd.
9. Plant Molecular Biology – A Practical Approach. Shaw, C. H. Panima Publishing Corporation.
10. A Laboratory Manual of Plant Biotechnology. Purohit. Publisher Agrobios.
11. Introduction to Plant Biotechnology. Chawla, H. S.
12. Practical Application of Plant Molecular Biology. Henry, R. J. Chapman and Hall.
13. Plant Biotechnology – Laboratory manual. Chawla, H. S. Oxford and IBH publishing Co. Pvt. Ltd.
14. Biotechnology. Gupta, P. K. Rastogi Publications.
15. Biochemistry and Molecular Biology of Plants. Buchanan, Gmissem and Jones.
16. Genetic Engineering of Crop Plants. Lyrett, G. W., Grierson, D.
17. Plant Molecular Biology. Grierson and S. N. Covey.

## ANIMAL BIOTECHNOLOGY (HARD CORE) – 48 Hrs

### Unit I

10 Hrs

**Culture of animal cells:** Advantages and limitations of tissue culture, aseptic handling, facilities required, media and cell lines. Primary culture: Isolation of mouse and chick embryos, human biopsies, methods for primary culture, nomenclature of cell lines, sub culture and propagation, immortalization of cell lines, cell line designation, selection of cell line and routine maintenance.

**Cloning and Selection:** Cloning protocol, stimulation of plating efficiency, suspension cloning, isolation of clones, isolation of genetic variants, interaction with substrate, selective inhibitors.

### Unit II

16 Hrs

**Cell separation and characterization:** Density based, antibody based, magnetic and fluorescence based cell sorting. Characterization of cells based in morphology, chromosome analysis, DNA content, RNA and protein, enzyme activity, antigenic markers, cytotoxicity assays, cell quantitation, cell culture contamination: monitoring and eradication, cryopreservation.

**Culturing of specialized cells:** Epithelial, mesenchymal, neuro ectodermal, hematopoietic gonad and tumor cells, Lymphocyte preparation, culture of amniocytes, fish cells, confocal microscopy. Stem cell culture and its applications

**Organic and embryo culture:** Choice of models, organ culture, histotypic culture, filter-well inserts, neuronal aggregates whole embryo culture eggs, chick and mammalian embryos.

### Unit III

16 Hrs

**Cell and Tissue engineering:** Growth factors for *in situ* tissue regeneration, biomaterials in tissue engineering, approaches for tissue engineering of skin, bone grafts, nerve grafts. Hemoglobin based blood substitutes, bio artificial or biohybrid organs. Limitations and possibilities of tissue engineering.

***In vitro* fertilization and Embryo transfer:** *In vitro* fertilization in Humans, Embryo transfer in Humans, Super ovulation and embryo transfer in farm animals e.g: Cow.

**Cloning of Animals:** Methods and uses. Introduction, nuclear transfer for cloning, cloning from-embryonic cells, adult and fetal cells. Cloning from short term cultured cells: cloning of sheep, monkeys, mice, pets, goats and pigs. Cloning from long term cultured cells: Cloning of cows from aged animals. Cloning efficiency, Cloning for production of transgenic animals, gene targeting for cloned transgenic animals, cloning for conservation, human cloning: ethical issues and risks.

### Unit IV

6 Hrs

**Transfection methods and transgenic animals:** Gene transfer or transfection, transfection of fertilized eggs or embryos, unfertilized eggs, cultured mammalian cells, targeted gene transfer. Transgenic animals and applications: mice and other animals, sheep, pigs, goats, cows and fish.

The legal and socio-economic impact of biotechnology at national and international levels, public awareness. Biosafety regulations- guidelines for research in transgenic animals, public awareness of the processes of producing transgenic organisms

### **Reference Books**

1. Anthony Atala, Robert P Lanza. 2002, Methods of tissue engineering, Academic press
2. Ian Freshney R. 2005, Culture of animal cells–A manual of basic techniques, John Wiley and Sons Inc. Hoboken, New Jersey
3. Animal Cell Culture – A Laboratory Manual. Frushney.
4. Animal Biotechnology. Ballinic, C. A., Philip, J. P and Moo Young, M. Pergamon Press.
5. Genetic Engineering of Animals. Puhler, A. VCH Publisher.
6. Methods of Tissue Engineering. Anthony Atala, Robert P. Lanza.
7. Animal Cell Biotechnology – Methods and Protocols. Nigel Tenkins.



## **PROJECT WORK/DISSERTATION (HARD CORE)**

### **COURSE CODE:**

#### **Course Outcome**

CO1-Review of recent research articles published in high impact journals and presentation by students.

CO2-Students do conduct review of literature followed by hands on training to do piece of research work.

CO3-They would be skill full to understand the experiment and interpret the result.

CO4-They get an idea to compile the data and present in the form of dissertation.

- Includes exhaustive review of literature on the topic selected, design of work, standardization of techniques and execution of work
- Compiling of the data generated in the form of thesis. Interpretation of the result correlating with the advanced information available in the literature.
- Research Paper presentation.



JSS COLLEGE OF ARTS COMMERCE AND SCIENCE  
(An Autonomous College of University of Mysore; Re-Accredited by  
NAAC with 'A' Grade)

OOTY ROAD, MYSURU- 25

**PG DEPARTMENT OF BOTANY**

Choice - Based Credit System (CBCS)

# **BOTANY**

M.Sc. DEGREE SYLLABUS

2018-19 ONWARDS  
(MODIFIED ON 2022)

**JSS MAHAVIDYAPEETHA**  
**JSS COLLEGE FOR ARTS, COMMERCE AND SCIENCE**  
**(AUTONOMOUS) OOTY ROAD, MYSURU- 25**  
**POST GRADUATE DEPARTMENT OF BOTANY**

**M.Sc., Botany Choice - Based Credit System (CBCS) Syllabus**  
**(CBCS-CGPA-Modified (2018-19))**  
**CORE SUBJECT: BOTANY – [POST GRADUATE]**

**DEGREE: M.Sc., BOTANY**

**1<sup>st</sup> and 3<sup>rd</sup> semester Changes made at BOS meeting held on 13.01.2022 (in %)**

**HC 1.3 Systematics of Angiosperms (5.17%)**

**HC 3.3 Plant Biotechnology (40.22%)**

**SC 3.3 Plant Propagation and Plant Breeding (1.7%)**

**OE 3.1 Plant Propagation Techniques (1.35%)**

**(CHANGES MADE ARE HIGHLIGHTED IN THE TEXT)**

<b>FIRST SEMESTER</b>				<b>Credits: 22</b>
<b>No.</b>	<b>Course/Paper Code</b>	<b>Title of the Course/ Paper</b>	<b>Hrs/Week L:T:P</b>	<b>Credits</b>
1	HARD CORE 1.1	<b>Virology, Bacteriology, Mycology and Plant Pathology</b>	<b>2:2:2</b>	2:1:1
2	HARD CORE 1.2	<b>Phycology, Bryophytes, Pteridophytes and Gymnosperms</b>	<b>2:2:2</b>	2:1:1
3	HARD CORE 1.3	<b>Systematics of Angiosperms</b>	<b>2:2:2</b>	2:1:1+ (2 credits for submission of tour report) 2:1:3
4	<b>SOFT CORE 1.1**</b>	<b>Fungal Biology and Biotechnology</b>	<b>2:2:2</b>	2:1:1
5	<b>SOFT CORE 1.2**</b>	<b>Algal Biology and Biotechnology</b>	<b>2:2:2</b>	2:1:1
6	<b>SOFT CORE 1.3**</b>	<b>Lichenology and Mycorrhizal Technology</b>	<b>2:2:2</b>	2:1:1
7	<b>SOFT CORE 1.4**</b>	<b>Phytopathology</b>	<b>2:2:2</b>	2:1:1
*Field Study/Tour: The student shall undertake a field trip for a minimum of 2-3 days and shall submit the herbaria and tour report for evaluation-2 credits.				
**Any two soft core papers shall be studied.				

<b>SECOND SEMESTER</b>			<b>Credits: 18</b>	
<b>No.</b>	<b>Course/Paper Code</b>	<b>Title of the Course / Paper</b>	<b>Hrs/Week L:T:P</b>	<b>Credits</b>
1	<b>HARD CORE 2.1</b>	<b>Reproductive Biology of Angiosperms and Plant Morphogenesis</b>	<b>2:2:2</b>	2:1:1
2	<b>HARD CORE 2.2</b>	<b>Cell Biology and Genetics</b>	<b>2:2:2</b>	2:1:1
3	<b>HARD CORE 2.3</b>	<b>Plant Breeding and Evolutionary Biology</b>	<b>2:2:2</b>	2:1:1
4	<b>SOFT CORE 2.1*</b>	<b>Plant Anatomy and Histochemistry</b>	<b>2:0:2</b>	2:0:1
5	<b>SOFT CORE 2.2*</b>	<b>Ethno-Botany and Intellectual Property Rights (IPR)</b>	<b>2:0:2</b>	2:0:1
6	<b>SOFT CORE 2.3*</b>	<b>Economic Botany</b>	<b>2:0:2</b>	2:0:1
7	<b>OPEN ELECTIVE 2.1</b>	<b>Medicinal Plants</b>	<b>2:2:0</b>	2:1:0
** Any two soft core papers shall be studied.				

<b>THIRD SEMESTER</b>			<b>Credits: 16</b>	
<b>No.</b>	<b>Course/Paper Code</b>	<b>Title of the Course /Paper</b>	<b>Hrs/Week L:T:P</b>	<b>Credits</b>
1	<b>HARD CORE 3.1</b>	<b>Biochemistry and Plant Physiology</b>	<b>2:2:2</b>	2:1:1
2	<b>HARD CORE 3.2</b>	<b>Molecular Biology</b>	<b>2:2:2</b>	2:1:1
3	<b>HARD CORE 3.3</b>	<b>Plant Biotechnology</b>	<b>2:2:2</b>	2:1:1
4	<b>SOFT CORE 3.1*</b>	<b>Molecular Genetics of Plants</b>	<b>2:2:2</b>	2:1:1
5	<b>SOFT CORE 3.2*</b>	<b>Molecular Plant Pathology</b>	<b>2:2:2</b>	2:1:1
6	<b>SOFT CORE 3.3*</b>	<b>Plant Propagation and Plant Breeding</b>	<b>2:2:2</b>	2:1:1
7	<b>SOFT CORE 3.4*</b>	<b>Phyto-chemistry and Herbal Technology</b>	<b>2:2:2</b>	2:1:1
8	<b>OPEN ELECTIVE 3.1</b>	<b>Plant Propagation Techniques</b>	<b>2:2:0</b>	2:1:0
* Any one soft core courses/papers shall be studied.				

<b>FOURTH SEMESTER</b>				<b>Credits:</b>
<b>16</b>				
<b>No.</b>	<b>Course/Paper Code</b>	<b>Title of the Course /Paper</b>	<b>Hrs/Wk L:T:P</b>	<b>Credits</b>
<b>1</b>	<b>HARD CORE 4.1</b>	<b>Ecology, Conservation Biology and Phytogeography</b>	<b>2:2:2</b>	2:1:1
<b>2</b>	<b>HARD CORE 4.2</b>	<b>Project Work *</b>	<b>4:2:2</b>	8
<b>3</b>	<b>SOFT CORE 4.1*</b>	<b>Seed Technology</b>	<b>2:2:2</b>	2:1:1
<b>4</b>	<b>SOFT CORE 4.2*</b>	<b>Seed Pathology</b>	<b>2:2:2</b>	2:1:1
<b>5</b>	<b>SOFT CORE 4.3*</b>	<b>Bio -Analytical Techniques</b>	<b>2:2:2</b>	2:1:1
<b>6</b>	<b>OPEN ELECTIVE 4.1</b>	<b>Plant Diversity and Human Welfare</b>	<b>2:2:0</b>	2:1:1
<p><b>*Project Work:</b> The student shall undertake a Project Work in the Department or in any other University or Institute under the guidance of a Research Supervisor and shall submit a Project Report duly signed by Student and Research Supervisor for Evaluation.</p>				

**Semester- Wise Credit Pattern:**

**I Semester= 22 [HC- 12+2=14 + 08 (SC)]**

**II Semester= 24 [HC- 12 + 08 (SC) + 04 (OE)]**

**III Semester= 18 (HC- 08 + 06 (SC) + 04 (OE)]**

**IV Semester= 20 (HC-12 +04 (SC) + 04 (OE)]**

In total= 46 HC + 26 (SC) + 12 (OE)= The Department is offering 84 Credits of B.Sc. Honors/ M.Sc. Botany (CBCS) Course including three Open Elective Course to the outside Department Students/

**Important Note:**

Student is required to earn the credit for qualifying B.Sc. Honors/ M.Sc. Botany from Department of Botany as follows:

Hard Core offered by the Department= 46 (Against maximum of 56)

Soft Core offered by the Department = 26 (Against minimum of 16)

Minimum Open Elective to be earned by the Student (Outside the Department) = 04

A total of 76 Credit is required for qualifying B.Sc. Honors/ M.Sc. Botany Course.

**SCHEME OF EXAMINATION/ASSESSMENT  
MODEL QUESTION PAPER (THEORY)  
JSS COLLEGE FOR ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS) OOTY ROAD, MYSURU- 25  
POST GRADUATE DEPARTMENT OF BOTANY  
M.Sc., Degree -----Semester Examination May/June-20--  
BOTANY**

Course/Paper: .....  
Course/Paper Code.....

**Time: 3 Hrs**

**Max Marks: 70**

**Instructions: 1) Answer all questions.  
2) Draw neat and labelled diagrams wherever necessary.**

**I. Answer the following; (10MCQs of 1 Marks each)**

**10 X 1 = 10**

- 2 from Unit I
- 3 from Unit II
- 2 from Unit III
- 3 from Unit IV

**II. Answer the following;**

**4 X 5 = 20**

- 2 from Unit I with internal choice
- 2 from Unit II with internal choice
- 2 from Unit III with internal choice
- 2 from Unit IV with internal choice

**III. Answer the following;**

**4 X10 = 40**

- 2 from Unit I with internal choice
- 2 from Unit II with internal choice
- 2 from Unit III with internal choice
- 2 from Unit IV with internal choice

**SCHEME OF PRACTICAL EXAMINATION/ASSESSMENT  
MODEL QUESTION PAPER (PRACTICALS)**

**JSS COLLEGE FOR ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS) OOTY ROAD, MYSURU- 25  
POST GRADUATE DEPARTMENT OF BOTANY  
M.Sc., Degree I Semester Examination May/June-2018  
BOTANY**

Course/Paper: .....  
Course/Paper Code.....

**Time: 3 Hrs**

**Max Marks: 70**

Conducting Experiment/Micro-preparation /Plant identification	15	
Q II. Minor experiment/ Demonstrations/ Procedure Writing		10
Q III. Critically comments (3x5 Marks)	15	
Q IV. Identification 5x2 Marks)	10	
Q V. Viva-voce examination	10	
Q VI. Class Records/ Submissions	10	

Q I.

**PO M.SC. BOTANY**

<b>Sl. No.</b>	<b>PO</b>
1.	Conduct investigations of complex problems by the use of research-based knowledge on an independent term project.
2.	Transfer of appropriate knowledge and methods from one topic to another within the subject.
3.	Carry out practical work, in the field and in the laboratory, with minimal risk.
4.	Able to think logically and organize tasks into a structured form and assimilate knowledge and ideas based on wide reading of text books and through the internet.
5.	Apply the scientific knowledge of basic science, life sciences and fundamental process of plants to study and analyse any plant form.
6.	Knowledge and understanding of the range of plant biology in terms of structure, function and environmental relationships.
7.	Apply reasoning informed by the contextual knowledge to assess plant diversity, and the consequent responsibilities relevant to the biodiversity conservation practice.

**PSO M.SC. BOTANY**

<b>Sl. No.</b>	<b>COURSE</b>	<b>PSO</b>
1.	Algal Biology and Biotechnology	Phylogeny, thallus organisation, economic and ecological importance of algal community
2.	Biochemistry and Plant Physiology	Biomolecules, metabolic pathways and stress physiology in plants
3.	Cell Biology and Genetics	Cell originals and Mendelian principles
4.	Ecology, Conservation Biology and Phytogeography	Diversity of vegetation, distribution and its conservation
5.	Economic Botany	Economic values of different crop plants and their applications
6.	Major Project	Hands on experience in various fields of plant science
7.	Molecular Biology	Molecular level organisation in prokaryotes and eukaryotes with respect to various mechanisms involved
8.	Plant Anatomy and Histochemistry	Anatomical features and organisation of cells in plants
9.	Plant Breeding and Evolutionary Biology	Plant breeding methods, procedures and their application for crop improvement
10.	Plant Biotechnology	Tissue culture techniques and its application in development of resistant varieties
11.	Plant Propagation and Plant Breeding	Propagation methods and plant breeding procedures and their application in different fields
12.	Plant Propagation Techniques	Propagation methods and procedures and their application in different fields
13.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Distribution, classification and phylogeny of lower plant communities
14.	Phytopathology	Concepts of plant diseases defence mechanisms in plants and study of plant diseases
15.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Embryological study of growth and development using plant models
16.	Seed Technology	Industrial scale processing of seeds up to marketing

17.	Systematics of Angiosperms	Angiospermic plant family study with their phylogeny
18.	Virology, Bacteriology, Mycology and Plant Pathology	Diversity, distribution of microorganism with respect to their economic aspects

**CO M.SC. BOTANY**

<b>Sl. No.</b>	<b>COURSE</b>	<b>CO</b>
1.	Algal Biology and Biotechnology	Specify in depth of thallus organization and phylogeny in algae
2.	Algal Biology and Biotechnology	Understand the details of toxins, blooms and distributions of algae
3.	Algal Biology and Biotechnology	Deliberate in depth about cultivation and marketing algae
4.	Algal Biology and Biotechnology	Specify the details of Algal products and uses
5.	Biochemistry and Plant Physiology	Learn in details with biomolecules and their function
6.	Biochemistry and Plant Physiology	Understand in depth about solute transport and photosynthesis in plants
7.	Biochemistry and Plant Physiology	Specify the details of metabolism of nitrogen, lipids and plant hormones
8.	Biochemistry and Plant Physiology	Understand in depth about Stress physiology
9.	Cell Biology and Genetics	Learn in detail about cell membranes transport and proteins
10.	Cell Biology and Genetics	Deliberate the Functions of cell organelles, programmed cell death
11.	Cell Biology and Genetics	Specify the extensions of Mendelian principles
12.	Cell Biology and Genetics	Learn about Sex determination and dosage compensation
13.	Ecology, Conservation Biology and Phytogeography	Understand the diversity of ecosystem and types of ecosystems
14.	Ecology, Conservation Biology and Phytogeography	Learn the in details of pollution and environmental biology
15.	Ecology, Conservation Biology and Phytogeography	Study the importance of biodiversity and conservation biology
16.	Ecology, Conservation Biology and Phytogeography	Detailed study of phytogeography and crop distribution
17.	Economic Botany	Specify the details of cereals, millets, pulses, oil yielding plants and study of horticultural plants and floriculture
18.	Economic Botany	Deliberate the characteristics of sugar yielding plants, spices and condiments
19.	Economic Botany	Understand the importance of fibre, timber and gum yielding plant
20.	Economic Botany	Deliberate on the medicinal plants and their applications
21.	Major Project	Learn the details of literature survey and methodology in research
22.	Molecular Biology	Identify the characteristics of genetic materials and its replication
23.	Molecular Biology	Learn the details of molecular basis of mutation, repair and recombination
24.	Molecular Biology	Deliberate the details of RNA formation, processing of RNA and post-RNA
25.	Molecular Biology	Understand in depth of gene regulation in prokaryotes and eukaryotes
26.	Plant Anatomy and Histochemistry	Learn in details of primary vegetative body of the plants
27.	Plant Anatomy and Histochemistry	Deliberate in details of differentiation in vascular tissues and study of apical meristems in shoot and root
28.	Plant Anatomy and Histochemistry	Deliberate the characteristics of secondary growth
29.	Plant Anatomy and	Understand the details of plant histochemistry



	Histochemistry	
30.	Plant Breeding and Evolutionary Biology	Learn in depth about plant breeding methods and techniques
31.	Plant Breeding and Evolutionary Biology	Understand the details of breeding for specific purposes
32.	Plant Breeding and Evolutionary Biology	Learn the details of Nature of evolution
33.	Plant Breeding and Evolutionary Biology	Identify the characteristics of variation and speciation
34.	Plant Biotechnology	Understand in depth about plant tissue culture and its techniques
35.	Plant Biotechnology	Specify the genetic engineering and tools used in it
36.	Plant Biotechnology	Understand the details of genetic manipulation, transgenic approaches to produce resistant plants
37.	Plant Biotechnology	Learn the details of engineering of crop plants for production of secondary metabolites
38.	Plant Propagation and Plant Breeding	Learn the details of importance of plant propagation, vegetative propagation and micro propagation
39.	Plant Propagation and Plant Breeding	Understanding of basic concepts of plant breeding and genetics
40.	Plant Propagation and Plant Breeding	Study types, purposes of plant breeding
41.	Plant Propagation and Plant Breeding	Deliberate study of advanced breeding aspects
42.	Plant Propagation Techniques	Learn the details of importance of plant propagation
43.	Plant Propagation Techniques	Understand in depth about types of vegetative propagation
44.	Plant Propagation Techniques	Learn the techniques of budding and layering
45.	Plant Propagation Techniques	Deliberate in details with examples of micro propagation in forestry and horticulture plants
46.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Understand the details of diversity, distribution, pigmentation and life cycle of algae
47.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Deliberate in depth of Bryophytes life cycle, classification, phylogeny and Economic importance
48.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Understand the details of Pteridophytes life cycle, phylogeny, classification, economic importance and anatomy
49.	Phycology, Bryophytes, Pteridophytes and Gymnosperms	Write down in details with examples Gymnosperms history, reproduction, edconomic importance and interrelationship
50.	Phytopathology	Learn the details of the concept, causative agents and disease cycle of plant pathogens
51.	Phytopathology	Deliberate the details of defense mechanisms in plants and its genetics
52.	Phytopathology	Study of Management of plant diseases
53.	Phytopathology	Identify in details with examples of diseases in crop plants
54.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Understanding the microsporogenesis and historical overview
55.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Specify in details with examples about megasporogenesis, fertilization, endosperm and embryo
56.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Specify the details of models and concepts of plant morphogenesis
57.	Reproductive Biology of Angiosperms and Plant Morphogenesis	Understand in details with examples of plant growth and development, photomorphogenesis
58.	Seed Technology	Understand the seed science and concepts
59.	Seed Technology	Study the seed production and processing methods

60.	Seed Technology	Learn about seed quality parameters and tests
61.	Seed Technology	Deliberate the procedure of seed certification
62.	Systematics of Angiosperms	Understand the principles and applications of Taxonomy of angiosperms
63.	Systematics of Angiosperms	Specify the details of taxonomic literature
64.	Systematics of Angiosperms	Deliberate in details with examples Dicot and monocot family and features of classification systems
65.	Systematics of Angiosperms	Specify in details molecular systematics with examples of softwares and databases
66.	Virology, Bacteriology, Mycology and Plant Pathology	Learn the classification and characteristics of viruses, viroids, prions and diseases of it
67.	Virology, Bacteriology, Mycology and Plant Pathology	Deliberate in details with examples of Bacteria, archeabacteria, actinomycetes and mycoplasma and its economic importance
68.	Virology, Bacteriology, Mycology and Plant Pathology	Specify the Fungal diversity, life cycle and economic importance of fungi
69.	Virology, Bacteriology, Mycology and Plant Pathology	Understand in details of etiology, distribution and management of plant disease

**BOTANY: I SEMESTER- HARD CORE 1.1**  
**VIROLOGY, BACTERIOLOGY, MYCOLOGY AND PLANT PATHOLOGY**

**Theory-32 Hrs**

**Unit-1: Virology:** Origin and evolution of viruses; Classification of viruses-ICTV and Baltimore Systems; Genome diversity in viruses; Methods of cultivation of viruses; Purification and detection of viruses; Transmission of viruses; Mechanism of replication of DNA and RNA viruses; Viroids - Structure and multiplication; Prions - structure and multiplication; Prion diseases.

**Unit-2: Bacteriology:** Introduction and classification of Bacteria by Bergey's Manual of Determinative and Systematic Bacteriology; C. R. Woese- Three domain classification of Bacteria; Archaeobacteria and Eubacteria - diversity and evolution; Nutritional types of bacteria; Bacterial growth; Recombination in bacteria (conjugation transformation, and transduction); Brief account on actinomycetes; Structure and multiplication of Mycoplasma and Phytoplasmas; Economic importance of bacteria.

**Unit -3: Mycology:** Present status of fungi; Outline classification of fungi (Ainsworth-1973). Vegetative organization in fungi; Nutrition in fungi (saprotrophs, biotrophs, necrotrophs; symbiotrophs); Methods of reproduction in fungi - Asexual and sexual methods; Spore liberation in fungi; Evolution of sex in fungi; Heterothallism and parasexuality; Life cycle pattern and phylogeny of Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina; Fungi and their economic importance.

**Unit-4: Plant Pathology:** Concepts and scope of plant pathology; Plant diseases and crop losses; Classification of plant diseases; Parasitism and disease development; Effect on physiology of host; Host range of pathogens; Defence Mechanisms in Plants; Plant Disease epidemics and plant disease forecasting; Methods of plant disease management; Study of plant diseases- Sandal Spike, Citrus Canker, Bacterial Blight of Paddy, Late Blight of Potato, Downy Mildew of Bajra, Tikka Disease of Ground nut, Grain Smut of Sorghum. Phloem Necrosis of Coffee, Root Knot Disease of Mulberry.

**Practicals-32 Hrs**

- 1) Laboratory guidelines, design, tools, equipments and other requirements for studying microorganisms.
- 2) Measuring the dimensions of microorganisms using Micrometry.
- 3) Determining total count of microbes using Haemocytometer.
- 4) Gram and special staining of bacteria.
- 5) Preparation of NA, PDA, sterilization, pouring, inoculation and culturing of bacteria/fungi.
- 6) Staining of fungi including VAM fungi.
- 7) Identification of fungi.
- 8) Measurement of bacterial growth by Spectrophotometer.
- 9) Recording environmental factors (Temperature, RH, and Rainfall and wind velocity).
- 10) Splash liberation of spores from diseased tissue.
- 11) Estimation of total phenols in diseased and healthy plant tissues.
- 12) Study of the following diseases: Sandal Spike, Citrus canker, Bacterial Blight of paddy, Late Blight of Potato. Downy Mildew of Bajra, Tikka disease of ground nut, Grain smut of Sorghum, Phloem Necrosis of Coffee, Root Knot disease of Mulberry.

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**BOTANY: I SEMESTER - HARD CORE 1.2**  
**PHYCOLOGY, BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS**

**Theory-32 Hrs**

**Unit-1: Phycology:** Diversity and distribution of algae; Unicellular, colonial, filamentous, heterotrichous, parenchymatous, pseudoparenchymatous, siphonous forms; General characteristics, classification and phylogeny of algae; Pigmentation in algal groups; Role of photosynthetic and accessory pigments; Life cycles in algae - haplontic, diplontic, isomorphic, heteromorphic; Economic importance of algae.

**Unit -2: Bryophytes:** Introduction, general characteristics, classification and phylogeny of Bryophytes; Distribution, habitat, external and internal morphology and reproduction; Comparative account on gametophytes and sporophytes of bryophytes; Economic and ecological importance.

**Unit -3: Pteridophytes:** Introduction, classification and phylogeny; Morphology, anatomy reproductive biology and phylogeny; Psilophytes, Lycophytes, Sphenophytes, Filicophyta; Evolution of sorus; evolution of sporangium; Gemetophyte development - homosporous and heterosporous ferns; Heterospory and seed habit; Stellar evolution in Pteridophytes; Ecology of Pteridophytes; Economic importance.

**Unit- 4: Gymnosperms:** Distribution, general characteristics, classification and phylogeny of Gymnosperms; Range in morphology, anatomy, reproduction and interrelationships of - Cycadales, Ginkgoales, Coniferales, Gnetales; Pteridosperms; Economic importance of Gymnosperms.

**Practicals-32 Hrs**

**1-4) Algae:** Study of Cyanophyceae: *Anabaena*, *Oscillatoria*; Study of Chlorophyceae: *Oedogonium*, *Pediastrum*; Study of Phaeophyceae: *Turbinaria*, *Ectocarpus*; Study of Rhodophyceae: *Gracilaria*, *Batrachospermum*; Economic products of algae.

5-7) **Bryophytes:** Study of morphology, anatomy and reproductive morphology - Hepaticopsida- *Marchantia*, *Dumortiera*; Anthocerotopsida- *Anthoceros*, *Notothylas*; Bryopsida- *Bryum* and *Polytrichum*.

8-10) **Pteridophytes:** Study of vegetative habit, anatomy and reproductive morphology of *Psilotum*, *Lycopodium*, *Isoetes*, *Ophioglossum*, *Botrychium*, *Angiopteris*, *Pteris*, *Hymenophyllum*, *Marselia*, *Salvinia*, *Azolla*; **Paleobotany-** Study of Lepidodendrales, Calamitales, Sphenophyllales and Coenopteridales (Fossil Pteridophytes).

11-12) **Gymnosperms:** Study of morphology, anatomy and reproductive morphology of *Zamia*, *Pinus* and *Ephedra*, *Ginkgo*, *Auracaria*, *Podocarpus*, *Gnetum*, *Agathis*, *Cupressus*, *Thuja*; Economic importance of Gymnosperms.

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**BOTANY: I SEMESTER - HARD CORE 1.3**  
**SYSTEMATICS OF ANGIOSPERMS**

**Theory-32 Hrs**

**Unit-1:** Introduction to plant systematics; Plant classification systems-artificial, natural and phylogenetic systems; Contributions of Carolus Linnaeus, Michel Adanson, de Jussieu, de Candolle to plant classification; Concepts of taxonomic hierarchy; Taxonomic Categories-Genus concept; Species concept; Intraspecific categories; subspecies; varieties and forms; History of botanical nomenclature; ICBN and ICN aims and principles; Rules and recommendations; Rule of priority; Typification; Author citation, Legitimate and illegitimate names; Name changes and synonyms; Effective and valid publication; Herbarium and its significance; Botanical gardens.

**Unit-2: Taxonomic Literature:** General taxonomic indices, world floras and manuals; Monographs and revisions; Bibliographies, catalogues and reviews; Periodicals, glossaries and dictionaries; Hortus Malabaricus; Taxonomic websites-IPNI, Plant List, Tropicos, Botanicum-Periodicum-Huntianum (BPH); Biodiversity Heritage Library (BHL); Botanicus, Index Herbariorum; Taxonomic Keys- bracketed keys, indented keys, numbered keys, edge punched and body punched keys.

**Unit-3:** Study of plant classification Systems; Broad outlines of Bentham and Hooker's system, Engler and Prantl's system, Hutchinson's system, Takhtajan's system, and Cronquist's system; Numerical Taxonomy-principles, selection of characters, merits and demerits; Angiosperm Phylogeny Group (APG) III & IV classification; Study of angiosperm families-Magnoliaceae, Nymphaeaceae, Urticaceae, Papaveraceae, Euphorbiaceae, Acanthaceae, Rubiaceae, Alismataceae, Cyperaceae, Commelinaceae, Zingiberaceae, Liliaceae, Dioscoreaceae and Orchidaceae.

**Unit-4: Molecular Systematics:** Nuclear, mitochondrial and chloroplast genes. Gene sequencing, analysis of molecular data, alignment of sequences; Phylogenetic tree construction-Maximum Likelihood and Neighbour Joining Methods; Phylogenetic analysis-rooted and unrooted trees; Data analysis- alignment, substitution, model building; Phylogenetic softwares-CLUSTAL W, MEGA, Mesquite, PAUP, PHYLIP, Treefinder, TreeBase.

**Practicals-32 Hrs**

1) Methods of preparation and maintenance of Herbaria.

2-4) A field trip of three days to a floristically rich area to study plants belonging to different families (Every student shall submit a report for evaluation for two credits).

5-10) Identification of the flowering plants in and around Mysore using keys, floras and monographs.

11-12) Construction of phylogenetic tree based on molecular data of plant species retrieved from GenBank.

**References:**

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**BOTANY: I SEMESTER - SOFT CORE 1.1**  
**FUNGAL BIOLOGY AND BIOTECHNOLOGY**

**Theory-32 Hrs**

**Unit-1:** Introduction and historical overview of mycology; General characteristics and importance of fungi in human life; Fungi –Taxonomy and Systematics; Fungi in genetic and applied research; Estimation of Fungal diversity; Quantitative Indices- species richness, species evenness and species abundance; Molecular methods used for fungal diversity estimation-nuclear genome, messenger RNA transcripts, Ribosomal/DNA sequence comparisons and mitochondrial genome.

**Unit-2:** Macro fungi and micro fungi living on plant substrata; Lignicolous macrofungi; Lichenized fungi; Sequestrate fungi; Endophytic fungi; Saprobic soil fungi; Fungi in stressful environment; Mutualistic, arbuscular, and endomycorrhizal fungi; Yeasts; Fungicolous fungi; Fungi in fresh and marine water habitats; Fungi associated with aquatic animals; Fungi as parasites of humans and plants; Fungi associated with animals, insect, arthropod and nematodes; Coprophilous fungi.

**Unit-3:** Fungal Fermentation and Food Products: Food and Beverages; Single cell proteins- Myco-proteins; Food processing by fungi-bread, soybean products, cheese and fermented milk; Fungal secondary metabolites-antibiotics, immunosuppressive agents, anti-tumour agents, fungal toxins as medicines; Fungal pigments; Steroid transformation; Fungal enzymes; Bio-control agents; Application of molecular biology in fungal biotechnology.

**Unit-4: Mushrooms and fungi in medicine;** Toxic macromycetes; Mushroom cultivation; Model organisms- *Saccharomyces cerevisiae/Neurospora crassa*; Bio-deterioration of food grains and mycotoxins; Fungal communities of herbivore dung; The fungal communities of composts; Fungal interactions and practical exploitation; Heavy metals in fungi-accumulation and sorption; Biotechnology of wood rotting fungi.

**Practicals-32 Hrs**

- 1) Study of Myxomycetes and Chytridiomycetes
- 2) Study of Plasmodiophoromycetes and Oomycetes
- 3) Study of Zygomycetes
- 4) Study of Ascomycetes
- 5) Study of Basidiomycetes
- 6) Study of
- Deuteromycetes 7) Study of
- Lichens
- 8) Study of VAM fungi
- 9) Detection of aflatoxin B1
- 10) Cultivation of Oyster mushroom.
- 11) Alcoholic fermentation of grape juice by *Saccharomyces*.
- 12) Cultivation of *Penicillium* and testing antibiotic principle.
- 13) Study of edible and poisonous mushrooms.
- 14) Study of fungal model organisms - *Saccharomyces cerevisiae/Neurospora crassa*

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**BOTANY: I SEMESTER - SOFT CORE 1.2**  
**ALGAL BIOLOGY AND BIOTECHNOLOGY**

**Theory-32 Hrs**

**Unit-1: Algal Biology:** Historical development of Phycology and contributions of Phycologists; Thallus organization in algae-Cyanophyceae, Chlorophyceae, Charophyceae, Euglenophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae; General characteristics, algal classification, affinities and phylogeny- polyphasic approach; Molecular markers for phylogenetic study; Algal physiology- ultra-structure of cells; Photosynthesis and respiration.

**Unit-2: Algal blooms and Toxins:** Blooms produced by algal groups; Toxins produced by cyanobacteria, diatoms, dinoflagellates, prymnesiophytes and eugleoids; bioaccumulation and biomagnification; effects of toxins on aquatic life and humans; Scenario in coastal waters of India- monitoring and safety measures; Algal communities of extreme environments- Thermal hot springs, cold springs, snow and ice; **Fresh water algae-** Ecological classification of fresh water organisms; Lentic communities of algae (pond, lake, bog, swamp); Lotic communities (streams, rivers, rapids; **Marine algae-** Marine biota; zonation; quantitative study of phytoplanktons, marine communities of algae.

**Unit-3: Algal Biotechnology:** Algal culture techniques; general principles; physical parameters; culture media; strain improvement; **Algal cultivation methods-**conventional, advanced; **Cultivation of microalgae-*Spirulina*** and ***Dunaliella***; Media, seeding, cultivation systems, harvesting; processing, drying methods, packaging, marketing; Algal cultivation and production in India; **Cultivation of macroalgae- *Porphyra***; Nutritional value; importance of life cycle; methods of cultivation in advanced countries; Pillar, semi raft floating and open sea cultivation.

**Unit-4: Applications of algae/products:** Pollution indicators, treatment of waste water plants, heavy metal toxicity and phyco-remediation; Bio-fouling and biofuel production; Algal products as sources of nutraceuticals; Food colorants; Aquaculture feed; Therapeutics and cosmetics; Medicines; Dietary fibres from algae and uses; Biotechnological applications of algal silica and oils.

**Practicals-32 Hrs**

- 1) Study of fresh water planktonic forms in the lake samples.
- 2) Study of fresh water diatoms.
- 3) Chlorophyceae: *Ulva*, *Caulerpa*, *Halimeda*, *Acetabularia*.
- 4) Xanthophyceae: Mounting of *Botrydium* from soils.
- 5) Phaeophyceae: *Dictyota*, *Sargassum*, *Cystophyllum*.
- 6) Rhodophyceae: *Gracilaria*, *Gelidium*.
- 7) Cyanophyceae: *Microcystis*, *Nostoc*, *Spirulina*.
- 8) Estimation of carotene content in algal cells .
- 9) Culturing of microalgae: *Spirulina*/*Chlorella*/*Scenedesmus*/*Dunaliella*.
- 10) Applications of algal products: Agar, spirulina tablets/powder, beta-carotene, phycobiliproteins, triglycerides, Mycosporine like amino acids (MAA), diatom silica as nanoparticles.
- 11) Visit to National Institute of Oceanography, Goa.
- 12) Study of algal herbaria.

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**BOTANY: I SEMESTER - SOFT CORE 1.3**  
**LICHENOLOGY AND MYCORRHIZAL TECHNOLOGY**

**Theory-32 Hrs**

**Unit-1:** Introduction: Photobionts- identification, reproduction, and taxonomy of photobionts; Occurrence within lichens; Mycobionts- Lichenized versus nonlichenized fungi; Bryophilous and folicolous lichens; Thallus morphology and anatomy; Growth forms - crustose lichens, foliose lichens, fruticose lichens; Vegetative structures- Homoiomerous thallus, stratified thallus, cortex, epicortex, and epinecral layer, photobiont layer and medulla, lower cortex, Attachment organs and appendages; Cyphellae and pseudocyphellae; Cephalodia (Photosymbiodemes); Reproductive structures- sexual reproduction in lichen-forming ascomycetes; Mating systems, dikaryon formation, Ascomal ontogeny, Ascosporeogenesis; Ascus structure and function; Generative reproduction: ascoma, perithecia, apothecia, Thallinocarpia, Pycnoascocarpia, Hysterothecia, Asci, Basidioma; Vegetative reproduction- aposymbiotic propagules, symbiotic propagules; Systematics of lichenized fungi- History, classification and phylogeny.

**Unit-2:** Morphogenesis- Acquisition of a compatible photobiont; Recognition and specificity; Structural and functional aspects of the mycobiont–photobiont interface; Genotypes and phenotypes, growth patterns; Biochemistry and secondary metabolites- intracellular and extracellular products; The fungal origin of the secondary metabolites; Major categories of lichen products; Application to pharmacology and medicine; Harmful properties of lichen substances, lichens in perfume, lichens in dyeing; Stress physiology and the symbiosis- stress tolerance, limits to stress tolerance; harmful effects of stress, constitutive and inducible stress tolerance, evolution of stress tolerance in lichens; Modes of water uptake, light, temperature, carbon dioxide; The carbon economy of lichens.

**Unit-3:** Nitrogen, its metabolism and potential contribution to ecosystems, Methods of determination of nitrogen fixation; Nutrients- chemical and physical properties of nutrients and metals; Nutrient requirements, sources of nutrients, accumulation mechanisms, compartmentalization of elements within lichens; Metal toxicity, metal tolerance; Environmental role of lichens- dispersal, establishment, pedogenesis and biodeterioration; Community structure, succession, ecosystem dynamics; Animal and lichen interactions; Forest management, conservation, environmental monitoring; Lichen sensitivity to air pollution- lichens in relation to sulfur dioxide, oxidants and lichens, hydrogen fluoride and organopollutants.

**Unit-IV:** Mycorrhizal fungi: Introduction and classification; Types of mycorrhizas- Arbutoid mycorrhizas, ectomycorrhizas, vesicular arbuscular mycorrhizas or arbuscular mycorrhizas, ectendomycorrhizas, ericoid mycorrhizas, monotropoid mycorrhizas and orchid mycorrhizas; Phosphate solubilisation; Ecological significance of AM fungi; Importance of mycorrhiza in evolution of land plants; Role of mycorrhiza in agriculture, horticulture and forestry.

**Practicals-32 Hrs**

- 1-3) Survey of lichen vegetation in the study area: Frequency, density and abundance.
- 4) Determination of species richness and species diversity.
- 5) Isolation and maintenance of cyanobionts and phycobionts
- 6) Isolation and maintenance of mycobionts

- 7) Analysis of secondary metabolites of lichens.
- 8) Biological activity of secondary metabolites of the lichens.
- 9) Culture methods for lichens and lichen symbionts.
- 10) Root clearing and staining technique to study arbuscular mycorrhizal fungi.
- 11) Assessment of % root colonization of arbuscular mycorrhizal fungi.
- 12) Isolation and identification of arbuscular mycorrhizal fungi.

**References:**

- 1) Thomas H. Nash , 2008. Lichen Biology, 3rd edn. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK
- 2) Awasthi D.D. 2000. Lichenology in Indian subcontinent: A supplement to "A hand book of lichens". Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.
- 3) Awasthi D. D. 2013). A hand book of lichens , Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.
- 4) Sally E. Smith and David J. Read (2008). Mycorrhizal Symbiosis. 3rd edn. Academic Press, New York.
- 5) Larry Peterson R., Hugues B. Massicotte, Lewis H. Melville, 2004. Mycorrhizas: Anatomy and Cell Biology, CAB International, UK.

**BOTANY: I- SEMESTER - SOFT CORE 1.4**  
**PHYTOPATHOLOGY**

**Theory-32 Hrs**

**Unit-1:** Concept of plant disease, Economic aspects of plant diseases; Types of plant diseases- Infectious diseases and non-infectious diseases; Causative agents of plant diseases; Angiospermic parasites; Development of plant pathology; Plant pathology in practice- Plant Clinic and Plant Doctor Concept; Parasitism and pathogenicity; Disease triangle; Infections and colonization; Weapons of plant pathogens; Effect of pathogen on physiology of host plant (photosynthesis, translocation and transpiration, respiration, permeability, transcription and translation).

**Unit-2: Defence mechanisms in Plants-** Pre-existing structural and chemical defences, induced structural and biochemical defences; Plant disease epidemiology- Elements of an epidemic and development of epidemics; Plant Disease forecasting; Genes and Diseases, Gene for gene concept, non-host resistance; Types of plant resistance to pathogens (Horizontal and Vertical Resistance); 'R' Genes and 'avr' genes; Genetics of virulence in pathogens and resistance in host plants; Breeding for disease resistance.

**Unit-3: Management of Plant Diseases:** Exclusion, eradication, cross protection, direct protection, integrated disease management, chemical methods of plant disease control; Biotechnological approaches to plant disease management; Gene silencing and disease control; Mechanism of gene silencing and control of viral diseases; Engineered resistance to viral, bacterial, fungal and insect diseases of crop plants.

**Unit-4: Study of diseases of crop plants:** Potato Spindle Tuber Disease, Tobacco Mosaic Disease, Sandal Spike Disease, Bacterial blight of Paddy, Citrus Canker, Late Blight of Potato, Downy Mildew of Maize, Blight of Paddy, Angular leaf spot of Cotton, Tikka disease of ground nut, Rust of coffee, Grain and Head smut of Sorghum. Leaf blight of Paddy, Blast of Paddy, Powdery mildew of cucurbits, Wilt of Tomato, Phloem Necrosis of Coffee, Root Knot of Disease of Mulberry and Vegetables; Non-parasitic diseases of plants; Seed-borne diseases.

**Practicals-32 Hrs**

- 1) Isolation of bacterial, fungal, and nematode plant pathogens of crop plants.
- 2) Study of mineral deficiency diseases of Tomato and French bean.
- 3) Estimation of foliar infection by Stover's method.
- 4) Study of spore germination.
- 5) Estimation of total phenols in diseased and healthy plant tissues.
- 6) Mycoflora analysis by Standard Blotter Method SBM/agar plating method.
- 7)-9) Study of Tobacco mosaic, Bacterial blight; Downy mildew of Maize; Powdery mildew of cucurbits; Grain smut of sorghum; Leaf rust of Coffee; Root Knot of Mulberry. Bunchy top of banana, Grassy shoot of sugar cane, Little leaf of Brinjal; Potato Spindle Tuber Disease (PSTVd)
- 10) Study of effect of pathogens on seed germination and vigour index.
- 11) Study of effect of fungicide on seed-borne pathogens.
- 12) Study of Fungal bio-control agents.

**References:**

- 1) Agrios, G. N. 2005. Plant Pathology 5th edn. Academic Press, San Diego.
- 2) Dickinson, M. 2003. Molecular Plant Pathology, Garland Publishing Inc, CT.
- 3) Ingram, D.S. and Robertson, N.F. 1999. Plant Diseases, Collins Publishers, London.

- 4) Johnston, A and Both, C. 1983. Plant Pathologists Pocket-book. 2nd edn. Commonwealth Mycological Institute, Oxford and IBH Pub. Co. Calcutta.
- 5) Lane, C.R., Beales P.A. and Hughes, K.J.D. 2012. Fungal Plant Pathogens, CABI Publishing, Wallingford.
- 6) Mehrotra, R. S., 2003. Plant Pathology, 2nd edn. Tata Mc. Graw Hill Pub. Co. Ltd., NewDelhi.
- 7) Rangaswamy, G. and Mahadevan, A. 2002. Diseases of crop plants in India, Prentice Hall of India Pvt.Ltd. New Delhi.
- 8) Schumann, G. L. and D'Arcy, C. J. 2012. Hungry Planet: Stories of Plant Diseases, APS Press, USA.
- 9) Singh, R. S., 2009. Plant Diseases. 9th edn. Oxford and IBH Pub.Co. New Delhi.
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## BOTANY: II- SEMESTER- HARDCORE 2.1

### REPRODUCTIVE BIOLOGY OF ANGIOSPERMS AND PLANT MORPHOGENESIS

#### Theory-32 Hrs

**Unit-1: Reproductive Biology of Angiosperms:** Historical overview; Contributions of P. Maheshwari; BM Johri; BGL Swamy to the development of embryology in India; Microsporogenesis and Microgametogenesis- wall layers and functions; Tapetum- types, concept of male germ unit and its significance; Pollen morphological features; Unusual features-pollen development in Cyperaceae, pollen embryo sac; Concept and scope of palynology.

**Unit-2: Megasporogenesis and Megagametogenesis;** Ovular structure and types; Development of monosporic, bisporic, tetrasporic and special types of embryo sacs; Ultra structure and nutrition of female gametophyte, concept of female germ unit and its significance; Fertilization- a general account, double fertilization, single fertilization, heterofertilization and polyspermy; Pollen recognition and rejection reactions - types, structures, methods to overcome incompatibility reactions; Endosperm- types, haustorial variations, ruminant and composite endosperm; Embryo- structure, development of monocot, dicot and grass embryo; Significance of embryonal suspensor; Experimental Embryology- scope and applications.

**Unit-3: Plant Morphogenesis:** Models of morphogenesis- comparison of plant v/s animal morphogenetic pathways: Embryo, *Arabidopsis thaliana*; Concepts- cell fate/ fate maps, gradients, stem cells in plants and their significance in development, polarity, symmetry, totipotency of cell types, pluripotency, plasticity, differentiation, redifferentiation, dedifferentiation and regeneration in *Acetabularia* and *Arabidopsis thaliana*.

**Unit-4: Plant Growth and Development:** Types, shoot apical meristems, root meristems; control of cell division in meristems; Quiescent center and meristeme de attente; *Arabidopsis*- vascular patterning and leaf development, abnormal growth; Cellular basis of growth- maintenance of cell shape; Cytoskeletal elements; Photomorphogenesis- definition, history, Hartmann's technique; Photoreceptors and photo morphogenesis, localization and properties; Effect of blue light-mediated photomorphogenesis with suitable examples.

#### Practicals-32 Hrs

##### Reproductive Biology of Angiosperms:

- 1) Study of microsporangium- slides: wall layers, tapetal types, two-celled and three-celled pollen; pollen tetrads.
- 2) Study of pollen germination: *Balsam*, *Delonix*, *Hibiscus* and *Peltaphorum*
- 3) Study of megasporangium-slides: female gametophyte development in *Penstemon*, *Xyris pauciflora*, 2, 4, 8-nucleate stages, mature embryo sac.
- 4) Endosperm mounting- *Cucumis sativus*, *Grevillia robusta* and *Croton sparsiflorus*
- 5) Embryo: Slides-monocot, dicot and grass embryo.
- 6) Embryo mounting : *Crotalaria*.

##### Plant Morphogenesis:

- 7) Study of stem cells in plants: SAM, RM.
- 8) Regeneration abilities of shoot apical meristems of dicots on media with combinations of growth regulators.
- 9) Study of totipotency in cell types: stomata, epidermal cells, stem and leaf explants on a tissue culture media.
- 10) Polarity in stem cuttings: *Pothos* spp.
- 11) Study of regeneration in succulents *Kalanchoe*, *Byrophyllum*.

- 12) Study of leaf galls of plants: *Pongamia pinnata* and *Achyranthes aspera*: Morphological observations and histology.
- 13) Study of *Arabidopsis thaliana* as a model plant.

**References:**

- 1) Johri, B. M. 1984. The embryology of Angiosperms. Springer Verlag.
- 2) Johri, B. M. 1982. The experimental embryology of vascular plants. Springer Verlag, New York.
- 3) Swamy, B.G.L. & Krishnamurthy, K. V. 1982. From flower to fruit: The embryology of angiosperms. Tata McGraw Hill Co. New Delhi.
- 4) Eames, 1961. Morphology of Angiosperms. McGraw Hill book Co., Inc., New York.
- 5) Maheshwari, P. 1950. An introduction to the embryology of Angiosperms. McGraw Hill book Co., Inc., New York.
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- 11) Lyndon, R. F. 1990. Plant Development : The Cellular basis. Unwin Hyman, London.
- 12) Aloni, R. 1987. Differentiation of vascular tissues. Annu. Rev. Plant Physiol. 38:179- 219.
- 13) Raman, A. 2007. Insect induced plant galls of India; unresolved questions. Curr. Sci. 92 (6): 748-757.
- 14) Smith, H. 1975. Phytochrome and Photomorphogenesis- an introduction to the photocontrol of plant development. Mc Graw- Hill Book Co. (UK), Ltd.
- 15) Mohr, H. 1972. Lectures in photomorphogenesis. Springer- Vohrleg, Berlin, Germany.

**BOTANY: II- SEMESTER - HARD CORE 2.2**  
**CELL BIOLOGY AND GENETICS**

**Theory-32 Hrs**

**Unit-1: Bio Molecules and Membranes:** Structure, composition of bio-molecules and their stabilizing interactions (carbohydrates, lipids, proteins and nucleic acids); Unit membrane structure and functions; Membrane proteins, membrane transport and the electrical properties; Intra-cellular compartments and protein sorting; Intracellular membrane traffic; Cytoskeletons.

**Unit-2: Functions of Organelles:** Cell wall, membranes, nucleus, mitochondria, Golgi bodies, lysosomes, spherosomes, peroxisomes, ribosomes, endoplasmic reticulum, Plastids, chloroplast, vacuoles and cytoskeleton; Cell cycle and mechanism of cell cycle regulations; A brief account of cell signalling, receptors, second messengers; General mechanism of signal transduction pathway; Programmed cell death in life cycles of plants.

**Unit-3: Extensions of Mendelian Principles** co-dominance, incomplete dominance, gene interactions, multiple alleles, lethal alleles, pleiotropy, penetrance and expressivity, polygenic inheritance, linkage and crossing over, sex linked inheritance, sex limited and influenced traits, genome imprinting, extra nuclear inheritance; **Concept of the gene-**classical-alleles, multiple alleles, pseudo-alleles, complementation test, experiments on rII locus and lozenge locus, modern- jumping genes, overlapping and genes within genes, split genes, nested genes, fusion genes; **Gene mapping methods-** linkage maps, tetrad analysis; Recombination in bacteria mapping genes in bacteria by interrupted mating technique, fine structure mapping, transduction and transformation mapping, mapping genes in Bacteriophages,

**Unit-4: Sex Determination and Dosage Compensation:** Chromosomal and genetic basis of sex determination; Mechanism of sex determination in *Melandrium*, *C. elegans*, *Drosophila* and humans, dosage compensation mechanisms in humans, *Drosophila* and *C. elegans*. **Transposable elements-** discovery in maize and bacteria, transposal elements in bacteria and bacteriophage, types and functions; Transposable elements in eukaryotes- Plants, *Drosophila* and Humans, mechanisms of transpositions; Transposable elements in research.

**Practicals-32 Hrs**

- 1) Determination of reducing sugars by Nelson-Somogyim's method.
- 2) Estimation of total soluble sugars by volumetric method.
- 3) Quantitative determination of free Amino acid content in germinating seeds.
- 4) Estimation of ascorbic acid in plant tissues.
- 5) Estimation of Phospholipids by TLC.
- 6) Slides/Charts/photos NP (Cytology Genetics and Embryology).
- 7) Study of mitosis in normal and induced root tips cells of Onion.
- 8) Study of meiosis in onion flower buds , translocation in *Rhoeo*.
- 9) Study of special chromosomes- B chromosomes, and sex chromosomes.
- 10) Determination of chiasma frequency in onion.
- 11) -12) To solve genetic problems on linkage, ordered and unordered tetrads.

**References:**

- 1) Atherly, A.G. Girton, J.R. Donald, J.R. 1999. The Science of Genetics. Saunders College Publishers. Fortworth .
- 2) Griffith, A.J.F. Gelbart, W.M. Muller, J.H. and Lewintin, R.C. 1999. Modern Genetic Analysis. W.H. Freeman and Co. New York.

- 3) Hartl. D. 1991. Basic Genetics. 2edn., Jones and Barlett Publishers Inc. Boston.
- 4) Fairbanks, D.J. and Anderson, W.R. 1999. Genetics the continuity of Life. Brooks's/Cole publishing Company, California.
- 5) Brooker. R.J. 1999. Genetics –analysis and principles. Addison Wesley Longman Inc. California.
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- 9) Strickberger, Monroe W. 2000. Evolution. 3rd Edn. Jones & Bartlett Publishers, Inc. 40 Tall Pine Drive Sudbury, MA 01776, USA.
- 10) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Rafi, Keith Roberts, and Peter Walter. 2008. Molecular biology of the cell, 5th ed., Garland science, Taylor & Francis Group, LLC, 270 Madison Avenue, New York NY 10017, USA.
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- 12) Kleinsmith, L.J. and Kish, V.M. 1995 .Principles of Cell and Molecular Biology 2nd edn. Harper Collins College Publishers, New York, USA.
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- 14) Buchanan, B.B. W.Gruissem and Jones, R.L. (2000). Biochemistry and Molecular Biology of Plants. ed. ASPP Press. USA.

**BOTANY: II SEMESTER HARD CORE 2.3**  
**PLANT BREEDING AND EVOLUTIONARY BIOLOGY**

**Theory-32 Hrs**

**Unit-1: Introduction:** Objective and role of plant breeding; Evolution of plant breeding, scope of plant breeding, sciences related to plant breeding, Vavilov's concept of origin of centers of origin of crop plants; Recent trends in plant breeding; **Breeding Methods**-plant introduction and acclimatization, domestication and agriculture, pure line, clonal, mass and progeny selections, recurrent selection, pedigree, bulk and back cross methods; Heterosis breeding synthetic and composite varieties; **Breeding Techniques**-Mutation breeding, polyploidy, hybridization, tissue culture techniques in crop improvement, protoplast fusion, electrophoration, electro-fusion, biolistics, somatic hybridization, transgenic plants (GMO's); The role of Gene technology in plant breeding.

**Unit-2: Breeding for Specific Purposes:** Breeding for disease resistance, insect resistance, drought and salinity, quality trait, multiple cropping systems, ideotype breeding, breeding for Adaptation; **Crop breeding and seed production**- Breeding field crops, seed production techniques, release of new varieties, intellectual property rights, computer application in plant breeding, crop breeding Institutes/Centers; Genetic resources and germplasm conservation; Scientific Plant breeding; Green revolution; The elite crop (Golden rice); Contributions of **Dr.**

M.S. Swaminathan, Dr. Norman E. Borlaug and N.I. Vavilov.

**Unit-3: Nature of Evolution :** The origin, theories of evolution of life, earth and the universe,; Conditions of the early earth, emergence of the first living cell, origin of prokaryotic and eukaryotic cells, life in the Palaeozoic, Mesozoic and Coenozoic era. **Development of Evolutionary thoughts;** Ecological context, before Darwin, Darwinism, Darwin's evolutionary theory, Neo – Darwinism, modern synthesis: **Fossil evidence of Ancient life,** fossilization,; Interpreting geological time scale and fossil records; Evidences from comparative, morphology, patterns of development, comparative physiology and biochemistry, biogeography, palaeontology, taxonomy, anatomy and embryology, plant and animal breeding; Evidence from changing earth and sea; Extinctions; Evolutionary ecology.

**Unit-4: Natural Selection :** Types of natural selection, selective forces, selection models, sexual selection, selection and non adaptive characters, Adaptive radiation, artificial selection, **Variation-** gene flow, genetic drift, gene mutation - Mendelian concept, chromosomal mutation, architectural changes in chromosomes; The Hardy – Weinberg law, polyploidy in plant evolution; Speciation and origin of higher categories -Types of speciation, models of speciation, pattern of speciation, isolating mechanism and species formation, signification of speciation; Molecular evolution.

**Practicals-32 Hrs**

- (1) Study of floral biology of crops - typical examples of self and cross pollinated plants.
- (2) Selfing and hybridization techniques - Bagging and emasculation.
- (3) Pollen viability: germination test and TTC test.
- (4) Studying of centre's of origin of cultivated crops - N.I. Vavilov Concept.
- (5) Mode of pollination study in different crops.
- (6) Identification of crop breeding institutes/ centers and logos.
- (7) Studying and identification of contributors of plant breeding - M.S. Swaminathan, N.I. Vavilov, Norman . E. Borlaug .
- (8) Study of contributions of scientists to evolutionary biology.
- (9)-12) Study of models and photographs related to evolution.

## References

- 1) Atherly, A.G. Girton, J.R. Donald, J.R. 1999. The Science of Genetics. Saunders College Publishers. Fortworth.
- 2) Griffith, A.J.F., Gelbart, W.M. Muller, J.H. and Lewintin, R.C. 1999. Modern Genetic analysis. W.H. Freeman and co. New York.
- 3) Hartl. D. 1991. Basic Genetics. II edn. Jones and Barlett Publishers Inc. Boston.
- 4) Fairbanks, D.J. and W.R. Anderson. 1999. Genetics the continuity of life. Brooks's/Cole publishing company. California.
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- 12) Chopra, V.L. 2000. Plant Breeding- theory and practices. Oxford and IBH Publishing Co. Pvt. Ltd., Oxford.
- 13) Chahal, G.S. and Gosal, S.S. 2002. Principles and procedures of Plant Breeding. Narosa Publishing House, New Delhi.

**BOTANY: II- SEMESTER - SOFT CORE 2.1**  
**PLANT ANATOMY AND HISTO-CHEMISTRY**

**Theory-32 Hrs**

**Unit-1: Plant Anatomy:** Primary vegetative body of the plant; Anatomical features of leaf, stem and root (dicot and monocot); leaf of fern and gymnosperm; Structure of modified leaves- Kranz anatomy and C4 photosynthesis; Ultra-structure and chemistry of the cell wall; formation of the cell wall and its uses.

**Unit-2: Anatomy of Vascular Tissue:** Ultra structure and differentiation of xylem and phloem tissues; Apical meristems- shoot apex in Pteridophytes, Gymnosperms and Angiosperms, theories, root apical meristems.

**Unit -3: Secondary Growth:** Vascular cambium, secondary xylem of gymnosperms and dicots and secondary phloem of Gymnosperms and dicots; Periderm and bark; Anomalous secondary growth in monocots and climbers; Leaf ontogeny - Dicot- simple, compound, Monocot; Floral anatomy-flower parts, floral meristem, vascular system.

**Unit-4: Plant Histochemistry:** Tests for minerals, carbohydrates, lignins, polyphenols, proteins, lipids and nucleic acids; Study of instruments: (a) Camera lucida (b) Micrometry (c) Microtome. Principles of histo-chemical stains; Killing, fixing and staining of plant tissues; Double staining- TBA method.

**Practicals-32 Hrs**

- 1) Staining of xylem and phloem elements.
- 2) Study of anatomy of roots in: *Ficus, Musa, Dieffenbachia, Vanda*.
- 3) Study of anomalous secondary growth in the following examples: Stem of *Aristolochia, Nyctanthes, Pyrostegia, Peperomia, Tinospora, Achyranthes*.
- 4) Study of Ecological anatomy.
- 5) Study of Vasculature in floral organs.
- 6) Studying double staining technique.
- 7-11) Embedding: TBA method, embedding for electron microscope, Sectioning, Microtomes, whole mounts maceration.
- 12) Histochemical- PAS Test, Sudan black- lipids, Feulgen reaction – Nucleic acids.

**References:**

- 1) Abraham, F. 1982. Plant Anatomy. 3rd edn. Pergaon Press. Oxford.
- 2) Cariquist, S. 1967. Comparative Plant Anatomy- Holt Reinert and Winston, New York.
- 3) Cutter, D. G. 1971. Plant Anatomy- Part 1, Cell and Tissues Edward Arnold London.
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- 9) Krishnamurthy, K. V. 1988. Methods in Plant Histochemistry. S. Viswanathan (Printers and Publishers) Pvt. Ltd. Madras.

**BOTANY: II- SEMESTER - SOFT CORE 2.2**  
**ETHNO-BOTANY AND INTELLECTUAL PROPERTY RIGHTS (IPR)**

**Theory - 32 Hrs**

**Unit-1: Ethno-botany:** Introduction, concept, scope and objectives; Ethno-botany as an interdisciplinary science; The relevance of ethno-botany in the present context; Ethnic groups; Ethno-botany- Major and minor ethnic groups of India and their life styles; Forest Vs. ethnic groups; Plants in tribal life with reference to Magico-religious rituals and social customs; Sacred groves.

**Unit-2:** Methodology used in the study of Ethnobotany and Ethno pharmacology: Field work, Herbarium, Ancient Literature, Archaeological findings, temples and sacred places, protocols. Preliminary phyto-chemical analysis of ethno-botanical important medicinal plants.

**Unit-3:** Role of ethno-botany in modern Medicine with special examples; Medico-ethno-botanical Sources in India with special reference to Karnataka; Tribals Vs. Agriculture: Shifting, Podu and Jhum cultivation; Role of ethnic groups on surrounding environment; Crop genetic sources; Endangered taxa and forest management (participatory forest management); Ethno- botany as a tool to protect interests of ethnic groups; Sharing of wealth concept with few examples from India.

**Unit-4:** Study of Intellectual Property Rights – patents, trademark, geographical indication, copyright; IPR and Traditional Knowledge; Bio-piracy of traditional knowledge; Ethno botany and legal aspects; National and international organizations and treaty related to traditional knowledge – WIPO, TKDL, TRIPS, CBD, Nagoya protocol etc., Ethno botany as a source (recent) of already known drugs: a) *Withania* as an antioxidant and relaxant b) *Sarpagandha* in brain ailments c) *Becopa* and *Centella* in epilepsy and memory development in children d) *Phyllanthus fraternus* in diabetic and viral jaundice e) *Artemisia* as a powerful cerebral anti malarial agent and its possible use in tuberculosis.

**Practicals-32 Hrs**

- 1) Survey and collection important ethno botanical plants by using questionnaire and interview.
- 2) Preliminary phyto- chemical analysis of medicinal plants.
- 3) Study of biological functional properties of crude drugs – Anti microbial activity.
- 4) Study of methods of *in-situ* or *ex-situ* conservation of important medicinal plants.
- 5) Study of techniques used in Pharmacognosy – organoleptic, anatomy and chemical methods.
- 6) A visit to a Tribal area to conduct field work and collect ethno botanical information / data.
- 7) Listing of Crude drugs in Pansali shops (local crude drugs shops) and their identification (little known drugs only).
- 8) -12) Visit to nearby Western Ghats and Sacred Groves.

**References:**

- 1) Jain, S.K. 1995. Manual of Ethno-botany, Scientific Publishers, Jodhpur.
- 2) Jain, S.K. 1981. Glimpses of Indian. Ethno-botany, Oxford and I B H, New Delhi
- 3) S.K. Jain 1989. Methods and approaches in ethno-botany. (ed.) Society of ethno botanists, Lucknow, India.
- 4) Jain, S.K. 1990. Contributions of Indian ethno-botany. Scientific Publishers, Jodhpur.



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- 7) Rajiv K. Sinha – Ethno-botany The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996
- 8) Faulks, P.J. 1958. An introduction to Ethno-botany, Moredale pub. Ltd. London

**BOTANY: II- SEMESTER - SOFT CORE 2.3**  
**ECONOMIC BOTANY**

**Theory -32 Hrs**

**Unit- 1: Economic Botany:** The origin of cultivated plants and Agriculture; The future role of plants in relation to mankind; Introduction to Green revolution; Study of origin, distribution, cultivation and utility of the useful parts of the following- - rice, wheat, maize, barley, sorghum and millets; Red gram, green gram, black gram, horse gram, pea, cow pea, bengal gram; Oil Yielding plants- sunflower, safflower, groundnut, linseed, rape seed; A brief account of economically important horticultural and floricultural plants.

**Unit- 2: Economic Botany:** Study and utility of the useful parts of the following- Sugar yielding plants- sugar cane and sweet potato, sugar beet and *Stevia*; Spices and condiments - ginger, turmeric, cardamom, cinnamon, clove, saffron, all spice, black pepper, nutmeg, red pepper, coriander, cumin, fennel and *Vanilla*.

**Unit -3: Economic Botany** Study and utility of the useful parts of the following- fibre- cotton, jute, flax, hemp, Sunn hemp, China grass, coconut and Kapok; Timber yielding plants- *Tectona* and *Dalbergia*; Dyes- indigo, henna; Masticatories and fumitories-areca nut, betel leaf, tobacco; rubber- Para rubber and other substitutes; Gums- Gum Arabic, Karaya gum.

**Unit-4: Medicinal Botany:** Scope and importance of medicinal plants; Indigenous medicinal Sciences; Important medicinal plants and their uses; Major exporters and importers of traditional medicinal plants and plant products; Application of natural products to certain diseases- jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases; Poisonous plants.

**Practicals-32 Hrs**

- 1) Utility, uses and economic importance of cereals and millets.
- 2) Utility, uses and economic importance of horticultural and floricultural plants
- 3) Utility, uses and economic importance of pulses and oil yielding crops.
- 4) Utility, uses and economic importance of sugar yielding crops.
- 5) Utility, uses and economic importance of spice and condiments.
- 6) Utility, uses and economic importance of fiber and timber yielding plants.
- 7) Utility, uses and economic importance of dye, rubber and gum yielding plants
- 8) Utility, uses and economic importance of masticatories and fumitories
- 9) -12) Study of medicinal and poisonous plants.

**References:**

- 1) Hill, A.F. 1952. Economic Botany, TataMcGraw Hill, New Delhi.
- 2) Kochhar, S.L. 1998. Economic Botany of Tropics, Macmillan India Publishers, New Delhi.
- 4) Pandey, B.P. 2000. Economic Botany. S. Chand & Company, New Delhi.
- 5) Pandey, S.N. and Chandha, A. 1999. Economic Botany. Vikas Publishing House Pvt. Ltd. New Delhi.

**BOTANY: II SEMESTER- OPEN ELECTIVE 2.1**  
**MEDICINAL PLANTS**

**Theory-32 Hrs**

**Unit-1: Medicinal Plants:** History, scope and importance of medicinal plants; Indigenous medicinal sciences; History, origin, panchamahabhutas, saptadhatu and tridosha concept, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e-tabiya, tumors treatments/ therapy, polyherbal formulations.

**Unit-2: Medicinal Plants Conservation:** Conservation of endangered and endemic medicinal plants; Endemic and endangered medicinal plants; Red list criteria; *In-situ* conservation- biosphere reserves, sacred groves, national parks; *Ex situ* conservation- botanic gardens, ethno medicinal plant gardens; Propagation of medicinal plants - objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

**Unit - 3: Funding for Cultivation of Medicinal Plants:** Sources of financial aids for medicinal plant cultivation: Aims and objectives, Functions and activities of the board, Schemes and Projects for Financial assistance, Funding of projects; Procedure for processing project proposal for approval, Implementation and monitoring.

**Unit- 4: Ethno botany and Folk medicines:** Definition; Ethno botany in India: Methods to study ethno botany; Applications of Ethno botany: National interacts. Ethno medicine. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases. Brief introduction to poisonous plants.

**References:**

- 1) Trivedi, P. C. 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
- 2) Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn.
- 3) Agrobios, India.
- 4) Yoganasimhan, S.N. Medicinal Plants of India- Vol 1- Karnataka, Interline Publishing Pvt. Ltd.

**BOTANY: III- SEMESTER - HARD CORE 3.1**  
**BIOCHEMISTRY AND PLANT PHYSIOLOGY**

**Theory -32 Hrs**

**Unit-1: Biochemistry-** Brief account of plant structural and functional molecules- carbohydrates, proteins, lipids and nucleic acids; classification, structural and functional properties of bio molecules; Biochemistry of cell membranes; **Lipids**-building and storage molecules, classification and significance; **Proteins**- classification, structure- primary, secondary, tertiary and quaternary structure; properties of proteins; **Enzymes**- Nomenclature, nature and properties of enzymes, active sites, co-enzymes, kinetics of enzyme action, catalysis, specificity and inhibition, allosteric enzymes, ribozyme and abzyme.

**Unit-2:Solute transport:** Transport of solutes across the membranes Transmembrane proteins, Transport of ions, solutes and macro-molecules, Mechanism of translocations in phloem; Role played in signal transduction pathway stomatal physiology; **Phytosynthesis in higher plants** (i) Photophosphorylation - Calvin cycle; **Photorespiration** - C4 – Pathway, CAM in plants; Oxidative Phosphorylations; Glycolysis -TCA – Cycle and terminal oxidation.

**Unit-3: Plant Hormones-** plant hormones-discovery, biosynthesis, metabolism, transport and physiological effects of plant hormones and their applications; **Nitrogen metabolism** -(i) Molecular mechanism of N<sub>2</sub> fixation (ii) Biosynthesis of amino acids (iii) Assimilation of nitrate and ammonium; **Lipid metabolism**- fats and oils biosynthesis and oxidation of lipids; Physiology of seed germination and flowering.

**Unit -4: Stress Physiology:** Water deficit and its physiological consequences; Drought tolerance mechanisms, Salinity stress and plant responses. Heat stress and heat shock proteins; Metal toxicity in plants. Biotic stress, HR and SAR mechanisms; **Mineral nutrition**- in plants and deficiency diseases; **Plant development**- physiology of flowering; **Phytochrome**- photochemical and biochemical properties of phytochrome; Concept of photoperiodism and vernalization and its influence on flowering;

**Practicals-32 Hrs**

- 1) Estimation of protein by Lowry's method
- 2) Determination of water potential of tissue by plasmolytic method
- 3) Determination of water potential by Gravimetric method
- 4) Quantitative estimation of chlorophyll a, chlorophyll b and total chlorophyll in plant tissue
- 5) Determination of diurnal fluctuation of acid content of CAM plants (TAN)
- 6) Determination of temperature quotient (Q<sub>10</sub>) of water uptake
- 7) Separation of chlorophyll pigments/Anthocyanin by TLC
- 8) Protein analysis by SDS PAGE method.
- 9) Estimation of Alpha-amylase activity in germinating seedling.
- 10) Silver staining of proteins.
- 11-12) Visit to Molecular Biology Laboratories.

**References:**

- 1) Barkla, B.J., and Pantajo, O. 1996. Physiology of ion transport across the tonoplast of higher plants. Ann. Rev. Plant Physiol. 47: 159-184.
- 2) Clayton, R.K. 1980. Photosynthesis: Physical mechanisms and chemical patterns. Cambridge Uni. Press, Cambridge.
- 3) Cohn, E.E., and Stumpf, P.K. 1992. Outlines of Biochemistry. Wiley Eastern Pvt. Ltd.
- 4) Kozaki, A., and Takeba, G. 1996. Photorespiration protects C3 plants from

photooxidation. Nature 384: 557- 560.

- 5) Taiz, L., and Zeiger, E. 1998. Plant Physiology. Sinaur Associates Inc. Publishers, Sunderland Massachusetts.
- 6) Mukherji, S., and GHosh, A.K. 1996. Plant Physiology. New Central Book Agency Pvt. Ltd. Kolkatta, India.
- 7) Rabinowithc, E., and Jee, G. 1969. Photosynthesis. Willey Press, New York.
- 8) Rudier, W., and Thummlar, K. 1994. The Phytochrome, Chromophore I. Photomorphogenesis in Plants, II Edition, Netherlands, 51-69.
- 9) Spanswick, R.M. 1981. Electrogenic ion pumps. Ann. Rev. Plant Physiol. 32: 267-289.
- 10) Mc Elroy, W.D. 1995. Cell Physiology and Biochemistry. Prantice Hall of India.
- 11) Walsh, C.T. 1979. Enzymatic reaction mechanisms. Editors: W.H. Freeman, New York.
- 12) Webb, E. 1984. Enzyme nomenclature. Academic Press, Orlando Fla.
- 13) Zimmermann, M.H., and Milburn, J.A. Transport in Plants. 1. Phloem transport (Encyclopedia of Plant Physiology. New Series Vol. 1), Springer, New York.
- 14) Devline and Witham, 1986. Plant Physiology. CBS Publs. and Distributors, New Delhi.
- 15) Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons. Inc., NewYork, USA.
- 16) Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer Verlag, New York, USA.
- 17) Singhal *et al.* 1999. Concepts in Photobiology, Photosynthesis and Phytomorphogenesis, Narosa Pub. House, New Delhi.

**BOTANY: III- SEMESTER - HARD CORE 3.2**  
**MOLECULAR BIOLOGY**

**Theory-32 Hrs**

**Unit-1: Organization of chromosomes and genes in prokaryotes and eukaryotes** - Operon, interrupted genes, gene families, unique and repetitive DNA, heterochromatin, euchromatin, transposons, mitochondrial and chloroplast genome organization, Transposable elements in prokaryotes and eukaryotes, genetic and evolutionary significance, **DNA replication**- patterns, Messelson and Stahl's and Taylor's experiment, enzymes of replication, mechanism of DNA replication in prokaryotes and Eukaryotes, proof reading and error correction mechanisms.

**Unit-2: Molecular mechanism of mutation, repair and recombination:- Mutation**-DNA damage by spontaneous mutations, physical and chemical mutagens and their molecular mechanisms, **Repair mechanisms**- direct reversal of damage, base and excision repair, recombinational repair, SOS repair, translation repair synthesis, transcription coupled repair, **Recombination**- homologous recombination, models of recombination, mechanisms, protein machinery of homologous recombination, genetic consequence of homologous recombination, gene conversion, site specific recombination, mechanism and biological significance, non homologous recombination- transposition, molecular mechanisms of transposition- conservative, replicative and retro-transposition.

**Unit-3: RNA synthesis, processing and translation:** transcription activators and repressors, promoters, RNA polymerases and transcription factors, mechanism of transcription in prokaryotes and eukaryotes, **RNA processing**- capping, polyadenylation, splicing, alternative splicing, RNA editing, exon shuffling and RNA transport, **Translation and processing**- ribosomes, tRNA aminoacylation, aminoacyl tRNA synthetase, genetic code, wobble hypothesis, deciphering of the code, translation mechanism , translation proof reading, translation inhibitors and post translational modifications.

**Unit-4: Regulation of gene expression in Prokaryotes:** Operon concept, regulation at transcription initiation- lac and trp operon control, regulation of lytic and lysogenic cycles in lambda phage, regulation beyond transcription initiation-premature termination- trp operon, ribosomal proteins as translational repressors, riboswitches, **Regulation of gene expression in eukaryotes**-transcription activators and repressors, regulation after transcription initiation- alternative splicing, translational control in ferritin and transferrin mRNA, RNA interference, role of chromatin in regulation of gene expression and gene silencing.

**Practicals-32 Hrs**

- 1) Isolation of DNA from CTAB method.
- 2) Isolation of DNA from Onion.
- 3) Isolation of DNA from mulberry leaves.
- 4) Estimation of DNA by DPA method.
- 5) Extraction of RNA by trizol/ phenol-chloroform methods.
- 6) Estimation of proteins by Biuret method.
- 7) Estimation of protein by Bradford method.
- 8) Determination of T<sub>m</sub> value of DNA.
- 9-12) Photo graphs/ charts related to molecular biology/Molecular Biologists.

**References:**

- 1) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Rafi, Keith Roberts, and Peter

Walter. 2008. Molecular biology of the cell, 5th edn., Garland science, Taylor & Francis Group, LLC, 270 Madison Avenue, NewYork ,USA.

- 2) Alberts, B., Bray, D., Lewis, J , Raff, M., Roberts, K and Watson, J.D. 1999 . Molecular biology of the cell. Garland Publishing, Inc., New York
- 3) Kleinsmith, L.J. and Kish, V.M. 1995 .Principles of Cell and Molecular Biology 2nd Edition Harper Collins College Publishers, New York, USA.
- 4) Lodish, H. Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology 4th Edition. W.H. Freeman and Co. New York, USA
- 5) Malacinski, G.M. and Freidfelder, D. 1998. Essentials of Molecular Biology 3rd Edition. Jones and Bartlet Publishers, Inc., London.
- 6) Gunning.B.E.S. and Steer, M.W.1996. Plant Cell Biology; Structure and Function. Jones and Bartlett Publishers, Boston, Massachusetts.
- 7) Harris,Nand Oparka, K.J. 1994. Plant Cell Biology A Practical Approach. IRL Press, Oxford University Press, U.K.
- 8) F.M. Ausubel, R.Brent, R.E. Kingston, D.D. Moore, J.G. Seidman, J.A. Smith, K. Struhl, (Current Edition) (2005). Current Protocols in Molecular Biology.
- 9) B.B. Buchanan, W.Gruissem and R.L. Jones . USA (2000) .Biochemistry and Molecular Biology of Plants. Ed. ASPP Press.
- 10) T.A. Brown, 2000. Essential of Molecular Biology, Vol-I & 2 Oxford University Press.
- 11) James D. Watson, Tania, . A. Baker, Stephen, P. Bell, Alexander ,Gannm, Michael Levine.2004. Molecular Biology of the gene. 5th Edition, Pearson Education.Philip M Gilmartin and Chris.
- 12) Bowle.2002. Molecular Biology of Plants. Vol 1 & 2 Oxford University Press.

**BOTANY: III-SEMESTER - HARD CORE 3.3**  
**PLANT BIOTECHNOLOGY**

**Theory-32 Hrs**

**Unit-1: Plant Tissue Culture:** Scope and importance of plant tissue culture - Media composition and types, hormones and growth regulators, explants for organogenesis; Micro propagation, embryo and endosperm culture, somatic embryogenesis, variation and cell line selection, androgenesis and microspore culture, significance of haploids, diploidization and bulbosum technique; Cryopreservation, germplasm collection; Somatic Hybrids- Isolation and protoplast culture and somatic hybridization and its significance, Synthetic seed production and somaclonal variations.

**Unit-2: Genetic Engineering:** Milestones in plant recombinant DNA technology; Importance of gene manipulation in future perspectives; **Tools in Genetic Engineering-** Enzymes in genetic engineering - restriction endonucleases, types and their actions, other DNA modifying enzymes; Cloning vectors- plasmids isolation and purification - Ti Plasmid, pBR322, pUC-series. Phage vectors-M13 phage vectors, Cosmids -types, phasmids or phagemids, shuttle vectors-types; YAC and BAC vectors, Lambda phage vectors, Lambda phage DNA as a vectors; Cloning vectors and expression vectors; Vectors for plant cells; Vectors for animal cells, baculovirus vectors- adenoviruses, retroviruses, transposons as vectors, Synthetic construction of vectors.

**Unit 3: Applications of Genetic Engineering for pest, disease and stress tolerance:** The genetic manipulation of herbicide resistance with suitable examples; The genetic manipulation of pest and disease resistance with suitable examples; Transgenic approaches to viral and bacterial disease resistance. Engineering for stress tolerance and Metabolic Engineering of Plants; Future prospects for GM crops.

**Unit 4: Biofertilizers:** Preparation and applications of biofertilizers such as Rhizobium, Azotobacter, Blue Green Algae and VAM. Single Cell proteins (SCP): Health benefits and advantages of single cell proteins- *Spirulina*. Biofuels: Ethanol and Biofuel production from plants. Mushroom cultivation and its advantages. Bioremediation: Phytoremediation; Biodegradation, Xenobiotics. Biotechnology of medicinal and aromatic plants for human welfare.

**Practicals-32 Hrs**

- 1) Preparation of plant tissue culture media and types.
- 2) Organ culture (Shoot tip, nodal and leaf culture) for callus Initiation and regeneration.
- 3) Anther culture for the production of haploids.
- 4) Suspension culture and production, separation and estimation of secondary metabolites.
- 5) Encapsulation of somatic embryos and production of Synthetic seed.
- 6) Extraction of secondary metabolites using Soxhlet extractor and Identification of In vitro secondary metabolites-alkaloids, steroids and flavonoids.
- 7) Restriction digestion of plasmid and genomic DNA and gel electrophoresis.



- 8) Isolation of genomic DNA from bacteria/plants and purification by agarose gel electrophoresis.
- 9) Restriction analysis of plasmids, gel purification of DNA, small and large scale purification of plasmids.
- 10) Preparation of competent *E. coli* cells. Bacterial transformation and recovery of plasmid clones.
- 11) Gene cloning in plasmids, analysis of recombinant plasmids.
- 12) DNA amplification by PCR, RT-PCR, Real Time PCR.
- 13) Analysis of DNA and RNA and Protein by Southern, Northern and Western blotting.
- 14) Primer design for PCR.

**References:**

- 1) Slater, N. Scott and M. Fowler. Plant Biotechnology 2003: The genetic manipulation of plants. Oxford University Press, Oxford.
- 2) Plant Biotechnology. 2000. J.H. Hammond, P. Mcgarvey, and V. Yusibov (eds). Springer Verlag, Heidelberg.
- 3) Text Book of Biotechnology. 2004. H.K. Das (ed). Wiley India Pvt. Ltd., New Delhi.
- 4) Plant Biotechnology -The Genetic Manipulation of Plants, Adrian Slater, Nigel Scott and Mark Flower, Oxford University Press, (2000).
- 5) Plant Genetic Transformation and Gene Expression by (eds) J.Draper *et.al.* Blackwell Scientific Publications, Oxford (1988).
- 6) Reinert, J. 1982. Plant Cell and Tissue Culture: A Laboratory Manual. Narosa Publishing House, New Delhi.
- 7) Chawla H.S., 2009, Plant Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
- 8) Bhojwani, S.S. and Razdan, M.K. 2004. Plant Tissue Culture: Theory and practice. Elsevier Science Publishers, New York, USA.
- 9) PUROHIT S. D., 2012. Introduction To Plant Cell Tissue And Organ Culture PHI Learning Pvt. Ltd., New Delhi
- 10) Roberta, H. Smith, 2012. Plant Tissue Culture: Techniques and Experiments 3 edition. Academic Press; US.

**BOTANY: III- SEMESTER- SOFT CORE 3.1**  
**MOLECULAR GENETICS OF PLANTS**

**Theory-32 Hrs**

**Unit-1: Plants as genetic tools in Biology:** *Arabidopsis*, *Rice*, *Maize*, *Saccharomyces*; Genome organization in plants; *Arabidopsis thaliana*- an experimental model for understanding plant development and functions; Plant genes and regulation; nucleus and chromatin organization; Histones and histone modifications; DNA packaging, organization and types of DNA sequences; functional and non- functional sequences, organization of plant nuclear genes, plastid genes and mitochondrial genes.

**Unit-2:** Genes responding to hormones, phytochrome, responses to abiotic stresses; Genes induced by water stress and freezing stress; Genes involved in photosynthesis and nitrogen fixation and their regulation; Molecular development of leaf and flower - ABC and revised model of flower development; Genes involved in fertilization, seed development, embryo development.

**Unit-3: Genetics of *Agrobacterium*:** Biology and genetics of *Agrobacterium tumefaciens*; The Ti- plasmid, *Vir* genes and expression, Mechanism of T-DNA transfer and integration; Basic features of vectors for plant transformation; Proteomics, genomics and bioinformatics; Structural and functional genomics, comparative genomics - biochemical, evolutionary, physiological and phylogenomics; Tools to study functional genomics.

**Unit-4: Proteomics-** functional and comparative proteomics; Protein distribution, characterization and identification, differential display proteomics, detection of functional linkages; Pharmacogenomics; Bioinformatics- tools of bioinformatics, data bases and data base management, bioinformatics in taxonomy, biodiversity, agriculture; Bioinformatics in drug design and drug discovery.

**Practicals-32 Hrs**

- 1) *Arabidopsis thaliana*- study of plant system and its biology.
- 2) *Arabidopsis* RNA extraction (total and polysomal) for Northern blotting.
- 3) Expression of foreign genes in plant cells through *Agrobacterium tumefaciens* (Chart)
- 4) Production of tobacco transgenic plants and assay for the introduced transgenic (Chart)
- 5) Co-cultivation of tobacco *Agrobacterium tumefaciens*
- 6) -12) Learning gene bank formats- EMBL format, FASTA format, Swiss- PROT, Ex PASy

**References:**

- 1) Buchmann, B.B., Gruissem, W., and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. ASPP Press, USA.
- 2) Ausubel, F.M., Brent, R., Kingston, R.E., Moore, D.D., Seidman, J.G., Smith, J.A., and Struhl, K. 2005. Current protocols in molecular biology. Current Edition.
- 3) Brown, T.A. 2000. Essentials of Molecular Biology. Vol. I & II, Oxford University Press.
- 4) Potrykus, I., and Spangenberg, G. 1995. Gene transfer to plants. Springer, Berlin, Heidelberg.
- 5) Watson, J.D., and Baker, T.A., Bell, S.P. Gannm, A. and Levine, M. 2004. Molecular Biology of Genes. 5th edn., Pearson Education.
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- 7) Karchar, S.J. 1995. Molecular Biology- A Project Approach, Academic Press, New York.
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- 10) Lea, P.J., and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. John Willey and Sons Press, New York.
- 11) Draper, J. 1988. Plant Genetic Transformation and Gene Expression. Blackwell Scientific Publications, Oxford.
- 12) Old, R.W., and Primrose, S.B. 2004. Principles of Gene Manipulation. An introduction to Genetic Engineering. 5th Edition, Blackwell Science Publications.

**BOTANY: IV- SEMESTER- SOFT CORE 3.2**  
**MOLECULAR PLANT PATHOLOGY**

**Theory-32 Hrs**

**Unit-1:** Concepts and scope of physiological and molecular plant pathology; Molecular approaches to plant disease diagnosis; Nucleic acid based probes for detection of plant pathogens including non-culturable organisms; **Pathogenicity and Disease Development-**factors; induced resistance, virulence and pathogenecity factors; Plant-pathogen interactions with emphasis on incompatible interactions and induced resistance.

**Unit -2: Pathogenesis:** Necrogenic plant pathogenic bacteria with emphasis on hrp and avr genes and virulence factors; Fungal plant pathogens with emphasis on virulence and pathogenicity factors; Plant viruses with emphasis on virus replication, virus transport in plants and control of plant viruses with transgenic plants; **Signal Transduction-** recognition of the pathogen by the host, transmission of the alarm signal to the host defense providers; Necrotic defense reaction, defense through hypersensitive response; Molecular basis of induced biochemical reaction; Local and systemic acquired resistance (SAR).

**Unit-3:Genetics of Plant Diseases and Resistance:** Genes and diseases; physiological specialization among plant pathogens; Variability in viruses, bacteria and fungi; Levels of variability in pathogens and loss of virulence in plant pathogens; Genetics of virulence in pathogens and of resistance in host plants; Molecular plant breeding for disease resistance.

**Unit-4: Genetics and molecular basis of host-pathogen interaction:** Evolution of parasitism; genetics oh host-pathogen interaction; Gene for gene relationship; Criteria for gene for gene type relationship; Molecular basis of host pathogen interaction; Host-parasite-interaction. **Biotechnological methods of plant disease management;** Genetic engineering and crop protection; Cross protection; Gene silencing and disease control- mechanism of gene silencing and control of viral diseases; Engineered resistance to viral, bacterial, fungal and insect diseases of crop plants.

**Practicals-32 Hrs**

- 1-2) Testing hypersensitivity reaction on *Nicotiana and Bajra*.
  - 3) Estimation of lipoxygenase in diseased and healthy plants.
  - 4) Estimation of polyphenols in diseased and healthy plants.
  - 5-7) Studying systemic acquired resistance in crop plants.
  - 8) Genetic testing of disease resistance in plants.
  - 9-11) Molecular detection of viruses, Mycoplasma, fungi and bacteria from infected plants.
  - 12) In-vitro testing of pathogen virulence.
- Visit to agricultural research station to study diseases on different crop plants.

**References:**

- 1) Singh, R. S. (1973). Plant Disease. Oxford and IBH Pub.Co. New Delhi.
- 2) Agrios, G. N. (1994). Plant Pathology 2nd Edn. Academic Press NY.
- 3) Johnston A and Both, C. 1983-Plant Pathologists Pocket-book. 2nd Edn. Commonwealth Mycological Institute, Oxford and IBH Pub. Co. Calcutta.
- 5) Rangaswamy G and Mahadevan A 2002. Diseases of crop plants in India, Prentice Hall of India Pvt. Ltd. New Delhi.
- 6) Mehrotra, R. S.1983-Plant Pathology Tata Mc. Graw Hill Pub. Co. Ltd., New Delhi.
- 7) Vidhyasekaran, P. 2004. Encyclopedia of Plant Pathology.Viva Books Pvt.Ltd. New Delhi.

**BOTANY: III SEMESTER- SOFT CORE 3.3**  
**PLANT PROPAGATION AND PLANT BREEDING**

**Theory-32 Hrs**

**Unit-1: Plant Propagation:** History, scope and importance of plant propagation; Propagation structures with reference to green house equipment and media; Seed propagation and vegetative propagation; Propagation by cuttings; Biology and techniques of grafting; Techniques of budding; Layering and its natural modifications; Propagation by specialized stems and roots; Micro propagation – techniques and applications in forestry and horticulture; Limitations and applications of vegetative propagation; Propagation methods of some selected plants – Citrus, Grape, Mango, Mulberry, Hibiscus, Rose, Croton, Eucalyptus.

**Unit-2: Plant Breeding:** History of plant breeding, objectives of plant breeding, salient achievements of plant breeding; Centres of origin of crop plants, Exploration and collection of plant genetic resources, evaluation of germplasm collection, documentation, conservation of plant genetic resources, utilization of genetic resources; The theory of pure line selection – Genetic basis, sources of genetic variation in pure lines, the land variety (races); **Mendelian experiments of plant hybridization;** Quantitative Inheritance; Applications of biometrical genetics in plant breeding.

**Unit-3: Plant Breeding:** Types of plant breeding; Fertility regulating mechanisms - manual or mechanical control, genetic control, incompatibility, male sterility, genetic engineering for male sterility, chemical control, genetic basis of heterosis; Synthetic and composite varieties -genetic basis, procedure for developing synthetic and composite varieties - genetic basis, procedure for developing synthetic varieties; Breeding for resistance to disease and insect pests.

**Unit - 4 :Mutation Breeding:** Significance of induced mutations in plant breeding; Polyploidy in plant breeding- types of polyploids, induction of polyploidy, phenotypic effects of polyploidy, significance of polyploids; Tissue culture in crop improvement; Molecular approaches to crop improvement- probes, gel electrophoration, electrofusion, biolistics, gene cloning, transgenic plants (GMO's), molecular markers, construction of genetic maps, application of DNA makers in plant breeding, the role of gene technology in plant breeding; Crop breeding Institutes/Centers, Molecular biology in relation to intellectual property rights.

**Practicals-32 Hrs**

- 1) Study of types of vegetative propagation: Cutting, Grafting, budding, layering.
- 2) Study of propagation by modified stems and modified roots.
- 3) Preparation of media, explants, culture, initiation of shoot multiplication.
- 4) Pot and green house implants (demonstration) (5) Studying of floral biology.
- 6) Hybridization techniques - bagging and emasculation.
- 7) Pollen viability test : Seed germination test, TTC test.
- 8) Mode of pollination study in different crops.
- 9) Visit to crop breeding stations/institutes / centres.
- 10) Estimation of protein quality, Amino acid Analysis and determination of oil and fatty acids.
- 11) Observation of colour and conditions of mature anthers in different crops.
- 12) Identification of and studying of important plant breeders.

**References:**

- 1) Abbottt, A.J. and Atkin, R.K. eds. 1987. Improving vegetatively propagated crops.

Academic press, New York.

- 2) Bose, T.K., Sadhu, M.K., & Das, P., 1986. Propagation of Tropical and Subtropical Horticultural crops, Nowya Prakash, Calcutta.
- 4) Hartmann, H.T., Kester E.D., Davis, F.T., and Geneve, R.L. 1997. Plant propagation. Principles and practices. Prentice Hall of India Private Limited, New Delhi.
- 5) Krishnamurthy. H.M. 1981. Plant Growth substances including application in Agriculture.
- 6) Pierik, L.M. 1987. In vitro culture of Higher plants Murtinus Nijhoff pub. Dordrecht.
- 7) Razdan, M.K. 1994. An Introduction to Plant tissue culture, Oxford and IBH Pub. Co., PVT. Ltd., Bombay and Calcutta.
8. Mac Donald, B. 1987. Practical woody plant propagation for nursery growers. Portland, OR: Timber press.
9. Sadhu, M.K. 1989. Plant propagation Wiley eastern Ltd. N. Delhi.

**BOTANY: III SEMESTER SOFT CORE 3.4**  
**PHYTOCHEMISTRY AND HERBAL TECHNOLOGY**

**Theory-32 Hrs**

**Unit-1: Phytochemistry:** Scope of phytochemistry, plants as source of chemical compounds, primary and secondary metabolites and its applications; Definition, source of herbal raw materials, identification, authentication, standardization of medicinal plants as per WHO guidelines and different herbal pharmacopoeias; Natural pigments, natural products as markers for new drug discovery.

**Unit-2: Extraction, isolation and purification of phytochemicals:** Selection of plant samples, processing and storage of samples for extraction; Factors influencing the choice of extraction, principles of extraction methods, infusion, decoction, digestion, maceration, percolation, solvent extraction, fluid extraction, ultrasound, microwave assisted extraction, advantage and disadvantage involved in each method; Isolation of selected primary and secondary metabolites – amino acids, proteins and carbohydrate; Phenolics, flavonoids, alkaloids, lipids, oils, terpenes and saponins; Purification techniques for primary and secondary metabolites – solvent-solvent fractionation and chromatography techniques.

**Unit-3: Characterisation of Phytochemicals:** Preliminary, qualitative and quantitative techniques – paper chromatography, thin layer chromatography, column chromatography-HPLC, GC (qualitative and quantitative), colour reactions for amino acids, sugars, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids; Spectroscopic estimations/gravimetric determination of total sugars, amino acids, proteins, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids; Characterisation using spectroscopic techniques - UV/VIS, FTIR, DSC (differential scanning calorimeter), NMR, MS, MALDI. XRD – single crystal and powder.

**Unit-4: Standardisation and Validation of Photochemical:** Quality determination of herbal drugs; Role of processing methods and storage conditions on quality of drugs; Standardisation parameters- impurity limit, ash content, extractable matter, moisture content, other phytochemicals, microbial contaminants, pesticides; Validation of drug – guidelines, limit of detection and quantification of impurities, organoleptic properties, physical, chemical, biological characteristics, stability testing, storage conditions and packing system/unit.

**Practicals-32 Hrs**

- 1) Survey and collection of medicinal plants for analysis.
- 2) Selection of plant part, processing and storage of samples for further analysis.
- 3) Extraction methods - aqueous and sequential solvent extraction of compounds.
- 4) Preliminary phytochemical analysis of active principles from the extracts.
- 5) Antibacterial/antifungal activity of crude /active principles
- 6) Identification of secondary metabolites using TLC- phenolics, flavonoids, alkaloids, terpenes, saponins etc.
- 7) Column chromatographic separation of active principles.
- 8) Characterisation of active principle using spectroscopy, HPLC, GCMS, LCMS, FTIR, and MALDI TOF.
- 9) -12) Submission of report on TEN important curative principles of Indian medicinal plants.

**References:**

- 1) Braithwaite, A. and Smith, F.J. 1996. Chromatographic Methods. 5<sup>th</sup> edn., Blackie Academic & Professional, London.
- 2) Bourne, U.K. Kokate, Purohit, C.K. and Gokhale S.B. 1983. Pharmacognosy. Nivali Prakashan Publication.
- 3) Braithwaite, A. and Smith, F. J. 1996. Chromatographic Methods. 5th edn. Blackie Academic & Professional, London.
- 4) Sadasivam. S. and A. Manickam, 0000. Bio Chemical methods 2<sup>nd</sup>edn. New Age International Pvt Ltd. New Delhi.
- 5) Harborne, J.B. 1984. Phytochemical Methods, 2<sup>nd</sup>edn. Chapman and Hall, London. Harborne J.B., 1973. Phytochemical methods a guide to modern techniques of plants analysis. Chapman and Hall Ltd. London.



**BOTANY: III SEMESTER- OPEN ELECTIVE 3.1**  
**PLANT PROPAGATION TECHNIQUES**

**Theory-32 Hrs**

**Unit-1:** History, scope and importance of plant propagation; Propagation structures with reference to green house equipment and media; Seed propagation – the development of seeds, techniques of seed production and handling principles and media.

**Unit-2:** Vegetative propagation: Techniques of propagation by cuttings; stem cuttings – hard wood, semi hard wood, soft wood and herbaceous, leaf cuttings, leaf bud cuttings, root cuttings; Biology and techniques of grafting: Whip and tongue, wedge and cleft, bark, side grafting, approach.

**Unit-3:** Techniques of budding: T- budding patch budding, chip budding, ring budding; Layering and its natural modifications- simple layering, tip layering, mound or stool layering, air layering, compound or serpentine layering and trench layering; Propagation by specialized stems and roots.

**Unit- 4:** Micro propagation – techniques and applications in forestry and horticulture; Advantage, limitations and applications of vegetative propagation, **Somaclonal variations;** Propagation methods of some selected plants – Citrus, gape, mango, mulberry, hibiscus, rose, Croton, Eucalyptus.

**References:**

- 1) Abbott, A.J. and Atkin, R.K. (eds.) 1987. Improving vegetatively propagated crops. Academic press, New York.
- 2) Bose, T.K., Sadhu, M.K., and Das, P., 1986. Propagation of Tropical and Subtropical Horticultural crops, Nowya Prakash, Calcutta.
- 3) Hartmann and Kester, 1983. Plant propagation
- 4) Hartmann, H.T., Kester E.D., Davis, F.T. and Geneve, R.L. 1997. Plant propagation. Principles and practices. Prentice Hall of India Private Limited, New Delhi.
- 5) Krishnamurthy. H.M. 1981. Plant Growth substances including application in Agriculture.
- 6) L.M. Pierik 1987. In vitro culture of Higher plants Murtinus Nijhoff pub. Dordrecht.
- 7) M.K. Razdan 1994. An Introduction to Plant tissue culture, Oxford and IBH Pub. Co., PVT. Ltd., Bombay and Calcutta.
- 8) Mac Donald, B. 1987. Practical woody plant propagation for nursery growers. Portland, OR: Timber press.
- 9) Sadhu, M.K. 1989. Plant propagation Wiley eastern Ltd. N. Delhi.

**BOTANY: IV- SEMESTER- HARD CORE 4.1**  
**ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY**

**Theory-32 Hrs**

**Unit-1: Introduction and scope of Ecology:** Plants and the environment- plant adaptation, ecotypes, habitat ecology- fresh water and marine water ecology (ecosystems), wetlands and their characteristics; Ecosystem function; The distribution of biomes; Major Terrestrial Biomes; Forests-Tropical Forests-Temperate Forests, Taiga, Grasslands, Savanna, Temperate Grasslands/Prairies, Tundra, Deser and Chaparral.

**Unit-2: Environmental Biology:** Global warming: Greenhouse gases - causes and consequences; Ozone depletion- causes and consequences; Air, water and soil pollution - major pollutants, their source, permissible limits - and control methods; Radioactive pollution- Ionising radiation, disposal of radioactive waste, nuclear accidents; Environmental Education Programmes - WWF, UNEP, MAB; Role of plants in solving energy crisis and ameliorating global warming.

**Unit-3: Biodiversity and Conservation Biology:** Science in the service of Biodiversity, biodiversity and its value, biodiversity issues, concerns, management; Biodiversity hot spots; Biodiversity- threats and current status of biodiversity; IUCN categories, Red Data book and Red lists, invasive alien species as threat to biodiversity; Conservation strategies- past, present, and future; Attitudes about conservation; conservation movements; CITES (Convention on international trade in endangered species), WCU (World Conservation Union); Endangered species Act. 2002 (GOI); Protected areas, Network of India- history, size, scale and management; Heritage trees.

**Unit-4: Phytogeography:** Biogeography of the world, India and Karnataka; Climatic zones, tectonics, continental movements; Types of plant distribution – discontinuous distribution - land bridge theory, continental drift; continuous distribution-cosmopolitan, circumpolar, circumboreal, circumaustral, pantropical; Distribution of plants - islands; Phytochorea of the world, India; Plant dispersal, migrations and isolation; Eendemic plants of Western Ghats and Eastern Himalayas; Origin, distribution and acclimatization of coffee, cardamom, sugarcane, cashew, ragi, maize, wheat, rice and cotton; Remote sensing and GPS, study of vegetation by GIS (Geographical Information system).

**Practicals-32 Hrs**

- 1) Study of local vegetation by quadrat method.
- 2) Water analysis for pollution studies.(Bio-monitoring: TDS, Hardness, Chlorides, CO<sub>2</sub> COD, DO, BOD)
- 3) Rapid detection of bacteriological quality of water with special reference to faecal coliforms.
- 4) Morphology and anatomy of plants in relation to habitats - Xerophytes, Mesophytes, Hydrophytes.
- 5) *In situ* and *Ex situ* method of conservation.
- 6) Eminent phytogeographers of the world (photos).
- 7) Continental drift (charts).
- 8) Application of Remote Sensing, GIS and GPS in Forestry and Wild life management.
- 9) Biogeography of the world – Oceans, deserts, islands, mountains.

- 10) Biogeography of India –rivers, mountains, islands.
- 11) Floristic regions of world – India and Karnataka.
- 12) Study of endemic plants of India.
- 13) Origin, acclimatization and distribution of Coffee, Cardamom, Sugarcane, Cashew, Ragi, Maize, Wheat, Rice and Cotton.

**References:**

- 1) Polunin, N. 1961. Introduction to plant geography.
- 2) Good R.D. 1974. Geography of the flowering plants.
- 3) James H. B. 1998. Biogeography.
- 4) Cain, S.A. 1944. Foundations of plant Geography.
- 5) Croiat, 1952. Manual of Phytogeography.
- 6) Edgar A. 1972. Plants, Man and Life.
- 7) Valentine, D. H. 1972. Taxonomy, Phytogeography & Evolution.
- 8) Phil Gibson J. and Gibson Terri, R. 2006. Plant ecology.
- 9) Primack, R. B. 2006. Essentials of conservation biology.
  
- 10) Ricklefs, R. E. 2001. The Economy of Nature.
- 11) Narasaiah M. L., 2005. Biodiversity and Sustainable Development.
- 12) Tondon P, Abrol Y. P, Kumaria S., 2007. Biodiversity and its significance.
- 14) Krishnamurthy K. V. 2007. An Advanced Textbook on Biodiversity: Principles and Practice.
- 15) Christian Leveque and Jean-Claude Mounolou (2003). Biodiversity.
- 16) Jeffries Michael J. 2006. Biodiversity and conservation.

**BOTANY: IV- SEMESTER- SOFT CORE 4.2  
PROJECT WORK**

**BOTANY: IV- SEMESTER- SOFT CORE 4.1**  
**SEED TECHNOLOGY**

**Theory-32 Hrs**

**Unit-1: Seed Technology:** Introduction to seed science and technology and its goals; Development of seed technology industry in India; Seed as basic input in agriculture; Seed Biology - Seed development, morphology and anatomy of dicot and monocot seeds; Seed structure and functions; Seed programmes and organizations; Seed village concept, seed production agencies, seed industry and custom seed production in India; International Seed Science and Technology Organizations.

**Unit-2:Seed Production:** General principles of seed production in self and cross pollinated and vegetatively propagated crops; Hybrid seed production; Maintenance of inbred lines and breeders seeds; Synthetic and composite seeds; Improved seed and their identification; Germplasm banks; **Seed Processing**-Harvesting, seed drying, seed cleaning and grading; Equipments; Seed Storage- types of storage structure; seed factors affecting storage life, effect of storage on relative humidity, temperature and moisture; Seed deterioration; Seed treatment.

**Unit-3: Seed Quality Testing:** Devices and tools used in seed testing; ISTA and its role in seed testing; Seed sampling- physical purity and heterogeneity test; Seed moisture content-importance and determination and methods; Viability and vigour testing; Genetic purity testing -objective and criteria for genetic purity testing, seed health testing, field and seed standards, designated diseases, objectionable weeds; Significance of seed borne diseases, seed health testing and detection methods for seed borne fungi, bacteria, viruses and nematodes; Preparation and dispatch of seed testing reports, storage of guard samples, application and use of seed standards and tolerances.

**Unit- 4: Seed Certification:** Principles and philosophy of seed certification, purpose and procedures, national seed programme; National Seed Corporation (NSC) - agencies responsible for achieving self-reliance in seed production and supply of quality of seeds (State Seeds Corporation; National Seed Development Council (NSDC); Central Seed Committee(CSC) ; Seed market surveys, seed industry in relation to global market; Concept of WTO, GATT, IPR, Plant Variety Protection and its significance seed technology; UPOV and its role.

**Practicals-32 Hrs**

- 1) Determination of physical purity of seed samples.
- 2) Determination of density or weight per thousand seeds.
- 3) Determination of seed Heterogeneity.
- 4) Visual examination of dry seeds for disease symptoms.
- 5) Determination of moisture content by hot air oven method.
- 6) Seed viability test- TTC method.
- 7) Determination of seed germination by TP/BP/Sand method.
- 8) Evaluation of seedlings vigour by BP/Sand methods.
- 9) Seed vigour evaluation by (a) conductivity test (b) Hiltner's test (c) Performance test(d) Accelerated ageing test (e) Cold test.
- 10) Examination of suspensions obtained from washings of seed.
- 11) Infection sites studied by planting seed components.
- 12) Detection of seed-borne fungi and their characters of five seed borne pathogens. Vist: Visit to seed industries/seed companies/ seed research stations.

**References:**

- 1) ACAR.2009. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
- 2) ACAR.2013. Handbook of Horticulture. Indian Council of Agricultural Research, New Delhi.
- 3) Agarawal, P. K. 2005. Principles of Seed Technology. 2<sup>nd</sup> edn. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- 4) Basra, A. S. 2006. Handbook of Seed Science and Technology, The Haworth Press, USA.
- 5) Copeland, L. O. and McDonald, M. B. 2001. Principles of Seed Science and Technology. 4<sup>th</sup> edn. Chapman & Hall.
- 6) Copeland, L.A. 1995. Principles of Seed Science and Technology- Kluwer Academic Publishers, The Netherlands.
- 7) Michael, B. and Bewley, D. 2000. Seed technology and its biological basis. Wiley- Blackwell.
- 8) Neergaard, P. 2005. Seed Pathology, Palgrave, Macmillan, Denmark. Science, Technology and Uses. CABI, UK.
- 9) Vanangamudi, K., Natarajan, K., Saravanan, T., Natarajan, N., Umarani, R., Bharathi, A. and Srimathi, P. 2006. Advances in Seed Science and Technology: Vol: III: Forest Tree Seed Technology and Management, Agrobios, New Delhi.

## BOTANY: IV- SEMESTER- SOFT CORE 4.2

### SEED PATHOLOGY

#### Theory - 32 Hrs

**Unit-1: Seed Pathology:** Introduction, historical development, development of seed health testing; Reduction in crop yields loss in due to seed-borne diseases; Seed-borne pathogens (Fungi, Bacteria, Mycoplasma-like Organisms, fastidious Vascular Bacteria, Spiroplasmas, Viruses, Viroids, Nematodes); Location of seed-borne inoculums, histopathology of some seed-borne pathogens; Seed infection, mechanism of seed infection, seed infestation or contamination; Factors affecting seed infection; Longevity of seed-borne pathogens.

**Unit-2:** Seed transmission and inoculation, factors affecting seed transmission; Cultural practices, epidemiology and inoculum thresholds of seed-borne pathogens; Classification of seed-borne; Role of Seed-borne inoculum in disease development; Economic loss due to seed borne pathogens; Certification program; Seed health tests, Nonparasitic seed disorders; Deterioration of grains; Storage fungi, field and storage fungi; Invasion by storage fungi; effects of seed deterioration.

**Unit-3: Detection of Seed-borne Diseases:** Examination of dry seeds; Isolation of fungi, Bright-field microscopic examination, observation under UV light, measurement of gases, Determination of FAV, Moldy smell, collection of seed exudates; Immunoassays, ergosterol estimation; Avoiding damage to seeds during harvesting; Processing, threshing, storage conditions, reducing seed moisture to safe limits, seed treatment, resistance.

**Unit-4:** Mycotoxins - Fungi known to produce mycotoxins, Factors affecting mycotoxin production the effects and control of mycotoxins, storage conditions, sorting of grains, cultural operations, chemical treatment, biological control, detoxification, regulatory measures, use of resistant cultivars; Control of seed-borne pathogens; Selection of seed production areas; Crop management, crop rotation, isolation distances, rouging, biological control, chemical method, mechanical method, physical methods; Certification- certification standards, plant quarantine, national and international regulations.

#### Practicals-32 Hrs

- 1-5) Detection of seed-borne fungi and their identification.
- 6) Detection of Seed-borne bacteria.
- 6) Detection of seed-borne viruses.
- 7) Detection of seed-borne insects by egg-plug staining.
- 8) Detection seed-borne nematodes.
- 9 ) Effect of deterioration of grains by Storage Fungi.
- 10) Detection of seed-borne fungi by PCR.
- 11) Estimation of ergosterol by UV-visible Spectrophotometer.
- 12) Detection of mycotoxins by thin Layer chromatography.

#### References

- 1) Agarwal, V. K. and Sinclair, J. B. 1996. Principles of Seed Pathology, 2nd edn. CRC Press, Taylor and Francis, USA.
- 2) Neergaard, P. 1977. Seed Pathology. Vol. I..Macmillan Press, Cornell University, USA.
- 3) Agrios, G. N. 1994 -Plant Pathology 2<sup>nd</sup> edn. Academic Press, New York.
- 4) Mehrotra, R. S. 1983-Plant Pathology Tata Mc. Graw Hill Pub. Co. Ltd., New Delhi.

- 5) Rangaswamy, G. and Mahadevan, K. 2002. Diseases of Crop plants in India. Prentice Hall of India Private Limited New Delhi.
- 6) Agarwal, P. K. 2005. Principles of Seed Technology. 2<sup>nd</sup> edn. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- 7) Basra, A. S. 2006. Handbook of Seed Science and Technology, The Haworth Press, USA.
- 8) Copeland, L.A. 1995. Principles of Seed Science and Technology- Kluwer Academic Publishers, The Netherlands.
- 9) Vanangamudi, K., Natarajan, K., Saravanan, T., Natarajan, N., Umarani, R., Bharathi, A. and Srimathi, P. 2006. Advances in Seed Science and Technology: Vol: III: Forest Tree Seed Technology and Management, Agrobios, New Delhi.

**BOTANY: IV- SEMESTER- SOFT CORE 4.3**  
**BIO- ANALYTICAL TECHNIQUES**

**Theory-32 Hrs**

**Unit- 1: Spectroscopy:** Principles of UV-Visible spectroscopy, chromophores and their interaction with UV-visible radiation and their utilization in structural, qualitative and quantitative analysis of drug molecules; Infrared Spectroscopy, Infrared radiation and its interaction with organic molecules, vibrational mode of bonds, instrumentation and applications, interpretation of IR spectra; FTIR and ATR, X-ray diffraction methods.

**Unit-2: Nuclear Magnetic Resonance Spectroscopy:** Magnetic properties of nuclei, field and precession, instrumentation and applications of NMR; Chromatographic techniques- Principles and applications- types- column, paper, thin layer and gas chromatography, HPLC, HPTLC, size exclusion chromatography, Affinity chromatography, Mass spectrometry, MALDI-TOF.

**Unit-3: Electrophoresis:** Principle and application of PAGE, SDS PAGE, immunostaining, immuno-electrophoresis, Iso-electric focusing, 2D electrophoresis Centrifugation- Principles, techniques of preparative and analytical centrifugation. Ultracentrifuges, molecular weight determination, sedimentation analysis, RCF. Microscopy- principles and applications of electron microscope (SEM and TEM), CryoEM, Preparations of specimen for electron microscopy- freeze drying, freeze etching, fixing, staining; confocal, fluorescent, flow cytometry - principles and applications.

**Unit-4: Molecular Biology Techniques:** Primer designing; Principles and applications of PCR; Blotting techniques; Hybridization techniques; Micro-array; Next Generation Sequencing- Nucleic acid sequencing.

**Practicals-32 Hrs**

- 1) Calibration of bio-analytical instruments.
- 2) Principles and instrumentation and applications of imaging techniques:
- 3) Separation of fatty acids/lipids by TLC/HPTLC.
- 4) Separation of proteins by PAGE, SDS- PAGE.
- 5) Agarose gel electrophoresis of DNA/RNA.
- 6) Immunoelectrophoresis
- 7) Agar gel diffusion, counter immuno electrophoresis.
- 8) Verification of Beer Lambert law with the U.V. spectrophotometer.
- 9) Demonstration of blotting techniques.
- 10) Performing PCR for amplification of ITS regions of fungi/ bacteria.

**References**

- 1) Braithwaite, A. and Smith, F.J. 1996. Chromatographic Methods. 5<sup>th</sup> edn. Blackie Academic & Professional London.
- 2) Budzikiewicz, H., Djerassi, C. and Williams, D.H. 1968. Mass Spectrometry of Organic Compounds. Holden-Day, San Francisco, CA
- 3) Harborne, J.B. 1984. Phytochemical Methods. 2<sup>nd</sup> edn. Chapman and Hall, London.
- 4) Harborne J.B. (1973) Phytochemical methods a guide to modern techniques of plants analysis. Chapman and Hall, London Ltd.



**BOTANY: II SEMESTER - OPEN ELECTIVE 4.1**  
**PLANT DIVERSITY AND HUMAN WELFARE**

**Theory-32 Hrs**

**Unit -1: Plant Diversity and Significance:** Role of plant diversity in ameliorating energy crisis and global warming; Types of biodiversity-genetic diversity, species diversity, plant diversity at the ecosystem level; Agro-biodiversity and cultivated plant taxa, wild taxa; **Values and uses of Biodiversity-** Ethical and aesthetic values, precautionary principle, methodologies for valuation, uses of plants and microbes.

**Unit -2: Loss of Biodiversity:** Major causes of for biodiversity loss; Loss of genetic diversity, Loss of species diversity; Loss of ecosystem diversity; Loss of agro-biodiversity; Projected scenario for biodiversity loss; Management of Plant Biodiversity- Organizations associated with biodiversity management; Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations; Biodiversity information management and communication.

**Unit -3: Conservation of Biodiversity:** Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation, Biodiversity awareness programmes, Conservation of Heritage Trees.

**Unit-4: Role of plants in relation to Human Welfare:** Importance of forestry their utilization and commercial aspects, Avenue trees, Ornamental plants of India, Alcoholic beverages through ages, Fruits and nuts- Fruit crops of Karnataka and their commercial importance; Wood and its uses.

**References:**

- 1) Krishnamurthy K. V. 2007. An Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IHB Publishing Co. Pvt. Ltd. New Delhi.
- 2) Christian Leveque and Jean-Claude Mounolou, 2003. Biodiversity. John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
- 3) Jeffries Michael J. 2006. Biodiversity and conservation, 2nd edn. Taylor and Francis Group, New York.

**JSS Mahavidyapeetha**



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
OOTY ROAD, MYSURU – 570 025

**POSTGRADUATE DEPARTMENT OF CHEMISTRY**



## **SYLLABUS**

**PROGRAMME: M.Sc. in CHEMISTRY**

**PROGRAMME CODE: CHE**

**Under**  
**Choice Based Credit System (CBCS) and**  
**Continuous Assessment Grading Pattern (CAGP)**  
**Effective from 2021-22**

# **GUIDELINES AND REGULATIONS LEADING TO MASTER OF SCIENCE IN CHEMISTRY (TWO YEARS - SEMESTER SCHEME UNDER CBCS-CAGP)**

## **Programme details**

<b>Name of the Department</b>	: PG Department of Chemistry
<b>Subject</b>	: Chemistry
<b>Faculty</b>	: Science
<b>Name of the Programme</b>	: Master of Science (M.Sc.) in Chemistry
<b>Duration of the Programme</b>	: 2 years divided into 4 semesters

## **Programme Objectives**

- To provide the latest subject matter both theory as well as practicals in such a way to foster their core competency and discovery learning. A chemistry postgraduate as envisioned in this framework would be sufficiently competent in the field to understand further discipline specific studies as well as to begin domine related employment.
- To mould a responsible citizen who is aware of most basic domain-independent knowledge including critical thinking and communication.
- Enable the graduate to prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC civil service examinations.

## **Programme Outcomes**

- Students will have a strong foundation in the fundamentals and applications of current theoretical and practical chemistry in Analytical, Inorganic, Organic and Physical Chemistry.
- Students will be able to design and carry out scientific experiments and accurately record and analyze the results of the experiments.
- Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
- Students will be able to explore new areas of research in both chemistry and allied fields such as Biochemistry, Material Chemistry, Pharmaceutical chemistry and Chemical biology and related technology.
- Students will understand the central role of chemistry to our society which includes understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.

### **Programme Specific Outcomes**

- Global level research opportunities to pursue Ph.D. programme, targeted approach of CSIR – NET and competitive civil service examinations.
- Enormous job opportunities at all levels of teaching, chemical, pharmaceutical, food products, life oriented material industries.
- Specific placements in R & D and many pharmaceutical & other industries.
- Facile development for the synthesis of biologically significant organic molecules using the green route for chemical reactions for sustainable properties.
- To inculcate the scientific temperament in the students and outside the scientific community.
- Learnt to handle sophisticated equipment for the determination and characterization of chemical compounds.
- Use of the latest chemistry software to avoid the laborious work in research.

### **Pedagogies used in the programme**

- Conventional method such as black board and chalk, and modern methods like power point presentation and information and communications technology (ICT) are used in class room teaching.
- Molecular models are used to teach molecular symmetry, stereochemistry and solid state chemistry topics.
- Each student performs experiments as per the protocol in practical classes.
- For the preparation of new compounds, each student can adopt new experimental setup, and also exposed to different analytical instruments for qualitative and quantitative analyses. In addition to this, students will acquire skill to handle various instruments independently.
- Students will be presenting seminars in each semester.
- Each student will be subjected to viva-voce examinations in every semester.
- Every student will work for project on a small research problem.
- Rigorous training will be giving for every student to interpret spectral data in the respective course including their dissertation.
- Special lectures are delivered by eminent scholars from different intuitions.
- National/International conferences are organized to upgrade the subject knowledge.

## GENERAL REQUIREMENTS

### Scheme of instructions

1. A Masters Degree programme is of 4 semesters-two Years duration. A candidate can avail a maximum of 8 semesters – 4 years (in one stretch) to complete Masters Degree (including blank semesters, if any). Whenever a candidate opts for blank semesters, he/she has to study the prevailing courses offered by the department when he/she continues his/her studies.
2. A candidate has to earn a minimum of 76 credits, for successful completion of a Master Degree. The 76 credits shall be earned by the candidate by studying Hardcore, Soft Core and Open Elective. A candidate may earn another 04 credits by studying MOOCs/SWAYAM courses.
3. **Minimum for Pass:** In case a candidate secures less than 30% in C<sub>1</sub> and C<sub>2</sub> put together, the candidate is said to have DROPPED the course, and such a candidate is not allowed to appear for C<sub>3</sub>.
4. In case a candidate secures less than 30% in C<sub>3</sub>, or secures more than 30% in C<sub>3</sub> but less than 50% in C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub> put together, the candidate is said to have not completed the course and he/she may either opt to DROP the course or to utilize PENDING option.
5. **Credits (Minimum) Matrix:** A candidate has to study 42 credits, but not exceeding 52 credits from hard Core, a minimum of 16 credits in Soft Core (sum total of 4 semesters) and 04 credits in Open Elective (III Semester) for the successful completion of the Masters Degree programme.
6. All other rules and regulations hold good which are governed by the University of Mysore from time to time.

### Definitions

1. In the Choice Based Credit System – Continuous Assessment Grading Pattern (CBCS-CAGP), programme means a course and a course means a paper.
2. **HC:** Hard Core; **SC:** Soft Core; **OE:** Open Elective

## GENERAL SCHEME WITH RESPECT TO ASSESSMENT OF CREDITS

Semester	Hard Core		Soft Core			Open Elective
		Theory		Theory	Practicals	
<b>I</b>	<b>I</b>	3 + 0 + 0 = 3	<b>A</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	-
	<b>O</b>	3 + 0 + 0 = 3	<b>I</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	
	<b>P</b>	3 + 0 + 0 = 3	<b>O</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	
	<b>A</b>	3 + 0 + 0 = 3	<b>P</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	
<b>II</b>	<b>I</b>	3 + 0 + 0 = 3	<b>A</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	-
	<b>O</b>	3 + 0 + 0 = 3	<b>I</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	
	<b>P</b>	3 + 0 + 0 = 3	<b>O</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	
	<b>G</b>	3 + 0 + 0 = 3	<b>P</b>	2 + 0 + 0 = 2	0 + 0 + 4 = 4 <sup>a</sup>	
<b>III</b>	<b>I</b>	3 + 0 + 0 = 3	<b>A</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	4 + 0 + 0 = 4
	<b>O</b>	3 + 0 + 0 = 3	<b>I</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	
	<b>P</b>	3 + 0 + 0 = 3	<b>O</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	
	<b>G</b>	3 + 0 + 0 = 3	<b>P</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	
<b>IV</b>	<b>I</b>	3 + 0 + 0 = 3	<b>A</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	-
	<b>O</b>	3 + 0 + 0 = 3	<b>I</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	
	<b>P</b>	3 + 0 + 0 = 3	<b>O</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	
	<b>A</b>	3 + 0 + 0 = 3	<b>P</b>	2 + 0 + 0 = 2	0 + 0 + 2 = 2 <sup>ab</sup>	
			<b>D</b>	--	0 + 0 + 4 = 4 <sup>c</sup>	
<b>Total Credits</b>	<b>48</b>		<b>24</b>			<b>04</b>

### NOTE

A–Analytical; I–Inorganic; O–Organic; P–Physical; G-Spectroscopy; D-Dissertation/Project Work; (L+T+P)-Theory + Tutorial + Practical

<sup>a</sup> Compulsory but 50% of the students will attend Analytical/Inorganic Practicals and remaining 50% students will attend Organic/Physical Practicals in I or III Semesters and vice-versa during II or IV Semesters.

<sup>b</sup> Practicals are only for Chemistry students which are compulsory papers.

<sup>c</sup> Dissertation/Project work, which is offered by the department during IV Semester.

## SCHEME OF STUDY AND EXAMINATION

### FIRST SEMESTER

#### HARD CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )	
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks
21CHA10	Concepts & Models of Inorganic Chemistry	3	3	100	15	15	3	70
21CHA11	Stereochemistry & Reaction Mechanism	3	3	100	15	15	3	70
21CHA12	Basic Physical Chemistry	3	3	100	15	15	3	70
21CHA13	Essentials of Analytical Chemistry	3	3	100	15	15	3	70

#### SOFT CORE PRACTICALS

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )	
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks
21CHA50	Analytical Chemistry Practicals	8	4	100	15	15	6	70
21CHA51	Inorganic Chemistry Practicals	8	4	100	15	15	6	70
21CHA52	Organic Chemistry Practicals	8	4	100	15	15	6	70
21CHA53	Physical Chemistry Practicals	8	4	100	15	15	6	70

**NOTE:** 50% of students will attend Analytical and Inorganic Practicals and the remaining 50% of students will attend Organic and Physical Practicals in I Semester and vice-versa in II Semester.

#### SOFT CORE COURSES

Course Code	Title	Contact Hours/ week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )	
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks
21CHA54	Titrimetric Analysis	2	2	100	15	15	3	70
21CHA55	Chemistry of Selected Elements	2	2	100	15	15	3	70
21CHA56	Chemistry of Natural Products-I	2	2	100	15	15	3	70
21CHA57	Biophysical Chemistry	2	2	100	15	15	3	70

## SECOND SEMESTER

### HARD CORE COURSES

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )		End Marks
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks	
21CHB10	Coordination Chemistry	3	3	100	15	15	3	70	
21CHB11	Synthetic Organic Chemistry	3	3	100	15	15	3	70	
21CHB12	Principles of Physical Chemistry	3	3	100	15	15	3	70	
21CHB13	Molecular Symmetry and Spectroscopy	3	3	100	15	15	3	70	

### SOFT CORE PRACTICALS

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )		End Marks
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks	
21CHB50	Analytical Chemistry Practicals	8	4	100	15	15	6	70	
21CHB51	Inorganic Chemistry Practicals	8	4	100	15	15	6	70	
21CHB52	Organic Chemistry Practicals	8	4	100	15	15	6	70	
21CHB53	Physical Chemistry Practicals	8	4	100	15	15	6	70	

**NOTE: Practicals:** Same as that of I Semester. Students who have conducted Analytical and Inorganic or Organic and Physical Practicals in the I Semester will get interchanged during II Semester.

### SOFT CORE COURSES

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )		End Marks
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks	
21CHB54	Titrimetric Analysis	2	2	100	15	15	3	70	
21CHB55	Chemistry of Selected Elements	2	2	100	15	15	3	70	
21CHB56	Chemistry of Natural Products-I	2	2	100	15	15	3	70	
21CHB57	Biophysical Chemistry	2	2	100	15	15	3	70	

**NOTE: Soft Core Theory:** All courses are same as that described in first semester.



### THIRD SEMESTER

#### HARD CORE COURSES

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C <sub>3</sub> )	
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks
21CHC10	Advanced Inorganic Chemistry	3	3	100	15	15	3	70
21CHC11	Organometallic and Photochemistry	3	3	100	15	15	3	70
21CHC12	Advanced Physical Chemistry	3	3	100	15	15	3	70
21CHC13	Chemical Spectroscopy	3	3	100	15	15	3	70

#### SOFT CORE PRACTICALS

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C <sub>3</sub> )	
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks
21CHC50	Analytical Chemistry Practicals	4	2	100	15	15	6	70
21CHC51	Inorganic Chemistry Practicals	4	2	100	15	15	6	70
21CHC52	Organic Chemistry Practicals	4	2	100	15	15	6	70
21CHC53	Physical Chemistry Practicals	4	2	100	15	15	6	70

**NOTE:** 50% of students will attend Analytical and Inorganic Practicals and the remaining 50% of students will attend Organic and Physical Practicals in I Semester and vice-versa in II Semester.

#### SOFT CORE COURSES

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C <sub>3</sub> )	
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks
21CHC54	Kinetic and Radiochemical Methods of Analysis	2	2	100	15	15	3	70
21CHC55	Frontiers in Inorganic Chemistry	2	2	100	15	15	3	70
21CHC56	Chemistry of Natural Products-II	2	2	100	15	15	3	70
21CHC57	Material Chemistry	2	2	100	15	15	3	70

#### OPEN ELECTIVE FOR NON-CHEMISTRY STUDENTS

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester End Exams (C <sub>3</sub> )	
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks
21CHC80	General Chemistry	4	4	100	15	15	3	70

## FOURTH SEMESTER

### HARD CORE COURSES

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )		End
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks	
21CHD10	Bioinorganic Chemistry	3	3	100	15	15	3	70	
21CHD11	Heterocyclic and Bioorganic Chemistry	3	3	100	15	15	3	70	
21CHD12	Nuclear, Radiation and Photochemistry	3	3	100	15	15	3	70	
21CHD13	Instrumental Methods of Analysis	3	3	100	15	15	3	70	

### SOFT CORE COURSES

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )		End
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Ma rks	
21CHD50	Analytical Chemistry Practicals	4	2	100	15	15	6	70	
21CHD51	Inorganic Chemistry Practicals	4	2	100	15	15	6	70	
21CHD52	Organic Chemistry Practicals	4	2	100	15	15	6	70	
21CHD53	Physical Chemistry Practicals	4	2	100	15	15	6	70	
21CHD54	Dissertation/Project Work	8	4	100	15	15	-	70	

**NOTE: Practicals:** Same as that of III Semester. Students who have conducted Analytical and Inorganic or Organic and Physical Practicals in the III Semester will get interchanged during IV Semester.

### SOFT CORE COURSES

Course Code	Title	Contact Hours/week	Credits	Max. Marks	Internal Assessment Marks		Semester Exams (C <sub>3</sub> )		End
					C <sub>1</sub>	C <sub>2</sub>	Duration (hrs)	Marks	
21CHD55	Automated Methods and Real Sample Analysis	2	2	100	15	15	3	70	
21CHD56	Bioinorganic Photochemistry	2	2	100	15	15	3	70	
21CHD57	Medicinal Chemistry	2	2	100	15	15	3	70	
21CHD58	Quantum Chemistry	2	2	100	15	15	3	70	

## SCHEME OF EXAMINATION FOR C1, C2 AND C3 COMPONENTS

### Preamble

In view of the CBCS syllabus, following is the model distribution of marks for C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub> Components. At a glance, the model includes HC, SC and OE courses for the assessment of marks.

The following is the scheme which will be followed for the assessment of marks for HC, SC and OE courses irrespective of the credits associated with each course. 30% of the marks will be assessed for internals (C<sub>1</sub> and C<sub>2</sub>) and remaining 70% will be for the Semester end Examinations (C<sub>3</sub>). Each course carries 100 marks and hence 30 marks will be allotted to internals and remaining 70 marks will be for Semester end Examinations. Out of 30 marks for internals, 15 marks will be allotted to each C<sub>1</sub> and C<sub>2</sub> components.

Each course (HC/SC/OE) consists of three components namely C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub>. C<sub>1</sub> and C<sub>2</sub> are designated as Internal Assessment (IA) and C<sub>3</sub> as Semester end Examination. Each course (HC/SC/OE) carries **100 Marks** and hence the allotment of marks to C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub> Components will be 15, 15 and 70 marks, respectively. i.e.,

C <sub>1</sub> Component	15 Marks	Assessment Marks
C <sub>2</sub> Component	15 Marks	
C <sub>3</sub> Component	70 Marks	Semester end Examination
<b>Total</b>	<b>100 Marks</b>	

**The above Scheme will be followed for all the HC, SC and OE courses in all the four semesters.**

### 1. HARD CORE (03 CREDIT COURSES)

#### Distribution of Marks for C<sub>1</sub> and C<sub>2</sub> Components

Assessment Marks (C<sub>1</sub> + C<sub>2</sub>) consists of 30 marks. It will be divided into three parts viz., **Internal Test, Home Assignment and Seminar**. Internal tests will be conducted during the 8<sup>th</sup> week of the semester for C<sub>1</sub> and 16<sup>th</sup> week of the semester for C<sub>2</sub>. Home Assignment will be considered for C<sub>1</sub> Component and Seminar for C<sub>2</sub> Component only. Hence, a teacher from each unit of a course may be given one assignment (or in their personal interest one more may be given). Since each course has three units, the marks shall be divided equally. Allotment of marks for C<sub>1</sub> and C<sub>2</sub> is as follows: Out of 15 Marks for C<sub>1</sub>, Internal test will be conducted for 30 Marks (10 Marks from each unit and reduced to 10 Marks) and Home Assignment will be given for 05 Marks (Each Home Assignment from every unit will be assessed for 05 Marks and finally reduced to 05 Marks). Assessment Marks for C<sub>2</sub> will be distributed as follows: Internal test will be conducted for 30 Marks (10 Marks from each unit and reduced to 10 Marks) and Seminar will be assessed for 20 Marks and finally its Marks will be distributed to each theory HC course. i.e.,

C <sub>1</sub>		C <sub>2</sub>	
Internal Test	30 Marks (10+10+10) <b>Reduced to 10 Marks</b>	Internal Test	30 Marks (10+10+10) <b>Reduced to 10 Marks</b>
Home Assignment	15 Marks (05+05+05) <b>Reduced to 5 Marks</b>	Seminar	20 Marks (05+05+05+05) <b>5 Marks will be distributed to each HC course</b>
<b>Total</b>	<b>15 Marks</b>	<b>Total</b>	<b>15 Marks</b>

### Distribution of Marks for C<sub>3</sub> Component (Semester end Examination)

The question paper is of 3 hrs duration with the Maximum of 70 Marks. The following question paper pattern will be followed for all the theory courses (HC/SC/OE). Question paper will have FIVE main questions. All the questions will cover all the units of the course with equal marks distribution. Q. No. 1 is of Medium/ Short Answer Type questions which will have nine questions and each question carries two marks. A student has to answer any seven questions. Q. No. 2 to 5 carries 14 marks each and a student has to answer all the four questions (*No Choice*). Each main question will have three sub-sections a, b, c. An examiner may set the questions like (4+4+6) or (4+5+5) or as his/her wish. However, sub-section 'c' will have an internal choice. i.e.,

#### Model Question Paper Pattern

**Max. Duration: 3 Hr**

**Max. Marks: 70**

**Note:** Answer all the questions. Each question carries 14 marks.

**Q. No. 1:** Nine Medium/ Short Answer Type Questions and any seven should be answered. Each question carries TWO marks. **(7 × 2 = 14)**

**Q. No. 2 to 5:** All the four questions have to be answered (*No Choice*). Each question carries **FOURTEEN** marks. An examiner may set the questions like (4+4+6) or (4+5+5) or as his/her wish. However, sub-section c will have an internal choice. (*Two marks questions shall be avoided for 2 to 5*). **(4 × 14 = 56)**

- a)
- b)
- c) **OR** c)

## 2. SOFT CORE (02 CREDIT COURSES)

### Distribution of Marks for C<sub>1</sub> and C<sub>2</sub> Components

Assessment Marks (C<sub>1</sub> + C<sub>2</sub>) consists of 30 marks. It will be divided into two parts viz., **Internal Test and Home Assignment**. Internal tests will be conducted during the 8<sup>th</sup> week of the semester for C<sub>1</sub> and 16<sup>th</sup> week of the semester for C<sub>2</sub>. As far as Home Assignment is concerned, the concerned teacher will assign one or two Home Assignments to each student. Since each course has two units, the marks will be divided equally. Allotment of marks for C<sub>1</sub> and C<sub>2</sub> is as follows: Out of 15 Marks for IA, Internal tests will be conducted for 20 marks and reduced to 10 marks, whereas Home Assignment is for 05 Marks. i.e.,

C <sub>1</sub>		C <sub>2</sub>	
Internal Test	20 Marks (10+10) <b>Reduced to 10</b>	Internal Test	20 Marks (10+10) <b>Reduced to 10</b>
Home Assignment	10 Marks (05+05) <b>Reduced to 05</b>	Home Assignment	10 Marks (05+05) <b>Reduced to 05</b>
<b>Total</b>	<b>15 Marks</b>	<b>Total</b>	<b>15 Marks</b>

### Distribution of Marks for C<sub>3</sub> Component (Semester End Examination)

The above described pattern (1.2) holds good in this case also.

### 3. PRACTICALS

The following Scheme will be applicable for all the four semesters (SC for chemistry students only)

Each practical consists of three components namely C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub>. C<sub>1</sub> and C<sub>2</sub> are designated as Internal Assessment (IA) and C<sub>3</sub> as Semester End Examination. Each practical carries **100 Marks** and hence the allotment of marks to C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub> Components will be 15, 15 and 70 marks respectively. i.e.,

C <sub>1</sub> Component	15 Marks	Internal Assessment Marks
C <sub>2</sub> Component	15 Marks	
C <sub>3</sub> Component	70 Marks	Semester End Examination
<b>Total</b>	<b>100 Marks</b>	

#### Distribution of Marks for C<sub>1</sub> and C<sub>2</sub> Components

IA consists of **15 Marks**. It will be divided into three parts viz., **Internal Test, Continuous Assessment and Record**. Continuous assessment refers to the daily assessment of each student based on his/her attendance, skill, results obtained etc. Thus, 05 marks are allotted for Continuous Assessment. Internal tests will be conducted for 05 Marks during the 8<sup>th</sup> week of the semester for C<sub>1</sub> and 16<sup>th</sup> week of the semester for C<sub>2</sub>. Finally, remaining 05 Marks will be for the record. i.e.,

C <sub>1</sub>		C <sub>2</sub>	
Internal Test	05 Marks	Internal Test	05 Marks
Continuous Assessment	05 Marks	Continuous Assessment	05 Marks
Record	05 Marks	Record	05 Marks
<b>Total</b>	<b>15 Marks</b>	<b>Total</b>	<b>15 Marks</b>

#### Distribution of Marks for C<sub>3</sub> Component (Semester End Examination)

The end examination will be conducted for **70 Marks/course** with a maximum duration of 6 hours. Two experiments will be given to each student which carries 30 Marks each. Each student will be subjected to Viva-Voce Examination for which 10 Marks is allotted. i.e.,

Two Experiments	30+30 Marks
Viva-Voce	10 Marks
<b>Total</b>	<b>70 Marks</b>

**Note: Examiners have to set at least one experiment from each part in the semester end Examination (C<sub>3</sub>).**

#### 4. Evaluation of Dissertation/Project Work:

Each student can take up Project Work/ Dissertation under the guidance of the faculty of the department during the IV Semester as a Soft Core course.

##### 4.1. Distribution of Marks for C<sub>1</sub> and C<sub>2</sub> Components:

IA consists of **fifteen Marks** for each components; it will be divided into three parts viz.,

**Attendance, Continuous Assessment and Work Progress.** Continuous assessment refers to the daily assessment of each student based on his or her skill, results obtained, literature survey etc. C<sub>1</sub> will be assessed during the 8<sup>th</sup> Week of the semester and C<sub>2</sub> during the 16<sup>th</sup> Week of the semester. Hence, the concerned guide will prepare the marks list based on the above said parameters for both C<sub>1</sub> and C<sub>2</sub> Components.

**4.2. Distribution of Marks for C<sub>3</sub> Component (Semester End Examination):**

The semester end examination will be conducted for **seventy Marks**. Every student is suppose to prepare a hard copy of the findings of the work in the form of report and submitted for evaluation. This part will be assessed for fourth Marks. Each student will be subjected to Viva-Voce Examination for which thirty Marks is allotted. i.e.,

Evaluation of Report	: 40 Marks
Viva-Voce	: 30 Marks
<b>Total</b>	<b>: 70 Marks</b>

# FIRST SEMESTER

## HARD CORE

### CONCEPTS AND MODELS OF INORGANIC CHEMISTRY

COURSE CODE: 21CHA10

#### Objectives

- To study the structures of ionic crystals and simple molecules through VSEPR model.
- To learn acid-base concepts and chemical reactions in non-aqueous, ionic liquids and supercritical fluids as media.
- To study the chemistry of f-block elements.

#### Course Outcome

- The periodic properties of the elements, structures of ionic solids and their lattice energy calculations. Further, the use of VSEPR concepts in analyzing the structures of simple molecules.
- Various acid-base concepts and their applications in different fields. Also, understand the utility of various non-aqueous solvents in inorganic synthesis.
- Complete understanding of the chemistry of lanthanides, actinides and their applications.

#### Pedagogy

- Familiarize the students with the periodic properties of the elements using modern periodic table.
- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- For teaching structures of solids, crystal models (MX and MX<sub>2</sub> types) are used.

### Course content

#### UNIT-I

[16 HOURS]

**Chemical Periodicity:** Review of periodic properties

**Structures and energetics of ionic crystals:** Introduction, MX (NaCl, CsCl, ZnS) and MX<sub>2</sub> (fluorite, rutile,  $\beta$ -cristobalite, cadmium chloride and cadmium iodide) types. The perovskite and spinel structures. Thermodynamics of ionic crystal formation. Hydration energy and solubility of ionic compounds, Lattice energy, Born-Haber cycle, Born-Lande equation. The Kapustinskii's equation, Consequences of lattice enthalpies. Applications of lattice energetics. Ionic radii, factors affecting the ionic radii, radius ratio rules.

**Structures and energetics of inorganic molecules:** Introduction, Bent's rule, Energetics of hybridization. VSEPR model for explaining structure of molecules including fluxional molecule. M.O. treatment of homo-nuclear and heteronuclear diatomic molecules. **M.O. treatment involving delocalized  $\pi$ -bonding ( $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{CO}_2$  and  $\text{N}_3^-$ ), M.O. correlation diagrams (Walsh) for triatomic molecules.**

#### UNIT-II

[16 HOURS]

**Modern concepts of acids and bases:** Lux-Flood and Usanovich concepts, solvent system and leveling effect. Hard-Soft Acids and Bases, Classification and Theoretical backgrounds.

**Non-aqueous solvents:** Classification of solvents, Properties of solvents (dielectric constant, donor and acceptor properties) protic solvents (anhydrous H<sub>2</sub>SO<sub>4</sub>, HF and glacial acetic acid)

aprotic solvents (liquid SO<sub>2</sub>, BrF<sub>3</sub> and N<sub>2</sub>O<sub>4</sub>). Solutions of metals in liquid ammonia, hydrated electron. Super acids and super bases. Heterogeneous acid-base reactions.

**Ionic liquids:** Molten salt solvent systems, Ionic liquids at ambient temperature, Reactions in and applications of molten salt/ionic liquid media.

**Supercritical fluids:** Properties of supercritical fluids and their uses as solvents. Supercritical fluids as media for inorganic chemistry

### UNIT-III

[16 HOURS]

**Lanthanoid Chemistry:** General trends, Electronic, optical and magnetic properties. Abundance and extraction, **General principles:** conventional, solvent extraction and ion-exchange methods. Separation from monazite. Chemistry of principal oxidation states (II, III and IV). Stability of tetrahalides, dihalides and aqua ions of simple lanthanide compounds. Redox potentials. **Uses:** lanthanides as shift reagents, lanthanides as probes in biological systems. High temperature super conductors.

**Actinoid Chemistry:** General trends and electronic spectra. Occurrence and preparation of elements, **Isolation of the elements:** thorium and uranium, enrichment of uranium for nuclear fuel, uranium hydrides, oxides and chlorides. Chemical reactivity and trend. Chemistry of trans-uranium elements.

**Supramolecular Chemistry:** Introduction, selectivity and Supramolecular Interactions.

#### References

1. Basic Inorganic Chemistry – 3<sup>rd</sup> edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons (2002).
2. Inorganic Chemistry, 3<sup>rd</sup> edition. James E. Huheey, Harper and Row Publishers (1983).
3. Inorganic Chemistry, 5<sup>th</sup> edition. G.L. Miessler, P. J. Fischer and D.A. Tarr, Pearson (2014).
4. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F. Armastrong, Oxford University Press (2014).
5. Inorganic Chemistry, 4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
6. Introduction to Modern Inorganic Chemistry, K.M. Mackay and R.A. Mackay, Blackie Publication (1989).
7. Concepts and Models of Inorganic Chemistry 3<sup>rd</sup> edition. B.E. Douglas, D.H. McDaniel and Alexander, Wiley (2001).
8. Ionic liquids-Classes and Properties (Ed) by Scott T. Handy, Intech Publisher (2011).
9. Lanthanide and Actinide Chemistry, Simon Cotton, John Wiley and Sons Ltd., (2006).
10. Supramolecular Chemistry, Peter J. Cragg, Springer (2010).



# STEREOCHEMISTRY AND REACTION MECHANISM

## COURSE CODE: 21CHA11

### Objectives

- To understand detailed molecular structures of organic compounds.
- To learn bonding and chemical reactions of organic compounds.
- To study different chemical reactions involved in organic synthesis.

### Course Outcome

- Optical and geometrical isomerism of Organic compounds. Application of stereochemistry in the study of regioselective and regiospecific reactions.
- The study of HMOT and its applications to simple organic molecules, and also understand the concept of aromaticity and methods of determining reaction mechanism.
- Nucleophilic, electrophilic and elimination reactions.

### Pedagogy

- Molecular models are used to teach stereochemistry.
- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.

## Course content

### UNIT-I

[16 HOURS]

**Stereoisomerism:** Projection formulae [flywedge, Fischer, Newman and sawhorse], enantiomers, diastereoisomers, mesomers, configurational notations of simple molecules, DL and RS configurational notations.

**Conformational analysis:** Conformational analysis of ethane, butane, cyclohexane, decalins, 1,2-, 1,3- and 1,4-disubstituted cyclohexane derivatives, Effect of conformation on the course and rate of reactions.

**Optical isomerism:** Conditions for optical isomerism; Elements of symmetry-plane of symmetry, centre of symmetry, alternating axis of symmetry (rotation-reflection symmetry). Optical isomerism due to chiral centers and molecular dissymmetry, allenes and biphenyls,

**Geometrical isomerism:** In C=C, C=N and N=N bonds, *E*, *Z* conventions, determination of configuration by physical and chemical methods. Geometrical isomerism in cyclic systems.

**Stereoselectivity:** Meaning and examples of stereospecific reactions, stereoselective reactions, diastereoselective reactions, regioselective, regiospecific reactions, enantioselective reactions and enantiospecific reactions.

### UNIT-II

[16 HOURS]

**Basics of organic reactions:** Meaning and importance of reaction mechanism, classification and examples for each class.

**Bonding in organic systems:** Theories of bonding-molecular orbital approaches. Huckel molecular orbital theory and its application to simple  $\pi$ -systems: ethylene, allyl, cyclopropyl, butadienyl, cyclopentadienyl, pentadienyl, hexatrienyl, cyclohexatrienyl, heptatrienyl, cycloheptatrienyl systems. Calculation of the total  $\pi$ -energy, and M.O. coefficients of the systems.

**Aromaticity:** Concept of aromaticity, Huckel's rule, Polygon rule, annulenes, heteroannulenes and polycyclic systems.

**Structure and reactivity:** Brief discussion on effects of hydrogen bonding, resonance, inductive and hyperconjugation on strengths of acids and bases.

**Methods of determining organic reaction mechanism:** Thermodynamic and kinetic requirements for reactions, kinetic and thermodynamic control; Identification of products; Determination of reaction intermediates, isotope labeling and effects of cross over experiments, kinetic and stereochemical evidence, solvent effect. Formation, structure, stability, detection and reactions of carbocations (classical and non-classical), carbanions, free radicals, carbenes, nitrenes, arynes and ylides (Sulphur, nitrogen and phosphorous).

### UNIT-III

[16 HOURS]

**Aliphatic Nucleophilic Substitution reactions:** Kinetics, mechanism and stereochemical factor affecting the rate of  $S_N1$ ,  $S_N2$ ,  $S_{RN}1$ ,  $S_Ni$ ,  $S_N1'$ ,  $S_N2'$ ,  $S_{N1i}$  and  $S_{RN1}$  reactions; Neighboring group participation.

**Electrophilic substitution reactions:** Kinetics, mechanism and stereochemical factor affecting the rate of  $S_E1$  &  $S_E2$

**Aromatic electrophilic substitution reactions:** Mechanism of nitration, halogenation, sulphonation, Friedel-Crafts alkylation and acylation, Mannich reaction, chloromethylation, Vilsmeier Haack reaction, Diazonium coupling, Gattermann-Koch reaction, Mercuration reaction.

**Aromatic nucleophilic substitution reactions:**  $S_N1$ ,  $S_N2$  and benzyne mechanism, Bucherer reaction, von Richter reaction.

**Mechanism of Addition reactions:** Addition to C=C multiple bonds involving electrophiles, nucleophiles. Markownikoff's rule and anti-Markownikoff's rule.

**Additions to carbonyl compounds:** Addition of water, alcohol, bisulphate, HCN and amino compounds. Hydrolysis of esters.

**Elimination reactions:** Mechanism and stereochemistry of eliminations -  $E_1$ ,  $E_2$ ,  $E_{1cB}$ . *cis* elimination, Hofmann and Saytzeff eliminations, competition between elimination and substitution reactions, decarboxylation reactions. Chugaev reaction.

#### References

1. Stereochemistry of carbon compounds, Ernest L. Eliel.
2. Stereochemistry: P. S. Kalsi.
3. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
4. Organic Chemistry, Vol-I by I. L. Finar.
5. Advance Organic Chemistry, IV edition, Jerry March.
6. Advance Organic Chemistry, III edition, Part-A and Part-B, Francis A. Carey and Rechar J. Sundberg.
7. Organic Chemistry, III edition, V. K. Ahluwalia and Rakesh Kumar Parashar.
8. Reactive intermediates in Organic Chemistry, N. S. Isaacs.

**BASIC PHYSICAL CHEMISTRY**  
**COURSE CODE: 21CHA12**

**Objectives**

- To understand thermal properties of chemical compounds.
- To study the rate of chemical reactions including fast reactions and factors influencing the reaction rate.
- To understand the theory of electrochemistry in solution.

**Course Outcome**

- The completion of this course will enable the students to gain the knowledge on fundamentals and theoretical background on the concepts of chemical thermodynamics, chemical kinetics and electrochemistry of solutions.
- This helps in understanding the stability and energetics of reaction.

**Pedagogy**

- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- To teach electrochemical aspects through animations.

**Course content**

**UNIT-I**

**[16 HOURS]**

**Chemical Thermodynamics: Entropy:** Physical significance, entropy changes in an ideal gas. Variation of entropy with temperature, pressure and volume. Entropy changes in reversible and irreversible processes.

**Free energy:** Helmholtz and Gibbs free energies, Gibbs-Helmholtz equation and its applications, Maxwell's relations and its applications. Nernst heat theorem: its consequences and applications. Third law of thermodynamics: statements, applications and comparison with Nernst heat theorem.

**Partial molar properties:** Physical significance, determination of partial molar volumes by intercept method and from density measurements. Chemical potential and its significance. Variation of chemical potential with temperature and pressure. Formulation of the Gibbs – Duhem equation. Derivation of Duhem-Margules equation.

**Fugacity:** Relation between fugacity and pressure, variation of fugacity with temperature and pressure. Determination of fugacity of gases.

**Activity and activity coefficient:** Variation of activity with temperature and pressure. Determination of activity co-efficient by vapour pressure, depression in freezing point, solubility measurements and by electrical methods.

**Thermodynamics of dilute solutions:** Raoult's law, Henry's law. Ideal and non-ideal solutions.

**UNIT-II**

**[16 HOURS]**

**Chemical Kinetics:** Complex reactions: Kinetics of parallel, consecutive and reversible reactions. Chain reactions: Branched chain reactions, general rate expression, Auto catalytic reactions (Hydrogen-Oxygen reaction), oscillatory reactions and explosion limits.

**Theories of reaction rates:** Collision theory and its limitations, Activated complex theory

(postulates -derivation) and its applications to reactions in solution. Energy of activation, other activation parameters - determinations and their significance. Lindemann theory, Hinshelwood's theory of unimolecular reactions.

**Potential energy surfaces:** Features and construction, theoretical calculations of  $E_a$ .

**Reactions in solution:** Ionic reactions - salt effects, effect of dielectric constant (single and double sphere models). Effect of pressure, volume and entropy change on the rates of reactions. Cage effect with an example.

**Fast reactions-** Introduction, study of fast reactions by continuous and stopped flow techniques, relaxation methods (T-jump and P-jump methods), flash photolysis, pulse and shock tube methods.

### UNIT-III

[16 HOURS]

**Electrochemistry of solutions:** Factor effecting electrolytic conductance. Debye-Huckel theory - Concept of ionic atmosphere. Debye-Huckel-Onsager equation of conductivity and its validity. Debye-Huckel limiting law (DHL), its modification for appreciable concentrations. A brief survey of Helmholtz-Perrin, Guoy-Chapman and Stern electrical double layer (no derivation). Transference number: True and apparent transference numbers, Abnormal transference numbers, effect of temperature on transference numbers. Liquid junction potential-determination and minimization.

**Energetics of cell reactions:** Effect of temperature, pressure and concentration on energetics of cell reactions (calculation of  $\Delta G$ ,  $\Delta H$  and  $\Delta S$ ).

**Irreversible electrode process:** Introduction, reversible and irreversible electrodes, reversible and irreversible cells. Polarization, over voltage - concentration over voltage, activation over voltage and ohmic over voltage. Experimental determination of over voltage. Equations for concentration over potential, stationary and non-stationary surface. Butler-Volmer equation, Tafel equation. Hydrogen oxygen over voltage. Effect of temperature, current density and  $pH$  on over voltage. Polarography- Half wave potential, application in qualitative and quantitative analysis.

### References

1. Thermodynamics for Chemists by S. Glasstone, Affiliated East-West Press, New Delhi, (1965).
2. Physical Chemistry by P.W. Atkins, ELBS, 5<sup>th</sup> edition, Oxford University Press (1995).
3. Text Book of Physical Chemistry by Samuel Glasstone, MacMillan Indian Ltd., 2<sup>nd</sup> edition (1974).
4. Elements of Physical Chemistry by Lewis and Glasstone, 2<sup>nd</sup> Edn. Macmillan & Co Ltd., New York.
5. Chemical Kinetics by K.J. Laidler, Tata McGraw-Hill Pub, Co Ltd, New Delhi.
6. Chemical Kinetics by Frost and Pearson.
7. Kinetics and Mechanism of Chemical Transformation by J. Rajaram and J.C. Kuriacose, Macmillan, New Delhi.
8. Chemical Kinetics by L.K. Jain.
9. Introduction to Electrochemistry by S. Glasstone, Affiliated East-West Press, New Delhi,
10. Electrochemistry –Principles and Applications by E.G. Potter, Cleaver-Hume press Ltd, London.
11. Modern Electrochemistry Vol. I and II by J.O.M. Bockris and A.K.N. Reddy, Pentium Press, New York (1970).

**ESSENTIALS OF ANALYTICAL CHEMISTRY**  
**COURSE CODE: 21CHA13**

**Objectives**

- To familiarize statistical methods to validate analytical methods.
- To learn sampling techniques and conventional volumetric methods.
- To learn extraction and chromatographic methods for the separation and identification of different compounds.

**Course Outcome**

- To enhance the knowledge on usage of analytical terminologies
- To build the skills on statistical analysis and comparison of results
- To acquire the skills on sampling, purification, separation and data analysis using instrumental techniques.
- To excel the knowledge on various separation techniques
- Explore topics such as experimental design, sampling, calibration strategies, standardization, optimization, statistics and the validation of experimental results

**Pedagogy**

- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- To evaluate validation parameters, MS-Office tools *viz.*, MS-Excel sheets can be used.

**Course Content**

**Unit-I**

**Analytical Chemistry** – Objectives. Meaning and role of analytical chemists. Quantitative and qualitative analysis. Analytical process and steps in quantitative analysis. Meanings of the terms: analysis, determination and measurement, techniques, methods, procedures and protocols. Calculating and reporting the data. Measurement of central tendency and variability: Mean, median, range, standard deviation and variance.

Meaning of error. Determinate and indeterminate errors and minimization of errors. Accuracy and precision, distribution of random errors, the normal error curve. Propagation of determinate and indeterminate errors

**Statistical treatment of finite samples**- Student's t-test, confidence interval of mean. Comparison of two means and two standard deviations. Comparison of an experimental mean and a true mean. Criteria for the rejection of an observation- Q-test.

**Standardization and calibration**: Comparison with standards-direct comparison and titrations. External standard calibration-the least squares methods, regression equation and regression coefficient. Internal standard methods and standard-addition methods.

**Validation of analytical method**: Linearity, accuracy, precision, sensitivity, selectivity, robustness and ruggedness.

**Figures of merit of analytical methods** – sensitivity, detection and quantitation limit, linear dynamic range.

**Obtaining and preparing samples for analysis**: Importance of sampling, designing a sample plan-random, judgement, systematic-judgement, stratified and convenience sampling. Type of sample to collect - grab and composite samples. *In situ* sampling. Size of sample and number of samples. Implementing the sampling plan - solutions, gases and solids. Bringing solid samples into solution - digestion and decomposing.

**[16 HOURS]**

## UNIT – II

**Solvent extraction:** Theory-Nernst partition law, efficiency and selectivity of extraction.

**Extraction systems:** Extraction of covalent neutral molecules, extraction of uncharged metal chelates and synergic extraction, extraction of ion-association complexes-non chelated complexes, chelated complexes and oxonium systems. Use of salting out agents. Methods of extraction-batch and continuous extractions. applications.

**Solid Phase Extraction (SPE):** Principles, apparatus and instrumentation. Solid phase sorbents, extraction formats - Automated solid phase extraction. Solid phase micro extraction (SPME). Applications of SPE and SPME.

**Chromatography:** Definition, principles and mechanism of separation, classification of chromatographic techniques. General descriptions of column chromatography-frontal analysis, displacement analysis and elution analysis. General theory of column chromatography: characterizing a chromatogram-retention time, retention volume and baseline width. Chromatographic resolution, capacity factor, column selectivity. Column efficiency-band broadening-rate theory and plate theory. Peak capacity, non ideal behavior. Optimizing chromatographic separations using capacity factor, column selectivity and column efficiency- van Deemter equation, and its modern versions, Golay equation and Huber-Knox equations.

**Thin layer chromatography (TLC) -** Principles and procedures, stationary and mobile phases, solute- detection, alternative TLC procedures and applications of TLC.

[16 HOURS]

## Unit-III

**Gas chromatography (GC) -** Principles and types. Mobile phases, Sample injections, columns and stationary phases. Temperature control and solute detection; thermal conductivity detector (TCD), flame ionization detector (FID), nitrogen-phosphorus detector (NPD) and electron capture detector (ECD). Instrument control and data processing. GC-procedures- temperature programming and special procedures used in GC. Quantitative and qualitative analyses.

**High performance liquid chromatography (HPLC):** Principles, mobile phases, solvent delivery systems, sample injection system, column and stationary phases. Solute detection-UV- visible, fluorescence, refractive index and electrochemical detectors. Instrument control and data processing. Modes of HPLC. Optimisation of separations, qualitative and quantitative analyses.

**Ion-exchange chromatography (IEC):** Principles, apparatus and instrumentation, and applications.

**Size-exclusion chromatography (SEC):** Principles, apparatus and instrumentation, and applications.

**Affinity chromatography (AFC):** Principles, methodology and applications.

**Supercritical fluid chromatography (SFC):** Properties of supercritical fluids, instrumentation and operating variables, comparison of SFC with other chromatographic techniques, applications.

**Supercritical fluid extraction (SFE):** Advantages, instrumentation, choice of supercritical fluids, off-line and on-line extraction, applications.

**Electrophoresis (EP) and electrochromatography (EC):** Principles- high performance capillary electrophoresis and capillary electrochromatography, running buffers, supporting medium, sample injection, solutes- detection, instrument control and data processing. Modes of EP and EC- capillary zone electrophoresis (CZE), micellar electrokinetic chromatography (MEKC), capillary gel electrophoresis (CZE), capillary isoelectric focusing (CIEF). Capillary electrochromatography (CEC), features, basis of separations. Qualitative analysis by CE and CEC and applications.

**[16 Hours]**

**References:**

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001, John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993, Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3<sup>rd</sup> edition, 2000, Blackwell Sci., Ltd. Malden, USA.
7. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

**SOFT CORE**  
**ANALYTICAL CHEMISTRY PRACTICALS**

**COURSE CODE: 21CHA50**

**[128 HOURS]**

Safety measures in the laboratory; MSDS; reporting of values.

**Course Objective**

- To understand basic concepts by carrying out analytical experiments.
- The experimental results are subjected to validation of analytical parameters

**Course Outcomes**

- After studying this course the student to:
- Analyze various samples with different classical and simple instrumental skills.
- Obtain knowledge for selection of analytical methods with suitable technique being adopted for the analysis different samples like, water, laboratory chemicals and reagents, body fluids such as urine etc.
- Distinguish classical and instrumental methods.
- Propose and conduct experiment for quantification of individual analytes

**Pedagogy**

- Computer aided applications for the evaluation of experimental results.
- Each student performs experiments as per the protocol in practical classes.

**PART – I**

1. Determination of total acidity of vinegar and wines by acid-base titration.
2. Determination of purity of a commercial boric acid sample, and  $\text{Na}_2\text{CO}_3$  content of washing soda.
3. Determination of relative equivalent weight of a weak organic acid by titration with  $\text{NaOH}$ .
4. Determination of ephedrine and aspirin in their tablet preparations by residual acid-base titrimetry.
5. Determination of carbonate and bicarbonate in a mixture by  $p\text{H}$ -metric titration and comparison with visual acid-base titration.
6. Determination of carbonate and hydroxide-analysis of a commercial washing soda by visual and  $p\text{H}$ -titrimetry.
7. Determination of purity of a commercial sample of mercuric oxide by acid-base titration.
8. Determination of benzoic acid in food products by titration with methanolic  $\text{KOH}$  in chloroform medium using thymol blue as indicator.
9. Determination of the  $p\text{H}$  of hair shampoos and  $p\text{H}$  determination of an unknown soda ash.
10. Analysis of water/ waste water for acidity by visual,  $p\text{H}$  metric and conductometric titrations.
11. Analysis of water/ waste water for alkalinity by visual,  $p\text{H}$  metric and conductometric titrations.
12. Determination of ammonia in house-hold cleaners by visual and conductometric titration.
13. Determination of chromate and dichromate in mixture by acid-base titration: visual and  $p\text{H}$  metric methods.



14. Potentiometric determination of the equivalent weight and  $K_a$  for a pure unknown weak acid.
15. Determination of purity of aniline by non-aqueous acid-base titration by visual and potentiometric methods.
16. Determination of purity of ethylene glycol and glycerol by oxidimetric method using periodate (Malprade reaction).
17. Spectrophotometric determination of creatinine and phosphorus in urine.
18. Flame emission spectrometric determination of sodium, potassium and calcium in river/ lake water.

### **PART – II**

1. Determination of percentage of chloride in a sample by precipitation titration- Mohr, Volhard and Fajan's methods.
2. Determination of silver in an alloy and  $\text{Na}_2\text{CO}_3$  in soda ash by Volhard method.
3. Mercurimetric determination of chloride in blood or urine.
4. Determination of total hardness, calcium and magnesium hardness and carbonate and bicarbonate hardness of water by complexation titration using EDTA.
5. Determination of calcium in calcium gluconate/ calcium carbonate tablets/ injections and of calcium in milk powder by EDTA titration.
6. Determination of zinc in a sample of foot powder and thallium in a sample of rodenticide by EDTA titration.
7. Analysis of commercial hypochlorite and peroxide solution by iodometric titration.
8. Determination of copper in an ore/ an alloy by iodometry and tin in stibnite by iodimetry.
9. Determination of ascorbic acid in vitamin C tablets by titrations with  $\text{KBrO}_3$  and of vitamin C in citrus fruit juice by iodimetric titration.
10. Determination of iron in razor blade by visual and potentiometric titration using sodium metavanadate.
11. Determination of iron in pharmaceuticals by visual and potentiometric titration using cerium(IV) sulphate.
12. Determination of nickel in steel by synergic extraction and boron in river water/ sewage using ferroin.
13. Determination of total cation concentration of tap water by ion-exchange chromatography.
14. Determination of magnesium in milk of magnesium tablets by ion-exchange chromatography.
15. Cation exchange chromatographic separation of cadmium and zinc and their estimation by EDTA titration.
16. Gas chromatographic determination of ethanol in beverages.
17. Solvent extraction of zinc and its spectrophotometric determination.
18. Anion exchange chromatographic separation of zinc and magnesium followed by EDTA titration of the metals.
19. Separation and determination of chloride and bromide on an anion exchanger.
20. Separation of *o*- and *p*-nitroaniline and analysis by thin layer chromatography.

## References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993, Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. Bothers Medical Publishers (P) Ltd., 1995.
7. Laboratory manual in biochemistry, J. Jayaraman, New Age International Publishers, New Delhi, 1981.
8. Practical Clinical Biochemistry by Harold Varley and Arnold.Heinmann, 4<sup>th</sup> edition.

## INORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHA51

[128 HOURS]

### Objectives

- To understand basic concepts by carrying out different experiments.
- To develop the skill for the qualitative and quantitative analysis of various samples.

### Course Outcome

- Determination of various analytes presents in different ore samples by volumetric, gravimetric and spectrophotometric methods.
- The chemistry of redox, complexometric and indirect methods
- The principle in the semi-micro analysis of an inorganic salt mixture

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Handling the instrument and pyrolysis for quantitative determination of analyte.

## Course experiments

### PART – A

1. Determination of iron in haematite using cerium (IV) solution (0.02M) as the titrant, and gravimetric estimation of insoluble residue.
2. Estimation of calcium and magnesium carbonates in dolomite using EDTA titration, and gravimetric analysis of insoluble residue.
3. Determination of manganese dioxide in pyrolusite using permanganate titration.
4. Quantitative analysis of copper-nickel in alloy/mixture:
  - i. Copper volumetrically using  $\text{KIO}_3$ .
  - ii. Nickel gravimetrically using DMG

5. Determination of lead and tin in a mixture: Analysis of solder using EDTA titration.
6. Quantitative analysis of chloride and iodide in a mixture:
  - i. Iodide volumetrically using  $\text{KIO}_3$
  - ii. Total halide gravimetrically
7. Gravimetric analysis of molybdenum with 8-hydroxyquinoline.
8. Quantitative analysis of copper(II) and iron(II) in a mixture:
  - i. Copper gravimetrically as  $\text{CuSCN}$  and
  - ii. Iron volumetrically using cerium(IV) solution
9. Spectrophotometric determinations of:
  - a. Titanium using hydrogen peroxide
  - b. Chromium using diphenyl carbazide in industrial effluents
  - c. Iron using thiocyanate/1,10-phenanthroline method in commercial samples
  - d. Nickel using dimethylglyoxime in steel solution
10. Micro-titrimetric estimation of :
  - a) Iron using cerium(IV)
  - b) Calcium and magnesium using EDTA
11. Quantitative estimation of copper (II), calcium (II) and chloride in a mixture.
12. Circular paper chromatographic separation of: (Demonstration)
  - a. Iron and nickel
  - b. Copper and nickel

### **PART – B**

Semimicro qualitative analysis of inorganic mixtures containing **TWO** anions and **TWO** cations (excluding sodium, potassium and ammonium cations) and **ONE** of the following less common cations: W, Mo, Ce, Ti, Zr, V and Li.

#### **References**

1. Vogel's Text Book of Quantitative Chemical Analysis – 5<sup>th</sup> edition, J. Basset, R.C. Denney, G.H. Jeffery and J. Mendhom.
2. A Text Book of Quantitative Inorganic Analysis by A.I. Vogel, 3<sup>rd</sup> edition.
3. Spectrophotometric Determination of Elements by Z. Marczenko.
4. Vogel's Qualitative Inorganic Analysis – Svelha.
5. Macro and Semimicro Inorganic Qualitative Analysis by A.I. Vogel.
6. Semimicro Qualitative Analysis by F.J. Welcher and R.B. Halin.
7. Quantitative Chemical Analysis by Daniel C. Harris, 7<sup>th</sup> edition, (2006).

**ORGANIC CHEMISTRY PRACTICALS**  
**COURSE CODE: 21CHA52** **[128 HOURS]**

**Objectives**

- To understand synthetic methods by carrying out different experiments.
- To develop the skill for the separation and qualitative analysis of binary mixtures of organic compounds.

**Course Outcome**

- Students are involved in the multi-step synthesis of different organic compounds.
- Understand the qualitative analysis of binary mixture of organic compounds through separation, identification of functional groups and preparation of solid derivatives.

**Pedagogy**

- Each student performs experiments as per the protocol in practical classes.
- Experimental setup for the synthesis of organic compounds by every individual.

**Course experiments**

**PART-A**

Safety measures in the laboratory; MSDS; reporting of values and demonstration of KingDraw/ ChemDraw

**Multistep synthesis**

1. Preparation *p*-bromoaniline from acetanilide.
2. Preparation of *n*-butyl bromide from *n*-butyl alcohol.
3. Oxidation of cyclohexanol to adipic acid.
4. Esterification: Preparation of benzocaine from *p*-nitrotoluene.
5. Diazotization (Sandmeyer's reaction): Preparation of *p*-chlorobenzoic acid from *p*-toluidine.
6. Preparation benzilic acid from benzoin.
7. Preparation of *o*-hydroxy benzophenone from phenyl benzoate *via* Fries rearrangement.
8. Preparation of benzanilide from benzophenone oxime *via* Beckmann rearrangement.
9. Preparation of benzoic acid from benzaldehyde (Cannizzaro Reaction).
10. Preparation of 2,4-dinitrophenylhydrazine from 2,4-dinitrochlorobenzene.
11. Preparation of *m*-nitrobenzoic acid from methylbenzoate.
12. Preparation of chalcone.

**PART-B**

**Qualitative analysis:** Separation of binary mixtures, identification of functional groups and preparation of suitable solid derivatives.

**References**

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-I: Small scale preparations, Part-II: Qualitative organic analysis, By Arthur I, Vogel.
3. Hand book of organic analysis, H. T. Clarke and Norman Collie.
4. Experiments in Organic Chemistry, Louis F. Fieser.
5. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
6. Practical Organic Chemistry by Mann F. G. and Saunders.

## PHYSICAL CHEMISTRY PRACTICALS

COURSE CODE: 21CHA53

[128 HOURS]

### Objectives

- To understand the rate of chemical reactions and factors influencing the reaction rate by carrying out kinetic experiments.
- To understand basic concepts of electrochemistry by carrying out experiments.

### Course Outcome

- After the completion of this course, the students can able to develop the experimental skill and theoretical interpretation of experimental results of many physical chemistry experiments of chemical kinetics in solution phase, thermodynamics, electrochemistry and spectrophotometry.
- This helps in academics, research and industries.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- To optimize the reaction conditions for understanding the rate of chemical reactions.

### Course experiments

#### PART - A

1. Study of kinetics of hydrolysis of methyl acetate in presence of two different concentrations of HCl/H<sub>2</sub>SO<sub>4</sub> and report the relative catalytic strength.
2. Study of kinetics of reaction between K<sub>2</sub>S<sub>2</sub>O<sub>8</sub> and KI, first order, determination of rate constants at two different temperatures and  $E_a$ .
3. To study the kinetics of saponification of ethyl acetate by conductivity method at two different concentrations of NaOH and report the relative catalytic strength.
4. Determination of partial molar volume of salt-water system (NaCl-H<sub>2</sub>O/KCl-H<sub>2</sub>O/KNO<sub>3</sub>-H<sub>2</sub>O) systems.
5. To study the kinetics of reaction between acetone and iodine - determination of order of reaction with respect to iodine and acetone.
6. Study the kinetics of decomposition of diacetone alcohol by NaOH, determine the catalytic coefficient of the reaction and comparison of strength of alkali.
7. Determination of energy of activation for the bromide-bromate reaction.
8. Kinetics of reaction between sodium formate and iodine and determination of energy of activation.
9. Determination of heat of solution of organic acid (benzoic acid/salicylic acid) by variable temperature method (graphical method).
10. Determination of degree of association of benzoic acid in benzene by distribution method.
11. To determine the eutectic point of a two component system (Naphthalene-*m*-dinitrobenzene system).
12. Analysis of a binary mixture (Glycerol & Water) by measurement of refractive index.
13. Determination of the molecular weight of a polymer material by viscosity measurements (cellulose acetate/methyl acrylate).

#### PART – B

1. Conductometric titration of a mixture of HCl and CH<sub>3</sub>COOH against NaOH.
2. Conductometric titration of sodium sulphate against barium chloride.
3. pH titration of (a) HCl against NaOH (b) Copper sulphate against NaOH and (c) CH<sub>3</sub>COOH/HCOOH against NaOH - determination of  $K_a$ .
4. Determination of equivalent conductance of weak electrolyte (CH<sub>3</sub>COOH) at infinite

- dilution following Kohlrausch law.
5. Determination of dissociation constant and mean ionic activity coefficient of weak acids ( $\text{CH}_3\text{COOH}/\text{HCOOH}/\text{ClCH}_2\text{COOH}$ ) by conductivity method.
  6. Potentiometric titration of KI vs  $\text{KMnO}_4$  solution.
  7. Determination of dissociation constant of a weak acid ( $\text{CH}_3\text{COOH}/\text{HCOOH}/\text{ClCH}_2\text{COOH}$ ) by potentiometric method.
  8. Potentiometric titration of a mixture of halides ( $\text{KCl}+\text{KI}/\text{KCl}+\text{KBr}/\text{KBr}+\text{KI}$ ) against  $\text{AgNO}_3$ .
  9. To obtain the absorption spectra of coloured complexes, verification of Beer's law and estimation of metal ions in solution using a spectrophotometer.
  10. Potentiometric titration of  $\text{K}_2\text{Cr}_2\text{O}_7$  against FAS determination of redox potential and concentration of  $\text{Fe}^{2+}$  ions.
  11. Conductometric titration of oxalic acid against  $\text{NaOH}$  and  $\text{NH}_4\text{OH}$ .
  12. Coulometric titration  $\text{I}_2$  vs  $\text{Na}_2\text{S}_2\text{O}_3$ .
  13. Determination of acidic and basic dissociation constant and isoelectric point of an amino acid by pH metric method.
  14. Kinetics of photodegradation of indigocarmine (IC) using  $\text{ZnO}/\text{TiO}_2$  as photocatalyst and study the effect of  $[\text{ZnO}/\text{TiO}_2]$  and  $[\text{IC}]$  on the rate of photodegradation.

## References

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels *et al.*
3. Selected Experiments in Physical Chemistry – Latham.
4. Experiments in Physical Chemistry – James and Prichard.
5. Experiments in Physical Chemistry – Shoemaker.
6. Advanced Physico-Chemical Experiments – J. Rose.
7. Practical Physical Chemistry – S.R. Palit.
8. Experiments in Physical Chemistry – Yadav, Geol Publishing House.
9. Experiments in Physical Chemistry – Palmer.
10. Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
11. Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

## SOFT CORE PAPERS

### TITRIMETRIC ANALYSIS

COURSE CODE: 21CHA54

### Objective

- To familiarize statistical methods to validate analytical methods.
- To learn sampling techniques and conventional volumetric methods.

### Course Outcome

After studying this course the student able to:

- Understand on quantitative and qualitative methods of analysis with relevant equilibrium chemistry.
- Develop the ideas with the fundamental aspects in analytical chemistry.
- Build the interest in students in developing good experimental protocols, and in interpreting

experimental results.

- Gain analytical knowledge for the quantitative analysis of various samples of different origin under titrimetric aspects.
- Learn statistical aspects from which the spirit of assessing the results will be enhanced.
- Learn method development and validation features so that they will become outstanding basement for their career in various industries.

### **Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## **Unit-I**

**Titrimetric analysis:** An overview of titrimetry. Principles of titrimetric analysis. Titration curves. Titrations based on acid-base reactions-titration curves for strong acid and strong base, weak acid and strong base and weak base and strong acid titrations. Selecting and evaluating the end point. Finding the end point by visual indicators, monitoring  $pH$  and temperature. Quantitative applications – selecting and standardizing a titrant, inorganic analysis-alkalinity, acidity and free  $CO_2$  in water and waste waters, nitrogen, sulphur ammonium salts, nitrates and nitrites, carbonates and bicarbonates. Organic analysis-functional groups like carboxylic acid, sulphonic acid, amine, ester, hydroxyl, carbonyl. Air pollutants like  $SO_2$ . Quantitative calculations. Characterization applications-equivalent weights and equilibrium constants.

**Acid-base titrations in non-aqueous media:** Role of solvent in acid-base titrations, solvent systems, differentiating ability of a solvent, some selected solvents, titrants and standards, titration curves, effect of water, determining the equivalence point, typical applications-determination of carboxylic acids, phenols and amines.

**Precipitation titrations:** Titration curves, feasibility of precipitation titrations, factors affecting shape - titrant and analyte concentration, completeness of the reaction, titrants and standards, indicators for precipitation titrations involving silver nitrate, the Volhard, the Mohr and the Fajan's methods, typical applications.

**[16 HOURS]**

## **UNIT – II**

**Complexometric titrations:** Complex formation reactions, stability of complexes, stepwise formation constants, chelating agents, EDTA - acidic properties, complexes with metal ions, equilibrium calculations involving EDTA, conditional formation constants, derivation of EDTA titration curves, effect of other complexing agents, factors affecting the shape of titration curves - completeness of reaction, indicators for EDTA titrations - theory of common indicators, titration methods employing EDTA - direct, back and displacement titrations, indirect determinations, titration of mixtures.

**Redox titrations:** Balancing redox equations, calculation of the equilibrium constant of redox reactions, calculating titration curves, detection of end point, visual indicators and potentiometric end point detection. Quantitative applications - adjusting the analyte's oxidation state, selecting and

standardizing a titrant. Inorganic analysis - chlorine residuals, dissolved oxygen in water, water in non-aqueous solvents. Organic analysis - chemical oxygen demand (COD) in natural and waste waters, titrations of mercaptans and ascorbic acid with  $I_3^-$  and titration of organic compounds using periodate.

**Automatic titrators:** Principles and theory of  $CO_2$ , sulphate, chloride and Karl Fisher titrators.

[16 HOURS]

### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001, John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993, Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3<sup>rd</sup> edition, 2000, Blackwell Sci., Ltd. Malden, USA.
7. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

## CHEMISTRY OF SELECTED ELEMENTS COURSE CODE: 21CHA55

### Objectives

- To learn basic chemistry of some selected group elements from periodic table.
- To understand properties of metal-metal bonding and cluster compounds.

### Course Outcome

- Understand the chemistry of hydrogen and group 2 elements.
- The chemistry of pseudohalogens, interhalogens and their halogen compounds.
- The chemistry of xenon and other noble gas compounds.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching. Course content

### UNIT-I

**Compounds of hydrogen:** The hydrogen and hydride ions, Dihydrogen and hydrogen bonding. Classes of binary hydrides: Molecular hydrides, saline hydrides and metallic hydrides.

**The Group 1 elements:** Occurrence, extraction and uses. Simple compounds: Hydrides, halides, oxides, hydroxides, oxoacids, nitrides, solubility and hydration and solutions in liquid ammonia. Coordination and organometallic compounds. Applications.

**The Group 2 elements:** Occurrence, extraction and uses. General properties. Halides, hydrides



and salts of oxo acids. Complex ion in aqueous solution and complexes with amido and alkoxy ligands.

**The Group 15 elements:** Introduction, oxides and oxoacids of nitrogen and phosphorus.

[16 HOURS]

## UNIT-II

**The Group 17 elements:** Occurrence, recovery and uses. Trends in properties and pseudohalogens. **Interhalogens:** Physical properties and structures, chemical properties, cationic interhalogens. **Compounds with oxygen:** Halogen oxides, oxoacids and oxoanions. Trends in rates of redox reactions and redox properties of individual oxidation states.

**Chemistry of astatine.**

**The Group 18 elements:** Occurrence, recovery and uses. Synthesis and structure of xenon fluorides, Reaction of xenon fluorides, xenon-oxygen compounds, Organoxenon compounds, other compounds of noble gases.

**M-M bonds:** Multiple metal-metal bonds.

**Cluster compounds:** carbonyl and carbide clusters.

### References

1. Basic Inorganic Chemistry – 3rd edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons (2002).
2. Inorganic Chemistry, 3rd edition. James E. Huheey, Harper and Row Publishers (1983).
3. Inorganic Chemistry, 3rd edition. G.L. Miessler and D.A. Tarr, Pearson Education (2004).
4. Inorganic Chemistry, 4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
5. Chemistry of the Elements – N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
6. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F.

## CHEMISTRY OF NATURAL PRODUCTS-I

COURSE CODE: 21CHA56

### Objectives

- To learn the nomenclature, classification, purification, structure and synthesis of some natural products.
- To understand the biological functions of biomolecules.

### Course Outcome

- Acquire the knowledge of chemistry of lipids, prostaglandins and terpenoids.
- Understand the biological importance of chlorophyll and porphyrins.
- Chemistry of flavonoids and isoflavonoids.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Lipids:** Nomenclature, classification, purification, structure and synthesis of fatty acids, phospholipids, sphingolipids. Biological importance of lipids (Lecithin, sphingolipids, oils and fats).

**Prostaglandins:** Introduction, classification and biological importance of PG's. Constitution of PGE1. Synthesis of PGE & F series.

**Terpenoids:** Introduction, classification and general methods of structural elucidation. Chemistry of pinene, camphor, caryophyllene, santonin. Biosynthesis of terpenoids.

### UNIT-II

[16 HOURS]

**Porphyrins:** Introduction, structure and biological functions of haemin. Vitamin B12: structure and as coenzyme in molecular rearrangement reactions; Chlorophyll: structure and biological importance.

**Flavonoids and Isoflavonoids:** Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin, Kaempferol, Quercetin, wedelolactone, Butein, Daidzein. Biosynthesis of flavonoids and isoflavonoids: Acetate Pathway and Shikimic acid Pathway. Biological importance of flavonoids and isoflavonoids

### References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jacob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.
5. Synthetic drugs, Gurdeep R. Chatwal.
6. Heterocyclic chemistry by Achison.
7. Heterocyclic chemistry by Smith and Joule.
8. Heterocyclic chemistry by Pacquete.

## BIOPHYSICAL CHEMISTRY

COURSE CODE: 21CHA57

### Objectives

- To understand the physico-chemical principles of biological fluids.
- To learn the pharmacokinetics, pharmacodynamics, toxicokinetics of biological systems.

### Course Outcome

- After the completion of this course, the students gain the knowledge on theory and principles of biophysical chemistry and pharmacokinetics.
- This course helps to understanding the bio-availability and different pharmacokinetic parameters of drugs in the living system.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Biophysical Chemistry:** Electrophoresis - Principles of free electrophoresis, zone electrophoresis, gel electrophoresis and its applications in qualitative and quantitative study of proteins. Determination of isoelectric point of a protein. Electro-osmosis and streaming potential and its biological significance. Biological significance of Donnan membrane phenomenon. Micelles and its involvement during digestion and absorption of dietary lipids. Diffusion of solutes across bio-membranes and its application in the mechanism of respiratory exchange. -Salting In and -Salting Out of proteins. Osmotic behaviour of cells and osmo-regulation and its application in the evolution of excretory systems of organisms. Effect of temperature and pH on the viscosity of bio-molecules (albumin solution). Significance of viscosity in biological systems - mechanism of muscle contraction, polymerization of DNA and nature of blood flow through different vessels. Effect of temperature, solute concentration (amino acids) on surface tension. Biological significance of surface tension - stability of Alveoli in lungs, interfacial tension in living cells (Danielli and Davson model). Application of sedimentation velocity and sedimentation equilibrium method for molecular weight determination of proteins.

### UNIT-II

[16 HOURS]

**Pharmacokinetics:** Introduction, biopharmaceutics, pharmacokinetics, clinical pharmacokinetics, pharmacodynamics, toxicokinetics and clinical toxicology. Measurement of drug concentration in blood, plasma or serum. Plasma level-time curve, significance of measuring plasma drug concentrations.

**One compartment open model:** Intravenous route of administration of drug, elimination rate constant, apparent volume of distribution and significance. Calculation of elimination rate constant from urinary excretion data, clinical application.

**Two compartment model:** Plasma level-time curve, relationship between tissue and plasma drug concentrations, Apparent volumes of distribution. Drug clearance, clinical example. Plasma level-time curve for a three compartment open model.

Drug absorption: Factors affecting the rate of drug absorption - nature of the cell membrane, Route of drug administration - Oral drug absorption, Intravenous infusion and intravenous solutions, Effect of food on gastrointestinal drug absorption rate.

### References

1. Introduction to Physical Organic Chemistry, R.D. Gilliom, Madison – Wesley, USA (1970).
2. Physical Organic Chemistry- Reaction Rate and Equilibrium Mechanism – L.P. Hammett, McGraw HillBook, Co., (1970).
3. Biophysical Chemistry- Principle and Technique – A. Upadhyay, K. Upadhyay and N. Nath, Himalaya Publishing House, Bombay, (1998).
4. Essentials of Physical Chemistry and Pharmacy – H. J. Arnikar, S. S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).
5. Applied Biopharmacokinetics and Pharmacokinetics - Leon Shargel, Andrew YuPrentice-Hall International, Inc (4<sup>th</sup> edition).
6. Essentials of Physical Chemistry and Pharmacy – H.J. Arnikar, S.S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).

## SECOND SEMESTER

### COORDINATION CHEMISTRY

COURSE CODE: 21CHB10

#### Objectives

- To understand the preparation, properties, electronic configuration and structural elucidation of coordination compounds.
- To learn the reaction mechanism, stereochemistry and photochemistry of coordination compounds.

#### Course Outcome

- Gain the knowledge of preparative methods of coordination compounds and geometries of different coordination numbers.
- Understand the CFT and MOT bonding theories of metal complexes.
- Electronic spectra, magnetic properties and infrared spectroscopy of coordination compounds. In addition, understand the reaction mechanism and photochemistry of coordination compounds.

#### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

### Course content

#### UNIT-I

[16 HOURS]

**Preparation of coordination compounds:** Introduction, Preparative methods- simple addition reactions, substitution reactions, oxidation-reduction reactions, thermal dissociation reactions. Geometries of metal complexes of higher coordination numbers (2-12).

**Stability of coordination compounds:** Introduction, trends in stepwise stability constants, factors influencing the stability of metal complexes with reference to the nature of metal ion and ligands, the Irving-William series, chelate effect.

**Determination of stability constants:** Theoretical aspects of determination of stability constants of metal complexes by spectrophotometric and polarographic methods.

**Crystal field theory:** Salient features of CFT, d-orbital splitting in octahedral, tetrahedral, square planar and tetragonal complexes, Jahn-Teller distortions, measurement of  $10 Dq$  and factors affecting it. Evidences for metal-ligand covalency.

**Molecular Orbital Theory:** MOT to octahedral, tetrahedral and square planar complexes without and with pi-bonding.

#### UNIT-II

[16 HOURS]

**Electronic spectra:** Introduction, selection rules and intensities, electronic spectra of octahedral and tetrahedral complexes, Term symbols for  $d^n$  ions, Orgel and Tanabe-Sugano diagrams, charge-transfer spectra. Ligand-field transition. Charge transfer and energy applications. Optical rotatory dispersion and Circular dichroism. Magnetic circular dichroism.

**Magnetic properties:** Introduction, magnetic susceptibility and its measurements, spin and orbital contributions to the magnetic moment, the effects of temperature on  $\mu_{\text{eff}}$ , spin-cross over, ferromagnetism, anti-ferromagnetism and ferrimagnetism.

**Applications of infrared spectroscopy of coordination compounds:** Metal complexes of

ammine, nitro, nitrito, hydroxo, carbonato, sulphato, cyano, cyanato and thiocyanato complexes.

### UNIT-III

[16 HOURS]

**Reactions and Mechanisms:** Introduction. Substitution reactions- Inert and labile compounds, mechanisms of substitution. Kinetic consequences of Reaction pathways- Dissociation, interchange and association. Experimental evidence in octahedral substitution- Dissociation, associative mechanisms, the conjugate base mechanism, the kinetic chelate effect.

**Stereochemistry of reactions-** Substitution in *trans* and its complexes, isomerization of chelate rings. Substitution reactions of square-planar complexes-kinetics and stereochemistry of square-planar substitutions, evidence for associative reactions, explanations of the *trans* effect.

Electron-transfer processes: Inner-sphere mechanism and outer-sphere mechanism, conditions for high and low oxidation numbers.

**Photochemistry of coordination compounds:** Photochemistry of chromium(III) ammine compounds, Light-induced excited state spin trapping in iron(II) compounds and MLCT photochemistry in pentammineruthenium(II) compounds.

#### References

1. Physical Inorganic Chemistry- A Coordination Chemistry Approach- S.F.A. Kettle, Spektrum, Oxford, (1996).
2. Inorganic Chemistry-4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
3. Inorganic Chemistry-5<sup>th</sup> edition. G.L. Miessler, P. J. Fischer and D.A. Tarr, Pearson (2014).
4. Inorganic Chemistry-6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F. Armastrong, Oxford University Press (2014).
5. Inorganic Chemistry- 3<sup>rd</sup> edition, James E. Huheey, Harper and Row Publishers, (1983).
6. Basic Inorganic Chemistry- 3<sup>rd</sup> edition, F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons, (2002).
7. Infrared and Raman Spectra of Coordination Compounds, Part-B- 6<sup>th</sup> edition, K. Nakamoto, John Wiley and Sons (2009).

# SYNTHETIC ORGANIC CHEMISTRY

## COURSE CODE: 21CHB11

### Objectives

- To understand the reactions of organic compounds involving various reagents.
- To learn the synthesis and retro-synthesis of different organic compounds.

### Course outcome

- Students are familiar about chemistry of oxidants, reductants and their applications in the organic synthesis.
- Understand the various catalysts in organic synthesis by known naming reactions.
- Retro-synthesis and molecular rearrangement.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Oxidation:** Oxidation with chromium and manganese reagents ( $\text{CrO}_3$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ , PCC, PDC, Sarret reagent,  $\text{MnO}_2$ ,  $\text{KMnO}_4$ ), peroxides and peracids, periodic acid,  $\text{OsO}_4$ ,  $\text{SeO}_2$ , NBS, Oppenauer oxidation, Sharpless epoxidation.

**Reduction:** Catalytic hydrogenation (homogeneous and heterogeneous) – catalysts (Pt, Pd, Ra-C, Ni, Ru, Rh), solvents and reduction of functional groups, catalytic hydrogen transfer reactions. Wilkinson catalyst,  $\text{LiAlH}_4$ ,  $\text{NaBH}_4$ , DIBAL-H, Sodium cyanoborohydride, Birch reduction, Leukart reaction (reductive amination), diborane as reducing agent, Meerwein-Ponndorf-Verley reduction, Wolff-Kishner reduction, Clemensen reduction, stannous chloride, Organoboron compounds: Introduction and preparations; Hydroboration and its applications; Reactions of organoboranes: isomerization reactions, oxidation, protonolysis, carbonylation, cyanidation. Reactions with aldehydes or ketones (*E* and *Z*-alkenes).

### UNIT-II

[16 HOURS]

**Reagents and reactions in organic synthesis:** Use of following reagents in organic synthesis and functional group transformations: Lithium diisopropylamide (LDA), Gilman reagent, dicyclohexyl carbodimide (DCC), dichlorodicyanoquinone (DDQ), Silane reagents-trialkylsilyl halides, trimethylsilyl cyanide, trimethyl silane; phase transfer catalyst, crown ethers, cyclodextrins, Ziegler-Natta catalyst, diazomethane, Woodward and Prevost hydroxylation, Stark enamine reaction, phosphorous ylides - Wittig and related reactions, Sulphur ylides – reactions with aldehydes and ketones, 1,3-dithiane anions - Umpolung reaction, Peterson reaction. Palladium reagents: Suzuki coupling, Heck reaction, Negishi reaction. Green Chemistry: Definition and principles, planning green synthesis in the laboratory, green preparations- aqueous reactions, solid state (solvent free) reactions, photochemical reactions, enzymatic transformations and reactions in ionic liquids.

## UNIT-III

[16 HOURS]

**Molecular rearrangements:** Introduction Carbon to carbon migration: Pinacol-pinacolone, Wagner-Meerwein, Benzidine, benzylic acid, Favorskii, Fries rearrangement, dienophile rearrangement. Carbon to nitrogen migration: Hofmann, Curtius, Lossen, Schmidt and Beckmann rearrangements. Miscellaneous rearrangements: Wittig, Smiles, Bayer-Villegier rearrangement and Barton reaction.

**Retrosynthesis:** Introduction to disconnection approach: Basic principles and terminologies used in disconnection approach. One group C-X and two group C-X disconnections. Synthons and synthetic equivalents. Retrosynthesis and synthesis of benzofurans, *p*-methoxy acetophenone, saccharine,  $\alpha$ -bisabolene, nuciferal, tetralone, ibuprofen; Functional group transformations in organic synthesis: nitro to keto, nitro to amine, acid to alcohol etc.

### References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-I & II by I. L. Finar.
3. Advance Organic Chemistry, IV edition, Jerry March.
4. Advance Organic Chemistry, III edition, Part-A and Part-B, Francis A. Carey and Rechar J. Sundberg.
5. Organic Chemistry, III edition, V. K. Ahluwalia and Rakesh Kumar Parashar.
6. Organic named reactions and molecular rearrangements, Gudeep Raj.
7. Modern synthetic reactions, II edition, H. O. House.
8. Organic synthesis, Jagadamba Singh and L. D. S. Yadav.
9. Green Chemistry, K. R. Desai.
10. Principles of Organic synthesis, R. O. C. Norman and J. M. Coxon.
11. Organic synthesis II edition, V. K. Aluwalia and Renu Agarwal.
12. Organic synthesis, Robert E. Ireland.
13. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jacob Sharefkin.
14. Organic chemistry by Clayden, Greeves, Warren and Wothers.

**PRINCIPLES OF PHYSICAL CHEMISTRY**  
**COURSE CODE: 21CHB12**

**Objectives**

- To understand the theoretical calculations of energies of simple molecules.
- To learn the calculation of different energies by statistical thermodynamics.
- To understand the basics of polymers, their kinetics and applications.

**Course Outcome**

- Principles of Quantum chemistry and theoretical calculations of energies of molecules and chemical reactions.
- Apply solutions of the Schrödinger equation for simple systems (particle in a box, rigid rotor, harmonic oscillator) to real systems (vibrational, rotational, and electronic energy states) in determining the energy of stationary states.
- Explain angular momentum as possessed by atomic or molecular systems, various descriptions of how angular momentum can be coupled, and how conservation of angular momentum is important to spectroscopy.
- Concepts and applicability of statistical thermodynamics in the calculations of different energies in the reacting system. Applications of phase rule for separation of the metals from ore.
- Fundamentals of polymers and their applications in controlling the quality and waste management of polymer product.

**Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.
- Assigning the students to solve the problems to understand the concepts.

**Course content**

**UNIT-I**

**[16 HOURS]**

**Quantum Chemistry:** Introduction to quantum mechanics: Schrödinger wave equation, time-independent and time dependent Schrödinger wave equation and the relation between their solutions. Eigen functions and Eigen values. Physical interpretation of wave function. Concept of operators – Laplacian, Hamiltonian, Linear and Hermitian operators. Angular momentum operators and their properties. Commutative and non-commutative operators. Normalization, orthogonality and orthonormality of wave functions. Postulates of quantum mechanics. Solutions of Schrödinger wave equation for free particles, particle in a ring, particle in three dimensional box. Quantum mechanical degeneracy, tunnelling (no derivation). Wave equation for H-atom, separation and solution of R,  $\phi$  and  $\theta$  equations. Application of Schrodinger equation to rigid rotator and harmonic oscillator. Eigen functions and Eigen values of angular momentum. Ladder operator method for angular momentum.



## UNIT-II

[16 HOURS]

**Statistical thermodynamics:** Objectives of statistical thermodynamics, concept of distribution, types of ensembles. Thermodynamic probability and most probable distribution law. Partition functions – definition, evaluation of translational, rotational and vibrational and electronic partition functions for monoatomic, diatomic and polyatomic gaseous molecules. Sackur-Tetrode equation for entropy of translation function. Calculation of thermodynamic functions and equilibrium constants in terms of partition functions. Different distribution laws (Types of statistics): Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics (derivation of the three distribution laws). Comparison of Bose-Einstein and Fermi-Dirac Statistics with Maxwell-Boltzmann statistics. Problems and their solutions.

**Phase rule studies:** Thermodynamic derivation of phase rule. Application of phase rule to the two component systems - compound formation with congruent melting point and incongruent melting points, Roozeboom's classification. Application of phase rule to three component systems- systems of three liquids and systems of two salts and water.

## UNIT-III

[16 HOURS]

**Polymers:** Fundamentals of polymers - monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers, Polymerization - condensation, addition, free radical, ionic, co-ordination polymerization and ring opening polymerization. Molecular weight and size, polydispersion. Average molecular weight concepts – number, weight and viscosity average molecular weight. Determination of molecular weights - viscosity method, osmotic pressure method, sedimentation and light scattering methods.

**Kinetics of Polymerization** - Condensation, addition, free radical, ionic, co-ordination polymerization.

**Phase transitions in polymers and thermal characterization:** Glass transition, crystallinity and melting- correlation with the polymer structure.

**Polymers in solution:** Criteria of polymer solubility, thermodynamics of polymer solutions.

**Colloids:** Types and classification, Micelles: Surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, micellar catalysis.

### References

1. Text Book of Physical Chemistry by Samuel Glasstone, MacMillan Indian Ltd., 2<sup>nd</sup> edition (1974).
2. Quantum Chemistry – A.K. Chandra. 2<sup>nd</sup> edition, Tata McGraw Hill Publishing Co. Ltd., (1983).
3. Quantum Chemistry – Eyring, Walter and Kimball. John Wiley and Sons, Inc., New York.
4. Quantum Chemistry – I.N. Levine. Pearson Education, New Delhi, (2000).
5. Theoretical Chemistry – S. Glasstone. East West Press, New Delhi, (1973).
6. Quantum Chemistry – R.K. Prasad, New Age International Publishers, (1996).
7. Text Book of Polymer Science, F.W. Billmeyer, Jr., John Wiley, London (1994).
8. Polymer Science. V. R. Gowrikar, N.V. Vishwanathan and J. Sreedhar, Wiley Eastern, New Delhi (1990).
9. Fundamentals of Polymer Science and Engineering. A. Kumar and S.K. Gupta, Tata – McGraw Hill New Delhi (1978).
10. Polymer Characterization, D. Campbell and J.R. White, Chapman and Hall, New York.
11. Fundamental Principles of Polymer Materials, R.L. Rosen, John Wiley and Sons, New York.

# MOLECULAR SYMMETRY AND SPECTROSCOPY

## COURSE CODE: 21CHB13

### Objectives

- To understand the concepts of symmetry and symmetry operations and their application to CFT, hybridization, MOT and vibrational spectroscopy.
- To learn the theory and applications of microwave, vibration and Raman spectroscopy.
- To understand the principles and applications of UV-Visible and resonance Raman spectroscopy.

### Course outcome

- Molecular symmetry and applications of group theory to CFT, hybridization, MOT and vibrational spectroscopy.
- Theory and principles of Rotation, Vibration and Raman Spectroscopy.
- Theory and principles Electronic and Resonance Raman spectroscopy.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Molecular models are used to teach symmetry aspects of molecules
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned to solve the numerical problems.

## Course content

### UNIT-I

[16 HOURS]

**Molecular symmetry and group theory:** Symmetry elements and symmetry operations.

**The Point Groups Used with Molecules:** Concept of a group, definition of a point group. Classification of molecules into point groups. Subgroups.

Hermann-Mauguin symbols for point groups. Multiplication tables ( $C_{2v}$ ,  $C_{2h}$  and  $C_{3v}$ ). Matrix notation for the symmetry elements. Classes and similarity transformation.

**Representation of groups:** The Great Orthogonality theorem and its consequences.

Character tables ( $C_s$ ,  $C_i$ ,  $C_2$ ,  $C_{2v}$ ,  $C_{2h}$  and  $C_{3v}$ ). Symmetry and dipole moment.

**Applications of group theory:** Group theory and hybrid orbitals.

**Symmetry in Chemical bonding:** Group theory to Crystal field theory and Molecular orbital theory (octahedral and tetrahedral complexes).

**Symmetry in Vibrational Spectroscopy:** Determining the symmetry groups of normal modes for non-linear molecules ( $H_2O$ ,  $NH_3$ ,  $CH_4$ ,  $trans-N_2F_2$ ) and linear molecules ( $CO$ ,  $HCl$ ,  $HCN$  and  $CO_2$ ) (Integration method).

### UNIT-II

[16 HOURS]

**Microwave spectroscopy:** Rotation spectra of diatomic Molecules - rigid and non rigid rotator model. Rotational quantum number and the selection rule. Effect of isotopic substitution on rotation spectra. Classification of polyatomic molecules based on moment of inertia. Rotation spectra of polyatomic molecules ( $OCS$ ,  $CH_3F$  and  $BCl_3$ ). Moment of inertia expression for linear tri-atomic molecules. Applications - Principles of determination of Bond length and moment of inertia from rotational spectra. Stark effect in rotation spectra and determination of dipole

moments.

**Vibration spectroscopy:** Vibration of diatomic molecules, vibrational energy curves for simple harmonic oscillator. Effects of anharmonic oscillation, expressions for fundamental and overtone frequencies. Vibration - rotation spectra of carbon monoxide. Vibration of polyatomic molecules – The number of degrees of freedom of vibration. Parallel and perpendicular vibrations ( $\text{CO}_2$  and  $\text{H}_2\text{O}$ ). Combination, difference and hot bands. Fermi resonance. Force constant and its significance. Theory of infrared absorption and theoretical group frequency. Intensity of absorption band and types of absorptions. Applications: Structures of small molecules:  $\text{XY}_2$  – linear or bent,  $\text{XY}_3$  – planar or pyramidal.

**Raman spectroscopy:** Introduction, Raman and Rayleigh scattering, Stokes and anti-Stokes lines, polarization of Raman lines, depolarization factor, polarizability ellipsoid. Theories of Raman spectra - classical and quantum theory. Rotation-Raman and vibration-Raman spectra. Raman activity of vibrations, rule of mutual exclusion principle. Vibration modes of some simple molecules and their activity.

### UNIT-III

[16 HOURS]

**UV Visible spectroscopy:** Quantitative aspects of absorption – Beer's law, Technology associated with absorption measurements. Limitations – real, chemical, instrumental and personal. Theory of molecular absorption. Vibration-rotation fine structure of electronic spectra. Types of absorption bands:  $n$  to  $\pi^*$ ,  $\pi$  to  $\pi^*$ ,  $n$  to  $\sigma^*$  and  $\sigma$  to  $\sigma^*$ , C-T and ligand field. Instrumentation.

**Applications:** Qualitative and quantitative analysis of binary mixtures, measurements of dissociation constants of acids and bases, determination of molecular weight. Woodward's empirical rules for predicting the wavelength of maximum absorption for olefins, conjugated dienes, cyclic trienes and polyenes,  $\alpha,\beta$ -unsaturated aldehydes and ketones, benzene and substituted benzene rings.

**Resonance Raman Spectroscopy:** Resonance Raman Effect and its applications. Non-linear Raman effects: Hyper, stimulated and inverse Raman effects. Coherent Anti-Stokes Raman Scattering and its applications.

#### References

1. Chemical Applications of Group Theory, 3rd edition, F.A. Cotton, John Wiley and Sons (2006).
2. Sons (2006).
3. Molecular Symmetry and Group Theory – Robert L Carter, John Wiley and Sons (2005).
4. Symmetry in Chemistry - H. Jaffe and M. Orchin, John Wiley, New York (1965).
5. Molecular Symmetry – David J. Willock, John Wiley and Sons Ltd., (2009).
6. Group Theory and its Chemical Applications - P.K. Bhattacharya, Himalaya Publications, New Delhi (1998).
7. Fundamentals of Molecular Spectroscopy, C.N. Banwell and E.M. McCash. 4<sup>th</sup> edition, Tata McGraw Hill, New Delhi.
8. Fundamentals of molecular spectroscopy, G. M. Barrow, McGraw Hill, New York (International students Edition), 1974.
9. Theoretical chemistry, S. Glasstone, affiliated East-West Press Pvt. Ltd, New Delhi,

- 1973.
10. Spectroscopy, B.P. Straughan and S. Walker, John Wiley & Sons Inc., New York, Vol. 1 and 2, 1976.
  11. Vibration Spectroscopy Theory and Applications, D.N. Satyanarayana, New Age International, New Delhi (2004).
  12. Spectroscopy, B.P. Straughan and S. Salker, John Wiley and Sons Inc., New York, Vol.2, 1976.
  13. Organic Spectroscopy, William Kemp, English Language Book society, Macmillan, 1987.
  14. Instrumental methods of analysis, H. H. Willard, L. L. Merritt and J. A. Dean, 7<sup>th</sup> Edition, 1988.
  15. Physical methods in inorganic chemistry, R. S. Drago, affiliated East-West press Pvt. Ltd., (Student Edition) 1978.

### **SOFT CORE**

### **ANALYTICAL CHEMISTRY PRACTICALS**

**COURSE CODE: 21CHB50**

**[128 HOURS]**

Safety measures in the laboratory; MSDS; reporting of values.

#### **Course Objective**

- To understand basic concepts by carrying out analytical experiments.
- The experimental results are subjected to validation of analytical parameters

#### **Course Outcomes**

- After studying this course the student to:
  - Analyze various samples with different classical and simple instrumental skills.
  - Obtain knowledge for selection of analytical methods with suitable technique being adopted for the analysis different samples like, water, laboratory chemicals and reagents, body fluids such as urine etc.
  - Distinguish classical and instrumental methods.
  - Propose and conduct experiment for quantification of individual analytes

#### **Pedagogy**

- Computer aided applications for the evaluation of experimental results.
- Each student performs experiments as per the protocol in practical classes.

### **PART – I**

1. Determination of total acidity of vinegar and wines by acid-base titration.
2. Determination of purity of a commercial boric acid sample, and Na<sub>2</sub>CO<sub>3</sub> content of washing soda.
3. Determination of relative equivalent weight of a weak organic acid by titration with NaOH.
4. Determination of ephedrine and aspirin in their tablet preparations by residual acid-base titrimetry.
5. Determination of carbonate and bicarbonate in a mixture by pH-metric titration and comparison with visual acid-base titration.

6. Determination of carbonate and hydroxide-analysis of a commercial washing soda by visual and *pH*-titrimetry.
7. Determination of purity of a commercial sample of mercuric oxide by acid-base titration.
8. Determination of benzoic acid in food products by titration with methanolic KOH in chloroform medium using thymol blue as indicator.
9. Determination of the *pH* of hair shampoos and *pH* determination of an unknown soda ash.
10. Analysis of water/ waste water for acidity by visual, *pH* metric and conductometric titrations.
11. Analysis of water/ waste water for alkalinity by visual, *pH* metric and conductometric titrations.
12. Determination of ammonia in house-hold cleaners by visual and conductometric titration.
13. Determination of chromate and dichromate in mixture by acid-base titration: visual and *pH* metric methods.
14. Potentiometric determination of the equivalent weight and  $K_a$  for a pure unknown weak acid.
15. Determination of purity of aniline by non-aqueous acid-base titration by visual and potentiometric methods.
16. Determination of purity of ethylene glycol and glycerol by oxidimetric method using periodate (Malprade reaction).
17. Spectrophotometric determination of creatinine and phosphorus in urine.
18. Flame emission spectrometric determination of sodium, potassium and calcium in river/ lake water.

### PART – II

1. Determination of percentage of chloride in a sample by precipitation titration- Mohr, Volhard and Fajan's methods.
2. Determination of silver in an alloy and  $\text{Na}_2\text{CO}_3$  in soda ash by Volhard method.
3. Mercurimetric determination of chloride in blood or urine.
4. Determination of total hardness, calcium and magnesium hardness and carbonate and bicarbonate hardness of water by complexation titration using EDTA.
5. Determination of calcium in calcium gluconate/ calcium carbonate tablets/ injections and of calcium in milk powder by EDTA titration.
6. Determination of zinc in a sample of foot powder and thallium in a sample of rodenticide by EDTA titration.
7. Analysis of commercial hypochlorite and peroxide solution by iodometric titration.
8. Determination of copper in an ore/ an alloy by iodometry and tin in stibnite by iodimetry.
9. Determination of ascorbic acid in vitamin C tablets by titrations with  $\text{KBrO}_3$  and of vitamin C in citrus fruit juice by iodimetric titration.
10. Determination of iron in razor blade by visual and potentiometric titration using sodium metavanadate.
11. Determination of iron in pharmaceuticals by visual and potentiometric titration using cerium(IV) sulphate.

12. Determination of nickel in steel by synergic extraction and boron in river water/ sewage using ferroin.
13. Determination of total cation concentration of tap water by ion-exchange chromatography.
14. Determination of magnesium in milk of magnesium tablets by ion-exchange chromatography.
15. Cation exchange chromatographic separation of cadmium and zinc and their estimation by EDTA titration.
16. Gas chromatographic determination of ethanol in beverages.
17. Solvent extraction of zinc and its spectrophotometric determination.
18. Anion exchange chromatographic separation of zinc and magnesium followed by EDTA titration of the metals.
19. Separation and determination of chloride and bromide on an anion exchanger.
20. Separation of *o*- and *p*-nitroaniline and analysis by thin layer chromatography.

### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993, Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. Bothers Medical Publishers (P) Ltd., 1995.
7. Laboratory manual in biochemistry, J. Jayaraman, New Age International Publishers, New Delhi, 1981.
8. Practical Clinical Biochemistry by Harold Varley and Arnold.Heinmann, 4<sup>th</sup> edition.

## INORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHB51

[128 HOURS]

### Objectives

- To understand basic concepts by carrying out different experiments.
- To develop the skill for the qualitative and quantitative analysis of various samples.

### Course Outcome

- Determination of various analytes presents in different ore samples by volumetric, gravimetric and spectrophotometric methods.
- The chemistry of redox, complexometric and indirect methods
- The principle in the semi-micro analysis of an inorganic salt mixture

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Handling the instrument and pyrolysis for quantitative determination of analyte.

## Course experiments

### PART – A

1. Determination of iron in haematite using cerium (IV) solution (0.02M) as the titrant, and gravimetric estimation of insoluble residue.
2. Estimation of calcium and magnesium carbonates in dolomite using EDTA titration, and gravimetric analysis of insoluble residue.
3. Determination of manganese dioxide in pyrolusite using permanganate titration.
4. Quantitative analysis of copper-nickel in alloy/mixture:
  - a. Copper volumetrically using  $\text{KIO}_3$ .
  - b. Nickel gravimetrically using DMG
5. Determination of lead and tin in a mixture: Analysis of solder using EDTA titration.
6. Quantitative analysis of chloride and iodide in a mixture:
  - a. Iodide volumetrically using  $\text{KIO}_3$
  - b. Total halide gravimetrically
7. Gravimetric analysis of molybdenum with 8-hydroxyquinoline.
8. Quantitative analysis of copper(II) and iron(II) in a mixture:
  - a. Copper gravimetrically as  $\text{CuSCN}$  and
  - b. Iron volumetrically using cerium(IV) solution
9. Spectrophotometric determinations of:
  - e. Titanium using hydrogen peroxide
  - f. Chromium using diphenyl carbazide in industrial effluents
  - g. Iron using thiocyanate/1,10-phenanthroline method in commercial samples
  - h. Nickel using dimethylglyoxime in steel solution
10. Micro-titrimetric estimation of :
  - c) Iron using cerium(IV)
  - d) Calcium and magnesium using EDTA
11. Quantitative estimation of copper (II), calcium (II) and chloride in a mixture.
12. Circular paper chromatographic separation of: (Demonstration)
  - c. Iron and nickel
  - d. Copper and nickel

### PART – B

Semimicro qualitative analysis of inorganic mixtures containing **TWO** anions and **TWO** cations (excluding sodium, potassium and ammonium cations) and **ONE** of the following less common cations: W, Mo, Ce, Ti, Zr, V and Li.

### References

1. Vogel's Text Book of Quantitative Chemical Analysis – 5<sup>th</sup> edition, J. Basset, R.C. Denney, G.H. Jeffery and J. Mendhom.
2. A Text Book of Quantitative Inorganic Analysis by A.I. Vogel, 3<sup>rd</sup> edition.
3. Spectrophotometric Determination of Elements by Z. Marczenko.
4. Vogel's Qualitative Inorganic Analysis – Svelha.
5. Macro and Semimicro Inorganic Qualitative Analysis by A.I. Vogel.
6. Semimicro Qualitative Analysis by F.J. Welcher and R.B. Halin.
7. Quantitative Chemical Analysis by Daniel C. Harris, 7<sup>th</sup> edition, (2006).

## ORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHB52

[128 HOURS]

### Objectives

- To understand synthetic methods by carrying out different experiments.
- To develop the skill for the separation and qualitative analysis of binary mixtures of organic compounds.

### Course Outcome

- Students are involved in the multi-step synthesis of different organic compounds.
- Understand the qualitative analysis of binary mixture of organic compounds through separation, identification of functional groups and preparation of solid derivatives.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Experimental setup for the synthesis of organic compounds by every individual.

### Course experiments

#### PART-A

Safety measures in the laboratory; MSDS; reporting of values and demonstration of KingDraw/ ChemDraw

### Multistep synthesis

1. Preparation *p*-bromoaniline from acetanilide.
2. Preparation of *n*-butyl bromide from *n*-butyl alcohol.
3. Oxidation of cyclohexanol to adipic acid.
4. Esterification: Preparation of benzocaine from *p*-nitrotoluene.
5. Diazotization (Sandmeyer's reaction): Preparation of *p*-chlorobenzoic acid from *p*-toluidine.
6. Preparation benzilic acid from benzoin.
7. Preparation of *o*-hydroxy benzophenone from phenyl benzoate *via* Fries rearrangement.
8. Preparation of benzanilide from benzophenone oxime *via* Beckmann rearrangement.
9. Preparation of benzoic acid from benzaldehyde (Cannizzaro Reaction).
10. Preparation of 2,4-dinitrophenylhydrazine from 2,4-dinitrochlorobenzene.
11. Preparation of *m*-nitrobenzoic acid from methylbenzoate.
12. Preparation of chalcone.

#### PART-B

**Qualitative analysis:** Separation of binary mixtures, identification of functional groups and preparation of suitable solid derivatives.

### References

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-I: Small scale preparations, Part-II: Qualitative organic analysis, By Arthur I, Vogel.
3. Hand book of organic analysis, H. T. Clarke and Norman Collie.
4. Experiments in Organic Chemistry, Louis F. Fieser.
5. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
6. Practical Organic Chemistry by Mann F. G. and Saunders.



## PHYSICAL CHEMISTRY PRACTICALS

COURSE CODE: 21CHB53

[128 HOURS]

### Objectives

- To understand the rate of chemical reactions and factors influencing the reaction rate by carrying out kinetic experiments.
- To understand basic concepts of electrochemistry by carrying out experiments.

### Course Outcome

- After the completion of this course, the students can able to develop the experimental skill and theoretical interpretation of experimental results of many physical chemistry experiments of chemical kinetics in solution phase, thermodynamics, electrochemistry and spectrophotometry.
- This helps in academics, research and industries.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- To optimize the reaction conditions for understanding the rate of chemical reactions.

### Course experiments

#### PART - A

1. Study of kinetics of hydrolysis of methyl acetate in presence of two different concentrations of HCl/H<sub>2</sub>SO<sub>4</sub> and report the relative catalytic strength.
2. Study of kinetics of reaction between K<sub>2</sub>S<sub>2</sub>O<sub>8</sub> and KI, first order, determination of rate constants at two different temperatures and  $E_a$ .
3. To study the kinetics of saponification of ethyl acetate by conductivity method at two different concentrations of NaOH and report the relative catalytic strength.
4. Determination of partial molar volume of salt-water system (NaCl-H<sub>2</sub>O/KCl-H<sub>2</sub>O/KNO<sub>3</sub>-H<sub>2</sub>O) systems.
5. To study the kinetics of reaction between acetone and iodine - determination of order of reaction with respect to iodine and acetone.
6. Study the kinetics of decomposition of diacetone alcohol by NaOH, determine the catalytic coefficient of the reaction and comparison of strength of alkali.
7. Determination of energy of activation for the bromide-bromate reaction.
8. Kinetics of reaction between sodium formate and iodine and determination of energy of activation.
9. Determination of heat of solution of organic acid (benzoic acid/salicylic acid) by variable temperature method (graphical method).
10. Determination of degree of association of benzoic acid in benzene by distribution method.
11. To determine the eutectic point of a two component system (Naphthalene-*m*-dinitrobenzene system).
12. Analysis of a binary mixture (Glycerol & Water) by measurement of refractive index.
13. Determination of the molecular weight of a polymer material by viscosity measurements (cellulose acetate/methyl acrylate).

#### PART – B

1. Conductometric titration of a mixture of HCl and CH<sub>3</sub>COOH against NaOH.
2. Conductometric titration of sodium sulphate against barium chloride.
3. pH titration of (a) HCl against NaOH (b) Copper sulphate against NaOH and (c) CH<sub>3</sub>COOH/HCOOH against NaOH - determination of  $K_a$ .
4. Determination of equivalent conductance of weak electrolyte (CH<sub>3</sub>COOH) at infinite

- dilution following Kohlrausch law.
5. Determination of dissociation constant and mean ionic activity coefficient of weak acids ( $\text{CH}_3\text{COOH}/\text{HCOOH}/\text{ClCH}_2\text{COOH}$ ) by conductivity method.
  6. Potentiometric titration of KI vs  $\text{KMnO}_4$  solution.
  7. Determination of dissociation constant of a weak acid ( $\text{CH}_3\text{COOH}/\text{HCOOH}/\text{ClCH}_2\text{COOH}$ ) by potentiometric method.
  8. Potentiometric titration of a mixture of halides ( $\text{KCl}+\text{KI}/\text{KCl}+\text{KBr}/\text{KBr}+\text{KI}$ ) against  $\text{AgNO}_3$ .
  9. To obtain the absorption spectra of coloured complexes, verification of Beer's law and estimation of metal ions in solution using a spectrophotometer.
  10. Potentiometric titration of  $\text{K}_2\text{Cr}_2\text{O}_7$  against FAS determination of redox potential and concentration of  $\text{Fe}^{2+}$  ions.
  11. Conductometric titration of oxalic acid against  $\text{NaOH}$  and  $\text{NH}_4\text{OH}$ .
  12. Coulometric titration  $\text{I}_2$  vs  $\text{Na}_2\text{S}_2\text{O}_3$ .
  13. Determination of acidic and basic dissociation constant and isoelectric point of an amino acid by pH metric method.
  14. Kinetics of photodegradation of indigocarmine (IC) using  $\text{ZnO}/\text{TiO}_2$  as photocatalyst and study the effect of  $[\text{ZnO}/\text{TiO}_2]$  and  $[\text{IC}]$  on the rate of photodegradation.

## References

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels *et al.*
3. Selected Experiments in Physical Chemistry – Latham.
4. Experiments in Physical Chemistry – James and Prichard.
5. Experiments in Physical Chemistry – Shoemaker.
6. Advanced Physico-Chemical Experiments – J. Rose.
7. Practical Physical Chemistry – S.R. Palit.
8. Experiments in Physical Chemistry – Yadav, Geol Publishing House.
9. Experiments in Physical Chemistry – Palmer.
10. Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
11. Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

## SOFT CORE PAPERS

### TITRIMETRIC ANALYSIS

COURSE CODE: 21CHB54

#### Objective

- To familiarize statistical methods to validate analytical methods.
- To learn sampling techniques and conventional volumetric methods.

#### Course Outcome

After studying this course the student able to:

- Understand on quantitative and qualitative methods of analysis with relevant equilibrium chemistry.
- Develop the ideas with the fundamental aspects in analytical chemistry.
- Build the interest in students in developing good experimental protocols, and in interpreting

experimental results.

- Gain analytical knowledge for the quantitative analysis of various samples of different origin under titrimetric aspects.
- Learn statistical aspects from which the spirit of assessing the results will be enhanced.
- Learn method development and validation features so that they will become outstanding basement for their career in various industries.

### **Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## **Unit-I**

**Titrimetric analysis:** An overview of titrimetry. Principles of titrimetric analysis. Titration curves. Titrations based on acid-base reactions-titration curves for strong acid and strong base, weak acid and strong base and weak base and strong acid titrations. Selecting and evaluating the end point. Finding the end point by visual indicators, monitoring  $pH$  and temperature. Quantitative applications – selecting and standardizing a titrant, inorganic analysis-alkalinity, acidity and free  $CO_2$  in water and waste waters, nitrogen, sulphur ammonium salts, nitrates and nitrites, carbonates and bicarbonates. Organic analysis-functional groups like carboxylic acid, sulphonic acid, amine, ester, hydroxyl, carbonyl. Air pollutants like  $SO_2$ . Quantitative calculations. Characterization applications-equivalent weights and equilibrium constants.

**Acid-base titrations in non-aqueous media:** Role of solvent in acid-base titrations, solvent systems, differentiating ability of a solvent, some selected solvents, titrants and standards, titration curves, effect of water, determining the equivalence point, typical applications-determination of carboxylic acids, phenols and amines.

**Precipitation titrations:** Titration curves, feasibility of precipitation titrations, factors affecting shape - titrant and analyte concentration, completeness of the reaction, titrants and standards, indicators for precipitation titrations involving silver nitrate, the Volhard, the Mohr and the Fajan's methods, typical applications.

**[16 HOURS]**

## **UNIT – II**

**Complexometric titrations:** Complex formation reactions, stability of complexes, stepwise formation constants, chelating agents, EDTA - acidic properties, complexes with metal ions, equilibrium calculations involving EDTA, conditional formation constants, derivation of EDTA titration curves, effect of other complexing agents, factors affecting the shape of titration curves - completeness of reaction, indicators for EDTA titrations - theory of common indicators, titration methods employing EDTA - direct, back and displacement titrations, indirect determinations, titration of mixtures.

**Redox titrations:** Balancing redox equations, calculation of the equilibrium constant of redox reactions, calculating titration curves, detection of end point, visual indicators and potentiometric end point detection. Quantitative applications - adjusting the analyte's oxidation state, selecting and

standardizing a titrant. Inorganic analysis - chlorine residuals, dissolved oxygen in water, water in non-aqueous solvents. Organic analysis - chemical oxygen demand (COD) in natural and waste waters, titrations of mercaptans and ascorbic acid with  $I_3^-$  and titration of organic compounds using periodate.

**Automatic titrators:** Principles and theory of  $CO_2$ , sulphate, chloride and Karl Fisher titrators.

[16 HOURS]

### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001, John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993, Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3<sup>rd</sup> edition, 2000, Blackwell Sci., Ltd. Malden, USA.
7. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

## CHEMISTRY OF SELECTED ELEMENTS COURSE CODE: 21CHB55

### Objectives

- To learn basic chemistry of some selected group elements from periodic table.
- To understand properties of metal-metal bonding and cluster compounds.

### Course outcome

- Understand the chemistry of hydrogen and group 2 elements.
- The chemistry of pseudohalogens, interhalogens and their halogen compounds.
- The chemistry of xenon and other noble gas compounds.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching. Course content

### UNIT-I

**Compounds of hydrogen:** The hydrogen and hydride ions, Dihydrogen and hydrogen bonding. Classes of binary hydrides: Molecular hydrides, saline hydrides and metallic hydrides.

**The Group 1 elements:** Occurrence, extraction and uses. Simple compounds: Hydrides, halides, oxides, hydroxides, oxoacids, nitrides, solubility and hydration and solutions in liquid ammonia. Coordination and organometallic compounds. Applications.

**The Group 2 elements:** Occurrence, extraction and uses. General properties. Halides, hydrides

and salts of oxo acids. Complex ion in aqueous solution and complexes with amido and alkoxy ligands.

**The Group 15 elements:** Introduction, oxides and oxoacids of nitrogen and phosphorus.

[16 HOURS]

## UNIT-II

**The Group 17 elements:** Occurrence, recovery and uses. Trends in properties and pseudohalogens. **Interhalogens:** Physical properties and structures, chemical properties, cationic interhalogens. **Compounds with oxygen:** Halogen oxides, oxoacids and oxoanions. Trends in rates of redox reactions and redox properties of individual oxidation states.

**Chemistry of astatine.**

**The Group 18 elements:** Occurrence, recovery and uses. Synthesis and structure of xenon fluorides, Reaction of xenon fluorides, xenon-oxygen compounds, Organoxenon compounds, other compounds of noble gases.

**M-M bonds:** Multiple metal-metal bonds.

**Cluster compounds:** carbonyl and carbide clusters.

### References

1. Basic Inorganic Chemistry – 3rd edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons (2002).
2. Inorganic Chemistry, 3rd edition. James E. Huheey, Harper and Row Publishers (1983).
3. Inorganic Chemistry, 3rd edition. G.L. Miessler and D.A. Tarr, Pearson Education (2004).
4. Inorganic Chemistry, 4th edition. C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd. (2012).
5. Chemistry of the Elements – N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
6. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F.

## CHEMISTRY OF NATURAL PRODUCTS-I

COURSE CODE: 21CHB56

### Objectives

- To learn the nomenclature, classification, purification, structure and synthesis of some natural products.
- To understand the biological functions of biomolecules.

### Course Outcome

- Acquire the knowledge of chemistry of lipids, prostaglandins and terpenoids.
- Understand the biological importance of chlorophyll and porphyrins.
- Chemistry of flavonoids and isoflavonoids.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Lipids:** Nomenclature, classification, purification, structure and synthesis of fatty acids, phospholipids, sphingolipids. Biological importance of lipids (Lecithin, sphingolipids, oils and fats).

**Prostaglandins:** Introduction, classification and biological importance of PG's. Constitution of PGE1. Synthesis of PGE & F series.

**Terpenoids:** Introduction, classification and general methods of structural elucidation. Chemistry of pinene, camphor, caryophyllene, santonin. Biosynthesis of terpenoids.

### UNIT-II

[16 HOURS]

**Porphyrins:** Introduction, structure and biological functions of haemin. Vitamin B12: structure and as coenzyme in molecular rearrangement reactions; Chlorophyll: structure and biological importance.

**Flavonoids and Isoflavonoids:** Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin, Kaempferol, Quercetin, wedelolactone, Butein, Daidzein. Biosynthesis of flavonoids and isoflavonoids: Acetate Pathway and Shikimic acid Pathway. Biological importance of flavonoids and isoflavonoids

### References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jacob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.
5. Synthetic drugs, Gurdeep R. Chatwal.
6. Heterocyclic chemistry by Achison.
7. Heterocyclic chemistry by Smith and Joule.
8. Heterocyclic chemistry by Pacquete.

## BIOPHYSICAL CHEMISTRY

COURSE CODE: 21CHB57

### Objectives

- To understand the physico-chemical principles of biological fluids.
- To learn the pharmacokinetics, pharmacodynamics, toxicokinetics of biological systems.

### Course Outcome

- After the completion of this course, the students gain the knowledge on theory and principles of biophysical chemistry and pharmacokinetics.
- This course helps to understanding the bio-availability and different pharmacokinetic parameters of drugs in the living system.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Biophysical Chemistry:** Electrophoresis - Principles of free electrophoresis, zone electrophoresis, gel electrophoresis and its applications in qualitative and quantitative study of proteins. Determination of isoelectric point of a protein. Electro-osmosis and streaming potential and its biological significance. Biological significance of Donnan membrane phenomenon. Micelles and its involvement during digestion and absorption of dietary lipids. Diffusion of solutes across bio-membranes and its application in the mechanism of respiratory exchange. -Salting In and -Salting Out of proteins. Osmotic behaviour of cells and osmo-regulation and its application in the evolution of excretory systems of organisms. Effect of temperature and pH on the viscosity of bio-molecules (albumin solution). Significance of viscosity in biological systems - mechanism of muscle contraction, polymerization of DNA and nature of blood flow through different vessels. Effect of temperature, solute concentration (amino acids) on surface tension. Biological significance of surface tension - stability of Alveoli in lungs, interfacial tension in living cells (Danielli and Davson model). Application of sedimentation velocity and sedimentation equilibrium method for molecular weight determination of proteins.

### UNIT-II

[16 HOURS]

**Pharmacokinetics:** Introduction, biopharmaceutics, pharmacokinetics, clinical pharmacokinetics, pharmacodynamics, toxicokinetics and clinical toxicology. Measurement of drug concentration in blood, plasma or serum. Plasma level-time curve, significance of measuring plasma drug concentrations.

**One compartment open model:** Intravenous route of administration of drug, elimination rate constant, apparent volume of distribution and significance. Calculation of elimination rate constant from urinary excretion data, clinical application.

**Two compartment model:** Plasma level-time curve, relationship between tissue and plasma drug concentrations, Apparent volumes of distribution. Drug clearance, clinical example. Plasma level-time curve for a three compartment open model.

Drug absorption: Factors affecting the rate of drug absorption - nature of the cell membrane, Route of drug administration - Oral drug absorption, Intravenous infusion and intravenous solutions, Effect of food on gastrointestinal drug absorption rate.

### References

1. Introduction to Physical Organic Chemistry, R.D. Gilliom, Madison – Wesley, USA (1970).
2. Physical Organic Chemistry- Reaction Rate and Equilibrium Mechanism – L.P. Hammett, McGraw HillBook, Co., (1970).
3. Biophysical Chemistry- Principle and Technique – A. Upadhyay, K. Upadhyay and N. Nath, Himalaya Publishing House, Bombay, (1998).
4. Essentials of Physical Chemistry and Pharmacy – H. J. Arnikaar, S. S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).
5. Applied Biopharmacokinetics and Pharmacokinetics - Leon Shargel, Andrew YuPrentice-Hall International, Inc (4<sup>th</sup> edition).
6. Essentials of Physical Chemistry and Pharmacy – H.J. Arnikaar, S.S. Kadam, K.N. Gujan, Orient Longman, Bombay, (1992).

## THIRD SEMESTER

### ADVANCED INORGANIC CHEMISTRY

COURSE CODE: 21CHC10

#### Objectives

- To understand the fundamental concepts of organometallic chemistry and general principles of homogeneous and heterogeneous catalysis.
- To learn the concepts of metal clusters, silicates and silicones.

#### Course Outcome

- Fundamental concepts of organometallic chemistry and synthesis, structure and bonding in different organometallics and their applications.
- Homogeneous and heterogeneous catalysts and their applications in the synthesis of organic compounds in industries.
- Chemistry of main group elements, metal clusters, silicates and silicones and their applications in day to day life.

#### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

### Course content

#### UNIT-I

[16 HOURS]

**Fundamental concepts:** Introduction, Classification of organometallic compounds by bond type, nomenclature, the effective atomic number rule, complexes that disobey the EAN rule, common reactions used in complex formation.

**Organometallics of transition metals:** Preparation, bonding and structures of nickel, cobalt, iron and manganese carbonyls. Preparation and structures of metal nitrosyls.

**Ferrocene:** Preparation, structure and bonding. **Metal-carbene and metal-carbyne complexes.**

**Complexes containing alkene, alkyne, arene and allyl ligands:** Preparation, structure and bonding.

#### UNIT-II

[16 HOURS]

**General principles of Catalysis:** Language of catalysis. Homogeneous and heterogeneous catalysts.

**Homogeneous catalysis - Industrial Applications:** Alkene hydrogenation and hydroformylation, The Wacker's process, Monsanto acetic acid process and L-DOPA synthesis, alkene oligomerizations, water-gas shift reactions. The Reppe reaction.

**Heterogeneous catalysis** –The nature of heterogeneous catalysts. Alkene polymerization: Ziegler-Natta catalysis, Fischer-Tropsch carbon chain growth. New directions in heterogeneous catalysis.

**Zeolites as catalysts for organic transformation:** Uses of ZSM – 5.

**Alkene metathesis,** hydroboration, arylation or vinylation of olefins (Heck reaction).

**Biological and Medicinal Applications:** Organomercury, organoboron, organosilicon and organoarsenic compounds.



### UNIT-III

[16 HOURS]

**Chemistry of main group elements:** Diborane and its reactions, polyhedral boranes (preparation, properties, structure and bonding). Wade's rules, carboranes and metallocarboranes. Borazines. Phosphazenes, S-N compounds.

**Metal clusters:** Evidences and factors favoring of M-M bonding, Wade's-Mingo's-Lauher rules, bi, tri, tetra, penta and hexa nuclear metal carbonyl clusters.

Low and high nuclearity carbonyl clusters. Electron counting schemes in carbonyl clusters. The isolobal analogy.

**Silicates:** Structure, classification - silicates with discrete anions, silicates containing chain anion, silicates with layer structure, silicones with three dimensional net-work and applications.

**Silicones:** General methods of preparation, properties. Silicone polymers - silicone fluids, silicone greases, silicone resins, silicone rubbers and their applications.

#### References

1. Organometallic Chemistry, 2nd edition, R.C. Mehrotra and A. Singh, New Age International Publications (2006).
2. Fundamental Transition Metal Organometallic Chemistry - Charles M. Lukehart, Brooks, Cole Publishing Company (1985).
3. The Organometallic Chemistry of the Transition Metals, 4th edition, Robert H. Crabtree, Wiley Interscience, (2005).
4. Organometallics - A Concise Introduction, 2nd edition, Christoph Elschenbroich and Albert Salzer VCH, (1992).
5. Inorganic Chemistry, 2nd edition, C.E. Housecroft and A.G. Sharpe, Pearson Education Ltd., (2005).
6. Inorganic Chemistry- 3rd edition, G.L. Miessler and D.A. Tarr, Pearson Education, (2004).
7. Basic Organometallic Chemistry - B.D. Gupta and A.J. Elias, Universities Press (2010).
8. Inorganic Chemistry Principles of Structure and Reactivity: James E. Huheey, Ellen A.
9. Keiter, Richard L. Keiter, Okhil K. Medhi, Delhi University, New Delhi (2006)
10. Chemistry of the Elements - N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
11. Inorganic Chemistry, 6th edition. D.F. Shriver, M. Weller. T. Overton, J. Rourke and F. Armstrong, Oxford University Press (2014).
12. Organometallic Chemistry and Catalysis, Didier Astruc, Springer (2007).
13. Transition Metal Organometallic Chemistry, Francois Mathey, Springer (2013).

# ORGANOMETALLIC AND PHOTOCHEMISTRY

## COURSE CODE: 21CHC11

### Objectives

- To understand the fundamental concepts of photochemistry and pericyclic reactions.
- To learn the synthesis and reactions of organometallic compounds.
- To learn the asymmetric synthesis of organic compounds.

### Course Outcome

- Basic concepts of photochemistry and pericyclic reactions and their usefulness in the synthesis of many organic compounds.
- Synthesis of organic compounds using different organometallic compounds as catalysts.
- Asymmetric synthesis of organic compounds using chiral compounds.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation is used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Photochemistry:** Light absorption and electronic transitions, Jablonski diagram, intersystem crossing, energy transfer, sensitizers, quenchers. Photochemistry of olefins, conjugated dienes, aromatic compounds, ketones-Norrish type-I and Norrish type-II reactions, enones, Paterno-Buchi reaction, di-pi methane rearrangement, photooxidation, photoreduction.

**Pericyclic reactions:** Electrocyclic reactions: Stereochemistry, symmetry and Woodward-Hofmann rules for electrocyclic reactions, FMO theory of electrocyclic reactions, correlation diagram for butadiene to cyclobutene and hexatriene to cyclohexadiene systems. Cycloaddition reactions: Classification, analysis by FMO and correlation diagram method. Cycloaddition reactions: [2+2] and [4+2] cycloadditions-FMO and correlation diagram method, Diels-Alder reaction, hetero Diels-Alder reaction and their applications. Intra and intermolecular 1,3-dipolar cycloadditions: involving nitrile oxide, nitrile imine, nitrile ylide and their application in organic synthesis. Sigmatropic reactions: Classification, stereochemistry and mechanisms. suprafacial and antarafacial shifts of H and carbon moieties. [3,3] and [5,5]-sigmatropic rearrangement, Claisen, Cope and aza-Cope rearrangement.

### UNIT-II

[16 HOURS]

**Chemistry of organometallic compounds:** Synthesis and reactions of organolithium (n-BuLi, PhLi), organocadmium, organomagnesium (Grignard reagent), organoselenium and organotellurium. Organoaluminium reagents: Preparation, site selective and stereoselective additions of nucleophiles mediated by organoaluminum reagents, reaction with acid chlorides, allyl vinyl ethers, 1,2-addition to imines and application in the synthesis of natural products. Organocopper reagents: Gilman reagent, preparation, reactions with aldehydes, ketones and imines. Application in the synthesis of brevicomin, Organozinc reagents: Preparation - oxidative addition and transmetallation, addition reactions of alkyl, aryl, allylic and propargylic zinc reagents, diastereoselective and enantioselective addition reaction with aldehydes, Reformatsky reaction. Organotin reagents: tributyltin hydride, Barton decarboxylation reaction, Barton deoxygenation reaction, Stille coupling, Stille-Kelley coupling reactions, Barton McCombie reaction, Keck stereoselective allylation and other applications.

## UNIT-III

[16 HOURS]

**Asymmetric synthesis:** Definition, importance, mechanism, energy consideration, advantages and limitations, methods of determination of enantiomeric excess. Methods of asymmetric induction:

**Topicity-Prochirality:** Substrate selectivity - Diastereoselectivity and enantioselectivity- Substrate controlled methods-use of chiral substrates - examples

**Auxiliary controlled methods:** Use of chiral auxiliaries - Chiral enolates-alkylation of chiral imines - Asymmetric Diels - Alder reaction

**Reagent controlled methods:** Use of chiral reagents - Asymmetric oxidation – Sharpless epoxidation - Asymmetric reduction - Use of lithium aluminium hydride and borate reagents. Synthesis and applications of oxazaborolidines, IPC-BBN, IPC2BH, (*S*)-BINAP-DIAMINE and (*R*)-BINAL-H. Use of (*R,R*)-DIPAMP, (*S,S*)-CHIRAPHOS, (*R,R*)-DIOP, SAMP, RAMP, *S*-Proline, *S*-PBMgCl, (-)-BOAlCl<sub>2</sub>, (+) and (-)-DET.

### References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Advance Organic Chemistry, IV edition, Jerry March.
3. Advance Organic Chemistry, III edition, Part-A and Part-B, Francis A. Carey and Rechar J. Sundberg.
4. Organic Chemistry, III edition, V. K. Ahluwalia and Rakesh Kumar Parashar.
5. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jacob Sharefkin.
6. Asymmetric synthesis, Garry Procter.
7. Mechanism in Organic Chemistry, VI edition, Peter Sykes.
8. Molecular reactions and photochemistry, Charles H. Depuy, Orville L. Chopman.
9. Modern methods of Organic synthesis, III edition, W. Carruthers.
10. Organometallics in Organic synthesis, J. M. Swan and D. Stc Black.
11. Organic chemistry by Clayden, Greeves, Warren and Wothers.

**ADVANCED PHYSICAL CHEMISTRY**  
**COURSE CODE: 21CHC12**

**Objectives**

- To understand the concepts of enzyme kinetics, industrial catalysis and linear free energy relationship.
- To learn the electrochemical aspects of batteries and electroplating.
- To understand the mechanism of corrosion prevention of metals by different methods.
- To understand the fundamentals of X-ray crystallography.

**Course Outcome**

- Applications of reaction kinetics help in correlating the rates of biological and chemical reactions.
- Theory and applications of electrochemical systems helps in the field of e-waste management and protection of metals.
- Fundamentals of X-ray crystallography and structural interpretation by various X-ray diffraction techniques.

**Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animation are used in class room teaching.
- Students will be assigned to solve the numerical problems to understand the concepts.

**Course content**

**UNIT-I**

**[16 HOURS]**

**Homogeneous Catalysis:** Electronic and structural effects on acidity and basicity. Hard and soft acids and bases. Acidity functions: Hammett acidity function, Zuckerman-Hammett hypothesis, Bonnett hypothesis. Industrial catalysis: Catalyst carrier, promoter, inhibitor and catalyst poison.

**Enzyme kinetics:** Effect of substrate concentration (Michaelis - Menton equation), Effect of pH, effect of catalysts and inhibitors (substrate, zeolite,  $\text{Cr}^{3+}$ ,  $\text{Fe}^{2+}$  ZnO, U.V light), effect of temperature. A brief kinetic and mechanistic applications of glucose oxidase in the oxidation of glucose.

**Linear Free Energy Relationship:** Hammett equation, Taft equation, Okamoto Brown equation and its application to oxidation of amino acids and aromatic amines. Swain-Scott and Edward equation. Winstein - Grunwald relationship. Isokinetic relationship and significance of isokinetic temperature, Exner criterion.

**Kinetic Isotope Effect:** Theory of kinetic isotope effect - normal and inverse isotope effect, primary isotope effect, secondary isotope effect, solvent isotope effect.

**UNIT-II**

**[16 HOURS]**

**Electrochemical cells and batteries:** Introduction, galvanic and electrolytic cells, schematic representation of cells. Faraday's law, mass transfer in cells. Batteries: Classification, characteristics, primary, secondary and lithium batteries, fuel cells.

**Electroplating:** Definition, theory and mechanism of electroplating, effect of plating variables on the properties of electro deposits, comparative account of complexing and non-complexing baths (general treatment), additives on plating baths and their significance.

**Metallic coating:** Preparation of substrate surface, electroplating of Cu and Cr. Application of

Au and Ag plating.

**Corrosion:** Types of corrosion, basis of electrochemical corrosion, theories and mechanism of wet corrosion. Thermodynamic aspects of corrosion. Current – potential relations (Evan diagram) in corrosion cells. Factors influencing the rate of corrosion: Metal and environmental factors. Kinetic aspects corrosion: Corrosion rate measurement by different methods – chemical and electrochemical methods. General aspects of corrosion prevention and control – designing aspects, effect of alloying and surface modification. Corrosion prevention by painting, phosphating and anodic (passivation) and cathodic protection. Corrosion inhibitors: Introduction, classification, Characteristics and requirements of efficient corrosion inhibitors, Green inhibitors and their significance, Corrosion inhibition mechanism.

### UNIT-III

[16 HOURS]

**Fundamentals of X-ray crystallography:** Law of interfacial angles, laws of symmetry, Miller indices, Bragg equation (No derivation), Experimental methods – powder and rotating crystal methods, indexing of powder and rotating crystal photographs. Atomic scattering factor, structure factor, Fourier synthesis and electron density diagrams. Electron diffraction of gases, experimental technique, Scattering-Intensity curves, Wierl equation (no derivation), Radial distribution method determination of bond lengths and bond angles.

**Imperfections in atomic packing:** Types of imperfections, classification of imperfections, point defects, Schottky defects, Frenkel defects, disordered crystals, line defects, dislocation types, plane defects, small-angle and large-angle boundaries, stacking faults, crystal growth and twinning, non-stoichiometry.

**Imperfections and physical properties:** electrical, optical, magnetic, thermal and mechanical properties.

#### References

1. Chemical Kinetics by K.J. Laidler, Tata McGraw-Hill Pub, Co Ltd, New Delhi.
2. Fundamentals of Chemical Kinetics, M. R. Wright, Harwood publishing, Chichesrer, 1999.
3. Kinetics and Mechanism of Chemical Transformation by J. Rajaram and J.C. Kuriacose, Macmillan, New Delhi.
4. Electrochemistry –Principles and Applications by E.G. Potter, Cleaver-Hume press Ltd, London.
5. Chemical and Electrochemical energy systems, R. Narayan and B. Viswanathan (University Press), 1998.
6. Industrial Electrochemistry, D. Pletcher and F. C. Walsh, Chapman and Hall, 2<sup>nd</sup> Edn, 1984.
7. An Introduction to Metallic Corrosion and its Prevention, Raj Narayan (Oxford –IBH, New Delhi), 1983.
8. Fundamentals of metallic corrosion, Philips A. Schweitzer, CRC press Taylor and Francis group, New York.
9. Corrosion prevention and control, Baldev Raj, U Kamachi Mudali & S. Rangarajan, Narora Publishing House, India.
10. Solid State Chemistry and its applications – A.R. West, John Wiley & Sons.
11. New Directions in Solid State Chemistry – CNR Rao and J. Gopalakrishna, Cambridge University Press.
12. Solid state chemistry, N. B. Hannay, PHI, New Delhi.
13. Principles of the Solid State – H.V. Keer, Wiley Eastern.

# CHEMICAL SPECTROSCOPY

COURSE CODE: 21CHC13

## Objectives

- To understand the basic concepts of spectroscopic techniques such as NMR, ESR, NQR, Mossbauer and photoelectron spectroscopy.
- To familiarize with the IR and mass spectroscopy.

## Course Outcome

- Understand the spectroscopic techniques such as NMR, IR, UV, and MS for recording and interpretation of spectra.
- Understand the characterization of chemical compounds.
- To learn electric and magnetic properties of radiation, molecules and bulk matter and solve the problems related to these properties.
- Understanding various fragmentation reactions of organic molecules.
- Predict the NMR, IR, UV, and MS spectra from a given molecular structure, including fragment-ions in MS.

## Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animation are used in class room teaching.
- Students will be assigned to solve the spectroscopic problems to understand the interpretation of spectra.

## Course content

### UNIT-I

[16 HOURS]

**NMR Spectroscopy:** Magnetic properties of nuclei (magnetic moment, g factor, nuclear spin), effect of external magnetic field on spinning nuclei, Larmor precession frequency, resonance conditions, population of nuclear magnetic energy levels, relaxation processes, relaxation time, line width and other factors affecting line width. Chemical Shift: Standards employed in NMR, factors influencing chemical shift: electronegativity, shielding and deshielding, van der Waals deshielding magnetic anisotropy, H-bonding, diamagnetic and paramagnetic anisotropies, spin-spin coupling, chemical shift values and correlation for protons bonded to carbon and other nuclei, Instrumentation. Chemical shift equivalence and magnetic equivalence, effects of chiral centre, Karplus curve-variation of coupling constants with dihedral angle. Complex NMR Spectra: Simplification of complex spectra-isotopic substitution, increased magnetic field strength, double resonance and lanthanide shift reagents, Nuclear Overhauser Effect (NOE), FT-NMR Spectroscopy and advantages.  $^{13}\text{C}$ -NMR Spectroscopy: multiplicity-Proton decoupling-Off resonance decoupling; Chemical shift, application of  $^{13}\text{C}$ ,  $^{19}\text{F}$ ,  $^{31}\text{P}$ ,  $^{11}\text{B}$  and  $^{15}\text{N}$ . Applications of NMR: Structural diagnosis, conformational analysis, keto-enol tautomerism, H-bonding. Solid state NMR and its applications.

**Multiple resonance spectroscopy:** Introduction to 2D-techniques: DEPT, COSY and NOESY.

### UNIT-II

[16 HOURS]

**Electron Spin Resonance Spectroscopy:** Basic principles, hyperfine couplings, the g values, factors affecting g values, isotropic and anisotropic hyperfine coupling constants, Zero

Field splitting and Kramer's degeneracy. Measurement techniques and applications to simple inorganic and organic free radicals and to inorganic complexes.

**NQR Spectroscopy:** Introduction, Principles, Quadrupolar nuclei, electric field gradient, nuclear quadrupole coupling constants, energies of quadrupolar transitions, effect of magnetic field. Applications.

**Mössbauer spectroscopy:** The Mössbauer effect, chemical isomer shifts, quadrupole interactions, magnetic splitting, measurement techniques and spectrum display, application to the study of  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$  compounds; iron in very high oxidation states- $\text{Fe(V)}$  and  $\text{Fe(VI)}$  nitride complexes;  $\text{Sn}^{2+}$  and  $\text{Sn}^{4+}$  compounds, nature of M-L bond, coordination number and structure, detection of oxidation states and an inter halogen compound  $\text{I}_2\text{Br}_2\text{Cl}_4$ .

**Photoelectron Spectroscopy:** Introduction, principles, chemical shifts, photoelectron spectra of simple molecules. X-ray photoelectron and Auger electron spectroscopy- Principles and applications.

### UNIT-III

[16 HOURS]

**IR spectroscopy:** Introduction, instrumentation, sample handling, Characteristic group frequencies and skeletal frequencies. Finger print region, Correlation chart. Identification of functional groups-alkanes, alkenes, alkynes, aromatics, carbonyl compounds (aldehydes, ketones, esters and lactones), halogen compounds, sulphur and phosphorous compounds, alcohols, amides, lactams, amino acids and amines, Factors affecting group frequencies and band shapes: conjugation, resonance and inductance, hydrogen bonding and ring strain. tautomerism, *Cis-trans* isomerism. Applications of IR spectroscopy.

**Mass Spectrometry:** Basic principles, Instrumentation-Mass spectrometer, interpretation of mass spectra, resolution, molecular ions, meta-stable ions, Nitrogen rule and isotope ions. Different methods of ionization (chemical ionization, electron impact, field ionization-FAB and MALDI). Fragmentation processes-representation of fragmentation, basic fragmentation types and rules. Factors influencing fragmentations and reaction pathways. McLafferty rearrangement. Fragmentations (fragmentation of organic compounds with respect to their structure determination) associated with functional groups-alkanes, alkenes, cycloalkanes, aromatic hydrocarbons, halides, alcohols, phenols, ethers, acetals, ketals, aldehydes, ketones, quinines, carboxylic acids, esters, amides, acid chlorides, nitro compounds, amines & nitrogen heterocycles. Fragmentation patterns of glucose, myrcene, nicotine, retro Diels-Alder fragmentation. Composite problems involving the applications of UV, IR,  $^1\text{H}$  and  $^{13}\text{C}$ -NMR and mass spectroscopic techniques for the structural elucidation of organic compounds.

### References

1. Organic Spectroscopy-3rd Ed.-W. Kemp (Pargrave Publishers, New York), 1991.
2. Spectrometric Identification of Organic Compounds - Silverstein, Bassler & Monnill (Wiley) 1981.
3. Spectroscopy of Organic Compounds-3rd Ed.-P.S. Kalsi (New Age, New Delhi) 2000.
4. E.A.V. Ebsworth, D.W.H. Ranklin and S. Craddock: Structural Methods in Inorganic Chemistry, Blackwell Scientific, 1991.
5. J. A. Iggo: NMR Spectroscopy in Inorganic Chemistry, Oxford University Press, 1999.
6. C. N. R. Rao and J. R. Ferraro: Spectroscopy in Inorganic Chemistry, Vol I & II (Academic) 1970.
7. Spectroscopy, B. P. Straughan and S. Salker, John Wiley and Sons Inc., New York, Vol.2, 1976.
8. Application of Absorption Spectroscopy of Organic Compounds, John R. Dyer, Prentice/Hall of India Private Limited, New Delhi, 1974.
9. Organic Spectroscopy, V. R. Dani, Tata McGraw-Hall Publishing Company Limited, New Delhi. 1995.

10. Interpretation of Carbon-13 NMR Spectra, F.W. Wehrli and T. Wirthin, Heyden, London, 1976.
11. NMR spectroscopy-Powai

### **SOFT CORE**

#### **ANALYTICAL CHEMISTRY PRACTICALS**

**COURSE CODE: 21CHC50**

**[64 HOURS]**

#### **Objectives**

- To familiarize with the handling of instruments in the quantitative analysis of various samples.
- To understand the analysis of real samples like waste water, soil samples and biological samples and mixtures

#### **Course Outcomes**

After studying this course, the student to:

- Get experience on analysis of various complex mixtures by following multistep reactions.
- Acquire the knowledge on handling instruments and to overcome the general problems arises during the analysis.
- Acquire industrial skills required for sampling, analytical and interpretation and presentation of results.
- Possess adequate knowledge on literature search for developed analytical methods.

#### **Pedagogy**

- Each student performs experiments as per the protocol in practical classes.
- Computer aided applications are used for the evaluation of experimental results.

**[128 HOURS]**

#### **PART – III**

1. Determination of calcium in limestone by redox, acid-base and complexation titrations.
2. Determination of vitamin C in orange juice by titration with cerium(IV) and with 2,6-dichlorophenol indophenol.
3. Determination of mercury in an algicide by EDTA titration; and arsenic in ant control preparation by redox titration.
4. Determination of aluminium and magnesium in antacids by EDTA titration.
5. Analysis of a copper-nickel alloy sample for copper and nickel by EDTA titration using masking and selective demasking reactions.
6. Determination of saccharin in tablets by precipitation titration.
7. Determination of iodine value and saponification value of edible oils.
8. Determination of ascorbic acid in goose berry/bitter gourd by titrimetry and spectrophotometry using *N*-bromosuccinimide (NBS).
9. Analysis of a mixture of iron(II) and iron(III) by EDTA titration using pH control.



10. Determination of sulpha drugs by potentiometry using  $\text{NaNO}_2$  and iodometric assay of penicillin.
11. Solvent extraction method for determination of silver as ion-associate with 1,10-phenanthroline and bromopyragallool red.
12. Electrolytic determination of copper and lead in brass.
13. Polarographic determination of copper and zinc in brass.
14. Determination of sodium, potassium and calcium in mineral waters by atomic emission spectrometry.
15. Determination of iron in mustard seeds and phosphorus in peas by spectrophotometry.
16. Analysis of waste water for anionic detergents and phenol by spectrophotometry.
17. Fluorimetric determination of riboflavin (vit.  $\text{B}_2$ ) in tablets.
18. Colorimetric analysis of procaine by diazotization and coupling reaction.
19. Determination of manganese in steel by extraction-free spectrophotometry and molybdenum in steel by extractive spectrophotometry.
20. Determination of ethanol in wine by titrimetric and spectrophotometric dichromate methods

#### **PART – IV**

1. Analysis of waste waters for DO and COD by titrimetry.
2. Analysis of a ground water sample for sulphate by titrimetry (EDTA) and turbidimetry.
3. Potentiometric determination of formula and stability constant of a silver-ammonia complex ion.
4. Determination of aspirin, phenacetin and caffeine in mixture and APC tablets by solvent extraction and UV spectrophotometry.
5. Kinetic determination of urinary creatinine and purity of a commercial  $\text{H}_2\text{O}_2$  sample.
6. Determination of chromium(III) and iron(III) in a mixture by kinetic masking methods.
7. Catalytic determination of traces of selenium in biological materials and iodide in blood serum.
8. Photometric and potentiometric titration of iron(III) with EDTA.
9. Photometric and potentiometric titration of copper with EDTA.
10. Determination of copper(II) and iron(III) in mixture by photometric titration with EDTA.
11. Analysis of brackish water for chloride content by a) spectrophotometry (mercuric thiocyanate method), b) conductometry (silver nitrate) and c) potentiometry (silver nitrate).
12. Conductometric titration of sodium acetate with HCl and  $\text{NH}_4\text{Cl}$  with NaOH.
13. Ascorbic acid determination in natural orange juice by coulometry.
14. Spectrophotometric determination of iron in natural waters using thiocyanate and 1,10-phenanthroline as reagents.
15. Determination of fluoride in drinking water/ground water by spectrophotometry(alizarin red lake method).
16. Analysis of waste water for
  - a) Phosphate by molybdenum blue method

- b) ammonia-nitrogen by Nessler's method
  - c) nitrite-nitrogen by NEDA method
15. Analysis of a soil sample for
- a) Calcium carbonate and organic carbon by titrimetry.
  - b) Calcium and magnesium by EDTA titration.
16. Analysis of a soil sample for
- a) Nitrogen content by Kjeldahl method
  - b) Available phosphorus by spectrophotometry.
  - c) Nitrate-nitrogen/nitrite nitrogen/ammonia nitrogen by spectrophotometry.
  - d) Sodium and potassium by flame photometry.
17. Analysis of urine for
- a) Urea and uric acid by titrimetry and spectrophotometry.
  - b) Sulphate by precipitation titration after ion-exchange separation.
  - c) Sugar by Benedict's reagent.
18. Analysis of blood for
- a) cholesterol by spectrophotometry
  - b) Bicarbonate by acid-base titration.
19. Fluorimetric determination of quinine in an antimalarial tablet.

### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993, prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulations, P. D. Sethi, 3<sup>rd</sup> edition, CBS Publishers & Distributors, New Delhi, 1997.
7. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. Bothers Medical Publishers (P) Ltd., 1995.
8. Laboratory Manual in Biochemistry, J. Jayaraman, New Age International Publishers, New Delhi, 1981.
9. Experiments on Water Pollution, D.I. Williams and D. Anglesia, Wayland Publishers Ltd., England, 1978.
10. Experiments on Land Pollution, D.I. Williams and D. Anglesia, Wayland Publishers Ltd., England, 1978.

15. Experiments in Environmental Chemistry, P.D. Vowler and D.W. Counel, Pergamon Press, Oxford 1980.
16. Manual Soil Laboratory Testing, vol.I, K.H. Head, Pentech Press, London 1980.

**INORGANIC CHEMISTRY PRACTICALS**  
**COURSE CODE: 21CHC51**

**[64 HOURS]**

**Objectives**

- To familiarize with the instrumental methods of analysis for determining metals present in the different samples.
- To familiarize with the preparation and characterization of different inorganic complexes.

**Course Outcome**

- Determination of alloy samples and understanding the electrochemical deposition of metals.
- Preparation and characterization of coordination compounds.
- Determination of composition, stability constant and magnetic susceptibility of metal complexes.

**Pedagogy**

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of the synthesized complexes.

**Course experiments**

**PART-A**

1. Determination of bismuth, cadmium and lead in a mixture: Analysis of a low melting alloy (Wood's alloy).
2. Simultaneous spectrophotometric determination of chromium and manganese in a steel solution.
3. Determination of chromium(III) and iron(III) in a mixture: Kinetic masking method.
4. Electrogravimetric determination of:
  - a) Copper in copper sulphate
  - b) Nickel in nickel sulphate
  - c) Copper and nickel in alloy solution
  - d) Lead in lead nitrate.
5. Flame photometric determination of the following metal ions from different samples:
  - a) sodium b) potassium and c) sodium and potassium in a mixture.
6. Polarographic estimation of cadmium and zinc.
7. Determination of iron as the 8-hydroxyquinolate by solvent extraction method.
8. Quantitative determination of nickel using dithizone and 1,10-phenanthroline by synergistic extraction.
9. Spectrophotometric determination of the  $pK_a$  value of methyl red.
10. Semimicro gravimetric determination of aluminium.

**PART-B**

1. Preparation and characterization of:
  - a) Chloropentammine cobalt(III) chloride
  - b) Estimation of chloride in a complex by potentiometric or ion-exchange method

- c) Record the electronic absorption spectrum of a complex and verify TanabeSugano diagram.
2. Preparation of *cis*- and *trans*- dichlorobis(ethylenediammine) cobalt(III)chloride. Record the UV-Vis spectra and compare it with *cis*-form. Measure the molar conductance.
3. Preparation of hexammine cobalt(III) chloride and estimate cobalt ion.
4. Determination of magnetic susceptibility of any two compounds/complexes by Gouy method.
5. Determination of the composition of iron-phenanthroline complex by:
  - (a) Job's method
  - (b) mole-ratio method and
  - (c) Slope-ratio method.
6. Determine the stability constant of iron-tiron/iron-phenanthroline by Turner-Anderson method.
7. Preparation of potassium tris(oxalato)ferrate(III) and estimate the metal ion.
8. Preparation of acetyl acetonatomanganese(III) complex.
9. Preparation of tris(en)nickel(II) chloride and hexamine nickel(II) chloride complexes. Record electronic spectra and evaluate spectrochemical series.
10. Using chloropentammine cobalt(III) chloride, prepare nitro and nitritopentammine cobalt(III) chloride. Record the IR spectra of the isomers and interpret.
11. Estimate the chloride ion in a given complex by silver nitrate titration after ion-exchange separation.
12. Demonstration Experiments:
  - (a) Recording and interpretation of IR and NMR spectra of complexes.
  - (b) Spectrochemical series- Evaluation of Dq value.
  - (c) DNA interaction with metal complexes by UV-visible absorption and viscosity methods.

## References

1. Advanced Physico-Chemical Experiments – J. Rose.
2. Instrumental Analysis Manual - Modern Experiments for Laboratory – G.G. Guilbault and L.G. Hargis.
3. A Text Book of Quantitative Inorganic Analysis – A.I. Vogel, 5<sup>th</sup> edition.
4. Experimental Inorganic Chemistry – G. Palmer.
5. Inorganic Synthesis – O. Glemser.
6. Experimental Inorganic/Physical Chemistry- Mounir A. Malati.
7. Quantitative Chemical Analysis – Daniel C. Harris, (2006) 7<sup>th</sup> edition.
8. Spectrophotometric Determination of Elements – Z. Marczenko

## ORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHC52

[64 HOURS]

### Objectives

- To understand the concepts of isolation and purification of natural products.
- To familiarize with the estimation of different functional groups in organic compounds.

### Course Outcome

- The isolation of caffeine, carotene, lycopene, cincole, azelaic acid and piperine from respective natural sources.
- Estimation of ketones, sugars, nitro and amino groups in natural products.
- Interpret UV, IR, NMR and MS data of different organic compounds.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of isolated natural products.

### Course experiments

#### PART-A

1. Fractional crystallization: separation of mixture of naphthalene and biphenyl.
2. Thin layer chromatography: Separation of plant pigments.
3. Column chromatography: Separation of *o*- and *p*-nitro aniline
4. Isolation of piperine from pepper.
5. Isolation of caffeine from tea.
6. Isolation of azelaic acid from castor oil.
7. Isolation of carotene from carrot.
8. Isolation of lycopene from tomato.
9. Isolation of cincole from eucalyptus leaves.

#### PART-B

#### Isolation of natural products & estimations:

1. Estimation of ketones by haloform reaction.
2. Estimation of sugars by Bertrand's method.
3. Estimation of nitro groups.
4. Estimation of amino group.
5. Determination of enol content by Meyer's method.
6. Determination of iodine value of an oil or fat.
7. Determination of saponification value of oil.
8. Determination of equivalent weight of carboxylic acid by silver salt method

**Interpretation of Spectra:** Structural elucidation of some simple organic compounds by UV, IR, NMR and mass. Spectra have to be provided by the Teachers/ Examiners.

### References

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-III: Quantitative organic analysis, By Arthur I, Vogel.
3. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
4. Practical Organic Chemistry by Mann F. G. and Saunders.
5. Natural products: A laboratory guide by Raphael Ikhan.

## PHYSICAL CHEMISTRY PRACTICALS

### Objectives

**COURSE CODE: 21CHC53**

**[64 HOURS]**

- To understand the significance of various factors influencing the reaction rate in proposing the reaction mechanism.
- To understand electrochemical and spectrophotometric methods of quantification of samples, and also determination of physico-chemical parameters of some important samples.

### Course Outcome

- Students can able to develop experimental skill and interpretation of plausible mechanisms of reactions.
- Gain practical knowledge on the theoretical basis of electrochemistry, thermodynamics, and spectrophotometry experiments.
- This helps in academics, research and industries.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Electrochemical and spectrophotometric tools are used to conduct the experiments.

## Course experiments

### PART-A

1. Determination of order of reaction for the acid hydrolysis of methyl acetate and evaluation of activation parameters.
2. Evaluation of Arrhenius parameters for the reaction between  $K_2S_2O_8$  and KI (First order reaction).
3. Study of kinetics of autocatalytic reaction between oxalic acid and  $KMnO_4$  and determine the order of reaction with respect to  $KMnO_4$ .
4. Kinetics of saponification of ethyl acetate by conductivity method and study the effect of dielectric constant of the medium (using  $CH_3OH$ ).
5. Study of effect of salt (ionic strength) on the kinetics of reaction between potassium persulphate and potassium iodide (second order reaction).
6. Spectrophotometric kinetics of oxidation of indigocarmine (IC) by chloramine-T (CAT) – Determination of order of reaction with respect to [CAT] and [IC].
7. To study the acid catalysed kinetics of oxidation of glycine by chloramine-T (CAT) - determination of order of reaction with respect to [CAT] and [glycine].
8. Study the phase diagram of three component system (Glacial acetic acid-Chloroform-water system / Glacial acetic acid-Acetone-Water system).
9. Study the rate of corrosion and inhibition efficiency of an inhibitor (thiourea) on mild steel/Al/Cu by weight loss method.

### PART-B

1. Conductometric titration of orthophosphoric acid against NaOH.
2. Conductometric titration of a mixture of HCl,  $CH_3COOH$  and  $CuSO_4$  against NaOH.
3. Conductometric titration of thorium nitrate with potassium tartarate.
4. Potentiometric titration of mixture of weak acids (acetic acid and monochloroacetic acid) against NaOH.
5. Determination of  $pK_a$  values of phosphoric acid by potentiometric / pH metric method.

- Potentiometric titration of mixture of KCl+KBr+KI against AgNO<sub>3</sub>.
- Potentiometric titration of FAS against ceric sulphate and sodium metavanadate, determine the concentration of FAS and redox potential.
- Potentiometric titration of lead nitrate against EDTA and determine the concentration of lead nitrate solution.
- Determination of *pK* value of an indicator (methyl orange/methyl red).
- Spectrophotometric analysis of a mixture of (a) KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
- Study of complex formation between ferric salt and salicylic acid.

### References

- Practical Physical Chemistry – A.J. Findlay.
- Experimental Physical Chemistry – F. Daniels *et al.*
- Selected Experiments in Physical Chemistry – Latham.
- Experiments in Physical Chemistry – James and Prichard.
- Experiments in Physical Chemistry – Shoemaker.
- Advanced Physico-Chemical Experiments – J. Rose.
- Practical Physical Chemistry – S.R. Palit.
- Experiments in Physical Chemistry – Yadav, Geol Publishing House.
- Experiments in Physical Chemistry – Palmer.
- Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
- Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

**SOFT CORE**  
**KINETIC AND RADIOCHEMICAL METHODS OF ANALYSIS**  
**COURSE CODE: 21CHC54**

### Objectives

- To learn aspects of kinetic and radiochemical methods for analysis
- To understand the knowledge of applied aspects of recent needs by simple techniques

### Course Outcome

- To understand the reaction kinetics
- To gain the principles of radiochemical methods
- To understand the applicability of radiometric assays

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and information and communications technology are used in class room teaching.
- Students will be assigned to solve the numerical problems to understand electrochemical concepts.

### Course Content

#### Unit-I

[16 HOURS]

**Kinetic methods of analysis:** Analytical uses of reaction rates relative, basis of reaction rate

methods, rate laws-first and second order reactions relative rates of reactions, analytical utility of first or pseudo first order reactions, determination of reaction rates, types of kinetic methods- differential methods, integral methods, multicomponent analysis-neglect of reaction of slow- reacting component, logarithmic extrapolation method, reaction rate method, applications- catalyzed reactions, measurement methods for catalyzed reactions, micro determination of inorganic species like iodide, selenium, cobalt & mercury in complex materials, determination of organic species, non-catalytic reactions. Applications of enzyme-catalysed reactions for the analysis of substrates stoichiometric and rate methods, determination of urea, uric acid, blood glucose, galactose and blood alcohol, determination of enzymes-LDH, GOT and GPT. A brief outline of IR, UV, NMR, Mass spectroscopy as tools for kinetic study.

## UNIT – II

[16 HOURS]

**Radiometric methods:** Radioactive isotopes. Nuclear emissions- $\alpha$  and  $\beta$ -particles, neutrons, gamma rays and miscellaneous nuclear particles. Nuclear reactions, radiochemical decay and activity. Instrumentation and measurement of radioactivity. Radiation detectors-gas ionization, scintillation and semiconductor detectors. Pulse height analysis. Autoradiography. Statistics of radioactive measurements.

**Radiochemical analysis: Neutron activation methods-**neutrons and their sources. Interaction of neutrons with matter. Theory, experimental considerations and applications.

**Isotope dilution methods-**direct isotope dilution and inverse isotope dilution methods and their applications. Radiometric titrations. Radiorelease methods. Radioactive tracers.

**Radio immunoassay:** Principles of immunoassay. Specificity of immuno assays. Preparation of the antibody, incubation period for the assay, separation of the bound and free antigen. Fluorescence immunoassay. Enzyme immunoassay.

### References:

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993 Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Instrumental Methods of Analysis by H.H. Willard, L.L. Merritt and J.A. Dean, 7<sup>th</sup> edition, (1988).
7. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3<sup>rd</sup> edition, 2000, Blackwell Sci., Ltd. Malden, USA.
8. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.



9. Introduction to Instrumental Analysis, Braun, Pharm. Med. Press. India.
10. Instrumental Method of Analysis, W. M. Dean and Settle, 7<sup>th</sup> edition, 1986, CBS Publishers, New Delhi.
11. Instant Notes of Analytical Chemistry, Kealey and Haines, Viva books Pvt. Ltd., 2002.
12. Soil Chemical Analysis, M.L. Jackson, Prentice Hall of India Pvt. Ltd., New Delhi, 1973.
13. Clinical Chemistry, Principles and Procedures, J.S. Annino, 2<sup>nd</sup> edition, Boston: Little, Brown, 1960.
14. Methods of Geochemical Analysis, D. Click, Ed., A Multivolume series, New York, Interscience.
15. Clinical Chemistry, Principles and Techniques, R.J. Henry, D.C. Cannon and J.W. Winkleman, Eds., 2<sup>nd</sup> edition, Hagerstorm, M.D: Harper and Row, 1974.
16. Fundamentals of Clinical Chemistry, N.W. Tietz, Ed., 2<sup>nd</sup> edition, Philadelphia: W.B. Saunders, 1976.

## FRONTIERS IN INORGANIC CHEMISTRY

COURSE CODE: 21CHC55

### Objectives

- To understand the basic concepts, synthesis and applications of materials.
- To learn the properties, fabrication and characterization of nanomaterials.

### Course Outcome

- Gain knowledge on design and synthesis of new inorganic materials.
- Fabrication and characterization of nanomaterials.
- Applications of ceramics, pigments, silicates and biomaterials.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Materials chemistry:** Historical Perspectives. Design of new materials through a Critical Thinking Approach. Materials sustainability.

**Synthesis of materials:** The formation of bulk material by different methods.

**Defects and ion transport:** Extended defects. Atom and ion diffusion. Solid electrolytes.

**Metal oxides, nitrides and fluorides:** Monoxides of the 3d metals, higher oxides and complex oxides, oxide glasses, nitrides and fluorides.

**Sulfides, intercalation compounds and metal rich phases:** Layered MS<sub>2</sub> compounds and intercalation, Chevrel phases.

**Ceramic materials:** Sol-gel process and applications of biomaterials of ceramics.

**Inorganic pigments:** Coloured pigments, white and black inorganic materials.

**Molecular materials and fullerides:** Fullerides, Molecular material chemistry.

**Silicates:** Structure, classification - silicates with discrete anions, silicates containing chain anion, silicates with layer structure, silicones with three dimensional net work and applications.

## UNIT-II

**Nanomaterials**-Introduction.

[16 HOURS]

**Fundamentals**-Terminology and history.

**Characterization and fabrication:** Top-down and bottom-up fabrication. Solution based synthesis of nanoparticles. Vapour-phase synthesis of nanoparticles. Templated synthesis of nanomaterials using frameworks, supports and substrates. Sonochemical microwave methods for the synthesis of nanoparticles.

Structural study of nanocomposites by different methods.

**Nanostructures and properties**

One-dimensional control: carbon nanotubes and inorganic nanowires.

Two-dimensional control: grapheme, quantum wells and solid-state super lattices.

Three-dimensional control: mesoporous materials and composites.

**Some applications of inorganic/organic/polymeric materials:** Optical, electrical, magnetic, and chemical and biosensors.

### References

1. Inorganic Chemistry, 4th edition. P. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Oxford University Press (2006).
2. Inorganic Chemistry Principles of Structure and Reactivity: James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Medhi, Delhi University, New Delhi (2006).
3. Chemistry of the Elements – N.N. Greenwood and A. Earnshaw, Pergamon Press (1985).
4. Industrial Inorganic Chemistry – 2nd edition. K.H. Buchel, H.H. Moretto and P. Woditsh, Wiley - VCH (2000).
5. Basic Inorganic Chemistry – 3rd edition. F.A. Cotton, G. Wilkinson and P.L. Gaus, John Wiley and Sons (2002).
6. Inorganic Chemistry, 3rd edition. James E. Huheey, Harper and Row Publishers (1983).
7. Inorganic Chemistry, 3rd edition. G.L. Miessler and D.A. Tarr, Pearson Education (2004).
8. Inorganic Chemistry, 2nd edition. C.E. Housecroft and A.G. Sharpe, Pearson Education.

**CHEMISTRY OF NATURAL PRODUCTS-II**  
**COURSE CODE: 21CHC56**

**Objectives**

- To familiarize with the chemical concepts of alkaloids and steroids.
- To learn the structural elucidation and biological importance of alkaloids and steroids.

**Course Outcome**

- Chemistry of alkaloids and their biological significances.
- Synthesis and characterization of several alkaloids and steroids.

**Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

**Course content**

**UNIT-I**

**[16 HOURS]**

**Alkaloids:** Introduction, classification, isolation and general methods of structural elucidation of alkaloids. Classification of alkaloids. Biological importance of alkaloids. Structural elucidation of nicotine, papaverine, quinine, reserpine and morphine. Biosynthesis of alkaloids (nicotine, coniine and cocaine).

**UNIT-II**

**[16 HOURS]**

**Steroids:** Introduction, Structural elucidation of cholesterol, bile acids, Ergosterol and its irradiation products. Sex hormones and corticosteroids: Synthesis of estrone, progesterone, androsterone, testosterone. Barton reaction for the synthesis of aldosterone. Brief discussion of homosteroids, norsteroids and oral contraceptives. Biological significance of anabolic steroids.

**References**

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jacob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.

**MATERIALS CHEMISTRY**

**COURSE CODE: 21CHC57**

**Objectives**

- To familiarize with the preparation and characterization of different types of nanomaterials.
- To learn the properties and applications of semiconductors and superconductors.

**Course Outcome**

- Understand the fundamentals and importance of different types of nanomaterials, their methods of preparation and characterization by different techniques.
- Basic aspects of semiconductors and superconductors, their properties and applications.

## Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Chemistry of nanomaterials:** Fundamentals and importance, metal nanoclusters, magic numbers, theoretical modelling of nanoparticles, geometric structure, electronic structure, reactivity, fluctuations, magnetic clusters, bulk to nano transitions. Semiconducting nanoparticles: optical properties, photo fragmentation, Coulombic explosion.

**Carbon nanoparticles:** Introduction, carbon molecules, nature of carbon bond, new carbon structure. Carbon clusters: Small carbon clusters, C<sub>60</sub>: Discovery, structure, alkali doping, super conductivity. Fullerenes and other bulky balls. Carbon nano-tubes: Fabrication structure, electrical properties, vibrational properties, mechanical properties. Quantum dots, Graphene, and applications of nanomaterials.

**Methods of preparation:** Plasma arc, Chemical vapour deposition (CVD), sol-gel, silica-gel, hydrolysis, condensation, polymerization of monomers to form nanoparticles, solvothermal, and hydrothermal methods, electrochemical, ball milling and pulsed laser methods. Characterization of nanomaterials (X-ray, IR, UV and SEM).

### UNIT-II

[16 HOURS]

**Semiconductors:** Metals, insulators and semiconductors. Band theory, energy bands, intrinsic and extrinsic semiconductors. Conductivity: electrons and holes, temperature dependence on conductivity, Optical properties: absorption spectrum, photoconductivity, photovoltaic effect and luminescence. Junction properties: metal-metal junctions, metal-semiconductor junctions, p-n junctions, transistors, industrial applications of semiconductors: Mixed oxides, spinels and other magnetic materials.

**Superconductors:** Introduction, critical temperature and zero resistivity, Meissner effect, critical magnetic field and its variation with temperature. Type - I and II super conductors, specific heat, isotope effect, basic concepts of BCS theory. High temperature (T<sub>c</sub>) superconductors and its applications.

## References

1. Introduction to Nanotechnology, Charles P. Poole. Jr. and Frank J. Owens, Wiley-Interscience, Joh Wiley and Sons Inc, 2006.
2. Nanotechnology, Richard Booker and Earl Boysen, Wiley.
3. Nanomaterials, A.K. Bandopadhyay, New Age International, 2<sup>nd</sup> edition.
4. Nanotechnology - Importance and Applications, M. H. Fulekar, Ink International publishing.
5. Solid State Chemistry – N.B. Hannay.
6. Introduction to Solids – Azaroff.
7. Solid State Chemistry and its applications – A.R. West.
8. Principles of the Solid State – H.V. Keer.
9. Basic Solid State Chemistry, 2<sup>nd</sup> edition, Anthony R. West.
10. Solid State Chemistry: An Introduction, 3<sup>rd</sup> edition, Lesley E. Smart and Elaine A. Moore.
11. Introduction to Solid state Physics-C. Kittel, 5<sup>th</sup> edition, Wiley Eastern, Limited.
12. C.N.R. Rao and J. Gopalakrishna –New Directions in solid state chemistry| Cambridge University Press, Cambridge (1999).

**OPEN ELECTIVE (FOR NON-CHEMISTRY STUDENTS ONLY)**  
**GENERAL CHEMISTRY**  
**COURSE CODE: 21CHC80**

**Objectives**

- To understand the basic concepts of chemistry including periodic properties of elements, structure and bonding.
- To learn the applications of synthetic products and biological importance of natural products. .
- To understand the basic concepts of thermodynamics, chemical kinetics, ionic equilibria and electrochemistry.
- To learn the statistical evaluation of experimental data. Applications of titrimetric methods and separation techniques.

**Course Outcome**

- Periodic properties of elements, structure and bonding of ionic compounds as well as various concepts of acids and bases.
- Hybridization, bonding and molecular structure of simple organic molecules. And also, biological importance of natural products.
- Basic concepts of thermodynamics, chemical kinetics, electrochemistry and ionic equilibria and their applications.
- Statistical evaluation of experimental data, concept of titrimetric and chromatographic methods.

**Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned to solve the numerical problems to understand the concepts.

**Course content**  
**UNIT-I**

**[16 HOURS]**

**Periodic table and chemical periodicity:** Periodic properties of elements, State of Matter, their resources. Important periodic properties of the elements, covalent radii, ionic radii, ionization potential, electron affinity and electronegativity.

**Structure and Bonding:** Properties of ionic compounds, structure of crystal lattices (NaCl, CsCl, ZnS, Wurtzite and rutile), Lattice energy, Born-Haber Cycle, radius ratio rules and their limitations. MO treatment for homo- and heteronuclear diatomic molecules. VSEPR model to simple molecules. Factors affecting the radii of ions, covalent character in ionic bonds, hydration energy and solubility of ionic compounds.

**Concepts of Acids and Bases:** Review of acid base concepts. Lux-Flood and solvent system concepts. Hard-soft acids and bases. Applications.

**UNIT-II**

**[16 HOURS]**

**Bonding and molecular structure:** Introduction to organic chemistry, atomic orbitals, sigma and pi bond formation-molecular orbital (MO) method, sp, sp<sup>2</sup> and sp<sup>3</sup> hybridization, bond length, bond dissociation energies and bond angles (open chain and cyclic compounds). Electronegativity and polarity of the bonds. Classifications and reactions of organic compounds (with examples).

**Acids and bases:** Hydrogen bonding, resonance and inductive effective on strengths of acids and bases.

**Biological importance of natural products:** Amino acids, proteins, carbohydrates (cellulose, starch, glycogen), lipids (fats and oils, phospholipids), prostaglandins, nucleic acids, steroids, alkaloids, vitamins, flavonoids.

**Applications of synthetic products:** Dyes, drugs, polymers (plastics), soaps and detergents, pesticides and pheromones.

### UNIT-III

[16 HOURS]

**Thermodynamics:** First and second laws of thermodynamics. Concept of entropy and free energy, entropy as a measure of unavailable energy. Entropy and free energy changes and spontaneity of process.

**Chemical kinetics:** Rate and order of reaction. Factor affecting the rate of reaction. and determination Order of reaction. Energy of activation and its determination. Brief account of collision and activated complex theories.

**Ionic equilibria:** pH scale, buffer solutions, calculation of pH of buffer solutions, buffer capacity and buffer index, buffer mixtures.

**Solutions:** Concentration units, solutions of liquids in liquids, Raoult's law, ideal and non-ideal solutions.

**Electrochemistry:** Electrolytic conductance, specific, equivalent and molar conductance, ionic mobility and transference number, factors affecting the electrolytic conductance, Arrhenius theory of strong and weak electrolytes, assumptions of Debye-Huckel theory of strong electrolytes. Single electrode potential, reference electrodes, galvanic cells, emf of galvanic cells and construction of electrochemical cells.

### UNIT-IV

[16 HOURS]

**Basic Statistics and Data Handling:** Significant figures, accuracy and precision. Types of errors: Determinate error and indeterminate error. Definitions for statistics. Quantifying random error: Confidence limits, variance. Rejection of results.

**Applications of titrimetric methods:** Introduction, theory and applications of acid base titrimetry, complexometric titrations and redox titrimetry

**Separation techniques:** Purification-Crystallization, sublimation, fractional crystallization, distillation techniques (simple distillation, steam distillation, distillation under reduced pressure, and fractional distillation), solvent extraction.

**Chromatography:** Thin layer chromatography and ion-exchange chromatography and their applications in the separation of the components from the mixture.

#### References

1. Text Book of Physical Chem., by Samuel Glasstone, MacMillan Indian Ltd., 2<sup>nd</sup>Ed., (1974).
2. Elements of Physical Chem., by Lewis and Glasstone, 2<sup>nd</sup> Edn. Macmillan & Co Ltd.
3. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
4. Organic Chemistry, Vol-I by I. L. Finar.
5. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
6. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
7. Practical Organic Chemistry by Mann F. G. and Saunders.
8. Fundamentals of analytical Chem., 8<sup>th</sup> Edition, D. A. Skoog, West, Holler and Crouch.
9. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3<sup>rd</sup> edition, 2000, Blackwell Sci., Ltd. Malden, USA.
10. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.

**FOURTH SEMESTER**  
**HARD CORE**  
**BIOINORGANIC CHEMISTRY**  
**COURSE CODE: 21CHD10**

**Objectives**

- To understand the structural parameters of metallo-proteins and their biological role.
- To learn the biological properties of metal complexes in chemo and radio therapeutics.

**Course Outcome**

- Structural building blocks of proteins, nucleic acids and their metal ion interactions. Biological role of Na/K channel, Ca, Vit B12, and coenzymes.
- Biochemical reactions of several metallo-enzymes and oxygen transport proteins.
- Medicinal applications of metals and metal complexes, and also treatment of toxicity due to heavy metal ions.

**Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

**Course content**

**UNIT-I**

**[16 HOURS]**

**Structural and molecular biology:** Introduction, The structural building blocks of proteins, the structural building block of nucleic acids. Metal ion interactions with nucleosides and nucleotides. General features of DNA - metal complex interaction.

**Bioenergetics:** Introduction, Redox reactions in metabolism, the central role of ATP in metabolism. Kinetic stability of ATP, Mitochondrial flow of electrons from NADH to O<sub>2</sub>. Phosphorylation and respiratory chain. Oxidative phosphorylation.

**Sodium and potassium-channels and pumps:** Introduction, transport across membranes. Potassium and sodium channels, The sodium-potassium ATPase, Macrocyclic crown ether compounds, cryptands and ionophores.

**Biochemistry of calcium:** Introduction - comparison of Ca<sup>2+</sup> and Mg<sup>2+</sup>. Biological roles of calcium, binding sites of calcium and proteins, storage of calcium, calcium in muscle contraction, calcium in blood clotting process.

**Vitamin B12 and Coenzymes:** Structural feature, names of different forms, chemistry of cobalamin, biochemical functions of cobalamins, model compounds. Special characteristics of B12 co-enzyme. Photosystems.

**UNIT-II**

**[16 HOURS]**

**Metal ion transport and storage:** Iron storage and transport: Transferrin, ferritin, phosvitin and gastroferrin. Iron transport in microbes: siderophores, *in vivo* microbial transport of iron.

**Oxygen transport and oxygen uptake proteins:** Properties of dioxygen (O<sub>2</sub>): thermodynamic and kinetic aspects of dioxygen as an oxidant, activation of dioxygen through complexation with metal ions. Haemoglobin (Hb) and Myoglobin (Mb) in oxygen transport mechanism: Introduction to porphyrin system, substituent effects on porphyrin rings, functions of Hb and Mb. Characteristics of O<sub>2</sub><sup>-</sup>-binding interaction with Hb and Mb. Model compounds for oxygen

carriers (Vaska's complex and cobalt(III) – Schiff base complexes). Hemerythrin and hemocyanin.

**Electron transport proteins and redox enzymes:** Iron – sulfur proteins (rubredoxins and ferredoxins) and cytochromes including cytochrome P450. Catalase and peroxidase: Structure and reactivity. **Superoxide dismutase:** Structure and reactivity.

**Molybdenum containing enzymes:** Aspects of molybdenum chemistry, Xanthine oxidase, aldehyde oxidase, sulfite oxidase, nitrogenase and nitrite reductase.

**Non-redox metalloenzymes - Structure and reactivity:** Carboxypeptidase-A, alcohol dehydrogenase, leucineaminopeptidase and carbonic anhydrase.

### UNIT-III

[16 HOURS]

**Medicinal Inorganic Chemistry: State of the Art, New Trends, and a Vision of the Future:**

Introduction, metals and human biochemistry, general requirements.

**Disease due to metal deficiency and treatment:** Iron, zinc, copper, sodium, potassium, magnesium, calcium and selenium.

**Metal complexes as drugs and therapeutic agents:** Introduction, Antibacterial agents, Antiviral agents, **Cancer Therapy:** Current Status and Mechanism of Action of Platinum-Based Anticancer Drugs. Non-platinum anticancer agents.

**Gold-Based Therapeutic Agents: A New Perspective:** Uses for the treatment of rheumatoid arthritis, **Diabetes:** Vanadium and diabetes,

**Metal-Based Radiopharmaceuticals:** Metal complexes as radio diagnostic agents.

**Treatment of toxicity due to inorganics:** General aspects of mechanism of metal ion toxicity,

- (i) Mechanism of antidote complex with poison, rendering it inert: arsenic, lead, mercury, iron and copper.
- (ii) Antidote accelerated metabolic conversion of poison to non-toxic product: cyanide and carbon monoxide.

### References

1. The Inorganic Chemistry of Biological Process- 2nd edition, M. N. Hughes, John Wiley and Sons, (1988).
2. Bioinorganic Chemistry - R.W. Hay, Ellis Horwood Ltd., (1984).
3. Biological Inorganic Chemistry – An Introduction, R.R. Crichton, Elsevier, (2008).
4. Bioinorganic Chemistry - A.K. Das, Books and Allied (P) Ltd, (2007).
5. Bioinorganic Chemistry - K. Hussain Reddy, New Age International Ltd. (2003).
6. Bioinorganic Chemistry: A Survey - EiichiroOchiai, Academic Press, (2008).
7. Bioinorganic Chemistry: A Short Course - 2nd edition, R.M. Roat-Malone, Wiley Interscience, (2007).
8. Medicinal Applications of Coordination Chemistry - Chris Jones and John Thornback, RSC Publishing, (2007).
9. Transition Metal Complexes as Drugs and Chemotherapeutic Agents - N. Farrell, Kluwer Academic Publishers (1989).
10. The Biological Chemistry of the Elements: The Inorganic Chemistry of Life - 2<sup>nd</sup> edition, J.J.R. Frausto da Silva and R.J.P. Williams, Oxford University Press, (2001).
11. Essentials of Inorganic Chemistry, K. A. Strohfeldt, John Wiley and Sons Ltd.,(2015).
12. Bioinorganic Medicinal Chemistry (Ed) EnzoAlessio, Wiley-VCH Verlag and Co., (2011).



# HETEROCYCLIC AND BIOORGANIC CHEMISTRY

COURSE CODE: 21CHD11

## Objectives

- To familiarize with the chemistry of heterocyclic compounds.
- To learn the synthesis and biological importance of carbohydrates, proteins and nucleic acid.

## Course Outcome

- Structure, reactivity and synthesis of several heterocyclic compounds.
- Synthesis, industrial and biological importance of carbohydrates.
- General synthesis of amino acids, peptides, nucleic acids and their biological significance.

## Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Heterocyclic compounds:** Nomenclature; Structure, reactivity, synthesis and reactions of furan, pyrrole, thiophene, indole, pyridine, quinoline, isoquinoline, pyrazole, imidazole, pyrone, coumarin, chromones, pyrimidines, purines. Synthesis and synthetic applications of azirines & aziridines, azetidines, oxazolines, isoxazolines, isoxazole, triazole and azepines and benzodiazepines.

### UNIT-II

[16 HOURS]

**Protecting groups:** Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis.

**Carbohydrates:** Introduction, Ring size determination of monosaccharides, configuration and conformations of monosaccharides, anomeric effect, Hudson's rules, epimerization and mutarotation. Synthesis, industrial and biological importance of glycosides, amino sugars, sucrose, maltose and lactose. Polysaccharides: General methods of structure elucidation. Industrial importance and biological importance of cellulose, starch, glycogen, dextran, hemicellulose, pectin, agar- agar. Photosynthesis and biosynthesis of carbohydrates.

### UNIT-III

[16 HOURS]

**Amino Acids:** General structure, physiological properties, protection of functional groups.

**Peptides:** Structure and conformation of peptide bond, peptide synthesis: Solution phase and Merrifield's solid phase synthesis, Racemization and use of HOBt, Synthesis of oxytocin and vasopressin, biological importance of insulin, selective cleavage of polypeptide bonds (chemical and enzymatic). **Proteins:** Structure determination: C and N terminal residue determination, primary, secondary, tertiary and quaternary structure determination, denaturing and renaturing of proteins.

**Nucleic acids:** Introduction, structure and synthesis of nucleosides and nucleotides, protecting groups for hydroxy group in sugar, amino group in the base and phosphate functions. Methods of formation of internucleotide bonds: DCC, phosphodiester approach and phosphoramidite methods. Solid phase synthesis of oligonucleotides. Structure of RNA and DNA, Crick-Watson model, role of nucleic acids in the biosynthesis of proteins.

## References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. Schaum's outline of theory and problems of Organic Chemistry, Harbert Meislich, Howard Nechamkin and Jacob Sharefkin.
4. Natural products: Their chemistry and biological significance, J. Mann, R. S. Davidson, J. B. Banthorpe and J. B. Harborne.
5. A text book of synthetic drugs, O. D. Tyagi and M. Yadav.
6. Synthetic drugs, Gurdeep R. Chatwal.
7. Carbohydrate Chemistry and applications of carbohydrates, K. M. Lokanatha Rai.
8. Heterocyclic chemistry by Achison.
9. Heterocyclic chemistry by Smith and Joule.
10. Heterocyclic chemistry by Pacquete.

## NUCLEAR, RADIATION AND PHOTOCHEMISTRY COURSE CODE: 21CHD12

### Objectives

- To understand the theory and applications of photochemistry.
- To learn the fundamentals and physico-chemical applications of radiation chemistry.
- To familiarize with the concepts of nuclear chemistry including radiochemical separation techniques and nuclear power reactors.

### Course Outcome

- Understand the principles of photochemistry, its experimental techniques and applications.
- Fundamentals of radiation chemistry, experimental methods of detection of radiation and applications of radioisotopes.
- General aspects of nuclear chemistry, different types of nuclear reactions, production and separation of radioisotopes and also basic features of different types of nuclear reactors.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## Course content

### UNIT-I

**[16 HOURS]**

**Nuclear chemistry:** Nuclear stability – nuclear forces, packing fraction, binding energy, liquid drop, shell and collective models. Radioactive decay – General characteristics, decay kinetics, parent –daughter decay growth relationships, determination of half-lives. Brief survey of alpha, beta and gamma decays. Nuclear reactions – Bethe's notation, types of nuclear reactions – specific nuclear reactions, photonuclear reactions, Oppenheimer – Phillips process, spallation reactions, Szilard-Chalmers process. Definition of Curie and related calculations. Production of radioisotopes and labelled compounds by bombardment.

**Radiochemical separation techniques:** carriers, solvent extraction and ion ion-exchange methods.

**Nuclear power reactors:** Types of nuclear power reactors, basic features and components of nuclear power reactors. An introduction to breeder reactors.

## UNIT-II

[16 HOURS]

**Radiation chemistry:** Introduction, units, interaction of electromagnetic radiation with matter, G-value, LET of radiation. Chemical dosimetry - Fricke and ceric sulphate dosimeters. Radiolysis - cysteine, water and biphenyl. Radioisotopes as tracers, use of isotopic tracers in the elucidation of reaction mechanism, structure determination and solubility of sparingly soluble substances.  $^{14}\text{C}$  dating, medical applications of isotopic tracers. Physico-chemical applications – isotope dilution method, activation analysis and radiometric titrations. Hazards in radiochemical work and radiation protection.

**Radiation detection and measurement:** Experimental techniques in the assay of radioisotopes. Radiation detectors – ionization chambers, proportional and Geiger-Muller counters – G.M. Plateau, dead time, coincidence loss, determination of dead time. Scintillation and semiconductor radiation detectors.

## UNIT-III

[16 HOURS]

**Photochemistry:** Introduction to photochemistry, laws of photochemistry, laws of light absorption, quantum yield and its determination, factors affecting quantum yield, Actinometry - Uranyl oxalate and potassium ferrioxalate actinometers, acetone and diethylketone actinometers. Term symbols for atoms and its significance. Photochemical properties of electronically excited molecules, nature of changes on electronic excitation, shapes of absorption band and Frank Condon principle. Experimental techniques to determine the intermediates in photochemical reactions. Photosensitization: by mercury, dissociation of  $\text{H}_2$ . Photochemical kinetics of: Decomposition of  $\text{CH}_3\text{CHO}$ , dissociation of  $\text{HI}$  and formation of  $\text{HCl}$ . Fluorescence and phosphorescence – theory and applications. Resonance fluorescence and quenching of fluorescence, Kinetics of collisional quenching (Stern-Volmer equation).

**Photocatalyst** – Principle, application of  $\text{ZnO}/\text{TiO}_2$  photocatalysts in the photo cleavage of dyes, environmentally hazardous waste and industrial effluents. Effect of photo degradation on COD value.

### References

1. Photochemistry, Calvert and Pitts, Wiley, New York (1996).
2. Fundamentals of Photochemistry, Gohatgi-Mukherjee, New Age International Ltd., 1986.
3. Principles and Applications of Photochemistry, R. P. Wayne, Elsevier, New York (1970).
4. Photochemistry, Paul Suppan, RSC, London (1994).
5. Introduction to Semiconductor Materials and devices, M. S. Tyagi, John Wiley & Sons, 1991.
6. Nuclear Chemistry by Friedlander and Kennedy, John Wiley and Sons (1987).
7. Essentials of Nuclear Chemistry by H.J. Arnikaar, Eastern Wiley (1990).
8. Nuclear Chemistry by U.N. Dash, Sultan Chand and Sons (1991).
9. Fundamentals of Radiochemistry by D.D. Sood, A.V.R. Reddy and N. Ramamoorthy.
10. Nuclear Radiation Detectors by S.S. Kapoor and Ramamoorthy, Wiley Eastern (1986).

# INSTRUMENTAL METHODS OF ANALYSIS

COURSE CODE: 21CHD13

## Objectives

- To understand the theory, instrumentation and applications of atomic emission spectroscopy.
- To get excel the knowledge on electro analytical techniques
- To learn the principles, instrumentation and applications of thermal methods of analysis.

## Course Outcomes

After studying this course, the student to:

- Gain the knowledge on the differences between classical and instrumental methods of chemical analysis.
- Explain different types of instrumental methods employed in chemical analysis.
- Develop an understanding of the range and theories of instrumental methods available in analytical chemistry.
- Make clear distinctions among spectrometric, electro-analytical, thermal and microscopic methods.
- Gain knowledge pertaining to the appropriate instrumental techniques.
- Obtain the practical experience in selected instrumental methods of analysis.
- Develop the skills on instrumental methods for planning, developing, conducting, reviewing, conducting experiments and reporting results.

## Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned numerical problems to understand the concepts.

## UNIT – I

**Flame photometry and Atomic absorption spectrometry:** Energy level diagrams-atomic absorption spectra. Flame characteristics. Flame atomizers and electrothermal atomization. Comparison of spectral interferences, chemical and physical interferences in FP and AAS. Background correction methods in AAS. Use of organic solvents. Quantitative techniques- calibration curve procedure and the standard addition technique. Typical commercial instruments for FP and AAS (Single and double beam atomic absorption spectrophotometers), applications of FES and AAS. Qualitative analysis and quantitative evaluations. Relative detectabilities of atomic absorption and flame emission spectrometry.

**Molecular luminescence spectrometry:** Theoretical basis for fluorescence and phosphorescence. Singlet and triplet excited states. Variables affecting luminescence-quantum efficiency, transition types, structure and structural rigidity, temperature and solvent effects, effect of pH, dissolved

oxygen and concentration effect. Excitation spectra vs emission spectra. Origin of fluorescence, relationship between fluorescence and concentration. Fluorescence instrumentation-fluorometers and spectrofluorometers. Sensitivity and selectivity. Modification necessary to measure phosphorescence. Applications of fluorometry: inorganic and organic analyses.

**Nephelometry and turbidometry:** Principles, instrumentation and applications.

[16 HOURS]

## UNIT – II

**Electroanalytical methods:** Classification. Potentiometers, galvanostats and potentiostats.

Potentiometric methods of analysis. Potentiometric electrochemical cells. The Nernst equation. Liquid junction potentials. Reference electrodes-SHE, calomel electrode and silver/ silver chloride electrode. Metallic indicator electrodes-electrodes of first kind and second kind. Redox electrodes. Membrane electrodes –membrane potential, selectivity of membranes. Glass ion selective electrodes. Crystalline solid state ion selective electrodes. Liquid-based ion selective electrodes. Gas sensing electrodes. Potentiometric biosensors. Quantitative applications. Activity vs concentration. Quantitative analysis using external standards and the method of standard additions. Measurement of *p*H. Clinical and environmental applications.

**Electrogravimetric analysis:** Theory, apparatus, cell processes, deposition and separation, electrolytic separation of metals, applications.

**Coulometric methods of analysis:** General discussion, coulometry at controlled potential, apparatus and general technique, applications, coulometric titrations (amperometric/coulometric)-principles, apparatus, comparison of coulometric titrations with conventional titrations, automatic coulometric titrations, applications.

**Amperometric titrations:** Principle, titration curve, apparatus and techniques, applications.

**Voltammetry:** Fundamentals of voltammetry. **Cyclic voltammetry:** Principles and applications. **Stripping analysis:** Stripping voltammetry-basic principles, electrodes used for stripping analysis, apparatus for stripping analysis, applications, determination of lead in water voltammetry with micro electrodes.

[16 HOURS]

## UNIT – III

**Thermal method of analysis:** Introduction,

**Thermogravimetric analysis (TGA):** Types of thermogravimetric analysis, principles and general thermal decomposition curve. Factors affecting the results-heating rate, furnace, instrument control/ data handling. Applications-purity and thermal stability, evaluation of correct drying temperature, analysis of complex mixture and determination of kinetic parameters of thermal degradation.

**Differential thermal analysis (DTA):** General principles. Theory-variables affecting the DTA curves. Instrumentation. Applications-analysis of the physical mixtures and thermal behaviour study. Determination of melting point, boiling point and decomposition point.

**Differential scanning calorimetry (DSC):** Basic principle. Instrumentation-power compensated DSC, Heat flux DSC. Applications- studies of thermal transitions and isothermal crystallization. Testing the purity of the pharmaceutical samples.

Thermomechanical analysis. Dynamic mechanical analysis.

**Enthalpimetric analysis:** Thermometric titrations and direct injection enthalpimetry: Principles,

apparatus and applications.

**Microscopic analysis:** Principle and mechanism in characterization of compounds by scanning electron and transmission electron microscopic (SEM & TEM) techniques. Components of instruments of SEM and TEM.

[16 HOURS]

### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993 Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Instrumental Methods of Analysis by H.H. Willard, L.L. Merritt and J.A. Dean, 7<sup>th</sup> Edition, CBS Publishers, New Delhi, 1988.
7. Principles and Practice of Analytical Chemistry, F.W. Fifield and Kealey, 3<sup>rd</sup> edition, 2000, Blackwell Sci., Ltd. Malden, USA.
8. Modern Analytical Chemistry, David Harvey, McGraw Hill, New Delhi, 2000.
9. Introduction to Instrumental Analysis, Braun, Pharm. Med. Press. India.
10. Instant Notes of Analytical Chemistry, Kealey and Haines, Viva Books Pvt. Ltd., New Delhi, 2002.
11. Analytical Transmission Electron Microscopy, An Introduction for Operators Thomas, Jürgen, Gemming, Thomas., Springer, 2014.
12. Scanning Transmission Electron Microscopy, Imaging and Analysis. Pennycook, Stephen J., Nellist, Peter D. (Eds.), Springer, 2011.

**SOFT CORE  
ANALYTICAL CHEMISTRY PRACTICALS**

**COURSE CODE: 21CHD50**

**[64 HOURS]**

**Objectives**

- To familiarize with the handling of instruments in the quantitative analysis of various samples.
- To understand the analysis of real samples like waste water, soil samples and biological samples and mixtures

**Course Outcome**

After studying this course, the student to:

- Get experience on analysis of various complex mixtures by following multistep reactions.
- Acquire the knowledge on handling instruments and to overcome the general problems arises during the analysis.
- Acquire industrial skills required for sampling, analytical and interpretation and presentation of results.
- Possess adequate knowledge on literature search for developed analytical methods.

**Pedagogy**

- Each student performs experiments as per the protocol in practical classes.
- Computer aided applications are used for the evaluation of experimental results.

**[128 HOURS]**

**PART – III**

1. Determination of calcium in limestone by redox, acid-base and complexation titrations.
2. Determination of vitamin C in orange juice by titration with cerium(IV) and with 2,6-dichlorophenol indophenol.
3. Determination of mercury in an algacide by EDTA titration; and arsenic in ant control preparation by redox titration.
4. Determination of aluminium and magnesium in antacids by EDTA titration.
5. Analysis of a copper-nickel alloy sample for copper and nickel by EDTA titration using masking and selective demasking reactions.
6. Determination of saccharin in tablets by precipitation titration.
7. Determination of iodine value and saponification value of edible oils.
8. Determination of ascorbic acid in goose berry/bitter gourd by titrimetry and spectrophotometry using *N*-bromosuccinimide (NBS).
9. Analysis of a mixture of iron(II) and iron(III) by EDTA titration using *pH* control.
10. Determination of sulphadiazine drugs by potentiometry using  $\text{NaNO}_2$  and iodometric assay of penicillin.
11. Solvent extraction method for determination of silver as ion-associate with 1,10-phenanthroline and bromopyragallol red.
12. Electrolytic determination of copper and lead in brass.

13. Polarographic determination of copper and zinc in brass.
14. Determination of sodium, potassium and calcium in mineral waters by atomic emission spectrometry.
15. Determination of iron in mustard seeds and phosphorus in peas by spectrophotometry.
16. Analysis of waste water for anionic detergents and phenol by spectrophotometry.
17. Fluorimetric determination of riboflavin (vit.B<sub>2</sub>) in tablets.
18. Colorimetric analysis of procaine by diazotization and coupling reaction.
19. Determination of manganese in steel by extraction-free spectrophotometry and molybdenum in steel by extractive spectrophotometry.
20. Determination of ethanol in wine by titrimetric and spectrophotometric dichromate methods

#### **PART – IV**

1. Analysis of waste waters for DO and COD by titrimetry.
2. Analysis of a ground water sample for sulphate by titrimetry (EDTA) and turbidimetry.
3. Potentiometric determination of formula and stability constant of a silver-ammonia complex ion.
4. Determination of aspirin, phenacetin and caffeine in mixture and APC tablets by solvent extraction and UV spectrophotometry.
5. Kinetic determination of urinary creatinine and purity of a commercial H<sub>2</sub>O<sub>2</sub> sample.
6. Determination of chromium(III) and iron(III) in a mixture by kinetic masking methods.
7. Catalytic determination of traces of selenium in biological materials and iodide in blood serum.
8. Photometric and potentiometric titration of iron(III) with EDTA.
9. Photometric and potentiometric titration of copper with EDTA.
10. Determination of copper(II) and iron(III) in mixture by photometric titration with EDTA.
11. Analysis of brackish water for chloride content by a) spectrophotometry (mercuric thiocyanate method), b) conductometry (silver nitrate) and c) potentiometry (silver nitrate).
12. Conductometric titration of sodium acetate with HCl and NH<sub>4</sub>Cl with NaOH.
13. Ascorbic acid determination in natural orange juice by coulometry.
14. Spectrophotometric determination of iron in natural waters using thiocyanate and 1,10-phenanthroline as reagents.
15. Determination of fluoride in drinking water/ground water by spectrophotometry(alizarin red lake method).
16. Analysis of waste water for
  - a) Phosphate by molybdenum blue method
  - b) ammonia-nitrogen by Nessler's method
  - c) nitrite-nitrogen by NEDA method
15. Analysis of a soil sample for
  - a) Calcium carbonate and organic carbon by titrimetry.
  - b) Calcium and magnesium by EDTA titration.



16. Analysis of a soil sample for
  - a) Nitrogen content by Kjeldahl method
  - b) Available phosphorus by spectrophotometry.
  - c) Nitrate-nitrogen/nitrite nitrogen/ammonia nitrogen by spectrophotometry.
  - d) Sodium and potassium by flame photometry.
17. Analysis of urine for
  - a) Urea and uric acid by titrimetry and spectrophotometry.
  - b) Sulphate by precipitation titration after ion-exchange separation.
  - c) Sugar by Benedict's reagent.
18. Analysis of blood for
  - a) cholesterol by spectrophotometry
  - b) Bicarbonate by acid-base titration.
19. Fluorimetric determination of quinine in an antimalarial tablet.

### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8<sup>th</sup> edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5<sup>th</sup> edition, 2001 John Wiley & Sons, Inc. India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, 1993, prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2<sup>nd</sup> edition, Saunders College Publishing, California, 1990.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulations, P. D. Sethi, 3<sup>rd</sup> edition, CBS Publishers & Distributors, New Delhi, 1997.
7. Practical Clinical biochemistry methods and interpretations, R. Chawla, J.P. Bothers Medical Publishers (P) Ltd., 1995.
8. Laboratory Manual in Biochemistry, J. Jayaraman, New Age International Publishers, New Delhi, 1981.
9. Experiments on Water Pollution, D.I. Williams and D. Anglesia, Wayland Publishers Ltd., England, 1978.
10. Experiments on Land Pollution, D.I. Williams and D. Anglesia, Wayland Publishers Ltd., England, 1978.
15. Experiments in Environmental Chemistry, P.D. Vowler and D.W. Counel, Pergamon Press, Oxford 1980.
16. Manual Soil Laboratory Testing, vol.I, K.H. Head, Pentech Press, London 1980.

## INORGANIC CHEMISTRY PRACTICALS

COURSE CODE: 21CHD51

[64 HOURS]

### Objectives

- To familiarize with the instrumental methods of analysis for determining metals present in the different samples.
- To familiarize with the preparation and characterization of different inorganic complexes.

### Course Outcome

- Determination of alloy samples and understanding the electrochemical deposition of metals.
- Preparation and characterization of coordination compounds.
- Determination of composition, stability constant and magnetic susceptibility of metal complexes.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of the synthesized complexes.

## Course experiments

### PART-A

1. Determination of bismuth, cadmium and lead in a mixture: Analysis of a low melting alloy (Wood's alloy).
2. Simultaneous spectrophotometric determination of chromium and manganese in a steel solution.
3. Determination of chromium(III) and iron(III) in a mixture: Kinetic masking method.
4. Electrogravimetric determination of:
  - a) Copper in copper sulphate
  - b) Nickel in nickel sulphate
  - c) Copper and nickel in alloy solution
  - d) Lead in lead nitrate.
5. Flame photometric determination of the following metal ions from different samples:
  - a) sodium b) potassium and c) sodium and potassium in a mixture.
6. Polarographic estimation of cadmium and zinc.
7. Determination of iron as the 8-hydroxyquinolate by solvent extraction method.
8. Quantitative determination of nickel using dithizone and 1,10-phenanthroline by synergistic extraction.
9. Spectrophotometric determination of the  $pK_a$  value of methyl red.
10. Semimicro gravimetric determination of aluminium.

### PART-B

1. Preparation and characterization of:
  - a) Chloropentammine cobalt(III) chloride
  - b) Estimation of chloride in a complex by potentiometric or ion-exchange method
  - c) Record the electronic absorption spectrum of a complex and verify Tanabe Sugano diagram.
2. Preparation of *cis*- and *trans*- dichlorobis(ethylenediamine) cobalt(III)chloride. Record the UV-Vis spectra and compare it with *cis*-form. Measure the molar conductance.

3. Preparation of hexammine cobalt(III) chloride and estimate cobalt ion.
4. Determination of magnetic susceptibility of any two compounds/complexes by Gouy method.
5. Determination of the composition of iron-phenanthroline complex by:
  - (d) Job's method
  - (e) mole-ratio method and
  - (f) Slope-ratio method.
6. Determine the stability constant of iron-tiron/iron-phenanthroline by Turner-Anderson method.
7. Preparation of potassium tris(oxalato)ferrate(III) and estimate the metal ion.
8. Preparation of acetyl acetonatomanganese(III) complex.
9. Preparation of tris(en)nickel(II) chloride and hexamine nickel(II) chloride complexes. Record electronic spectra and evaluate spectrochemical series.
10. Using chloropentammine cobalt(III) chloride, prepare nitro and nitropentammine cobalt(III) chloride. Record the IR spectra of the isomers and interpret.
11. Estimate the chloride ion in a given complex by silver nitrate titration after ion-exchange separation.
12. Demonstration Experiments:
  - (d) Recording and interpretation of IR and NMR spectra of complexes.
  - (e) Spectrochemical series-Evaluation of Dq value.
  - (f) DNA interaction with metal complexes by UV-visible absorption and viscosity methods.

## References

1. Advanced Physico-Chemical Experiments – J. Rose.
2. Instrumental Analysis Manual - Modern Experiments for Laboratory – G.G. Guilbault and L.G. Hargis.
3. A Text Book of Quantitative Inorganic Analysis – A.I. Vogel, 5<sup>th</sup> edition.
4. Experimental Inorganic Chemistry – G. Palmer.
5. Inorganic Synthesis – O. Glemser.
6. Experimental Inorganic/Physical Chemistry- Mounir A. Malati.
7. Quantitative Chemical Analysis – Daniel C. Harris, (2006) 7<sup>th</sup> edition.
8. Spectrophotometric Determination of Elements – Z. Marczenko

## ORGANIC CHEMISTRY PRACTICALS

**COURSE CODE: 21CHD52**

**[64 HOURS]**

### Objectives

- To understand the concepts of isolation and purification of natural products.
- To familiarize with the estimation of different functional groups in organic compounds.

### Course Outcome

- The isolation of caffeine, carotene, lycopene, cincole, azelaic acid and piperine from respective natural sources.
- Estimation of ketones, sugars, nitro and amino groups in natural products.
- Interpret UV, IR, NMR and MS data of different organic compounds.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of isolated natural products.

## Course experiments

### PART-A

1. Fractional crystallization: separation of mixture of naphthalene and biphenyl.
2. Thin layer chromatography: Separation of plant pigments.
3. Column chromatography: Separation of *o*- and *p*-nitro aniline
4. Isolation of piperine from pepper.
5. Isolation of caffeine from tea.
6. Isolation of azelaic acid from castor oil.
7. Isolation of carotene from carrot.
8. Isolation of lycopene from tomato.
9. Isolation of cincole from eucalyptus leaves.

### PART-B

#### Isolation of natural products & estimations:

1. Estimation of ketones by haloform reaction.
2. Estimation of sugars by Bertrand's method.
3. Estimation of nitro groups.
4. Estimation of amino group.
5. Determination of enol content by Meyer's method.
6. Determination of iodine value of an oil or fat.
7. Determination of saponification value of oil.
8. Determination of equivalent weight of carboxylic acid by silver salt method

**Interpretation of Spectra:** Structural elucidation of some simple organic compounds by UV, IR, NMR and mass. Spectra have to be provided by the Teachers/ Examiners.

#### References

1. Vogel' text book of practical organic chemistry, V edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatehell.
2. Elementary practical organic chemistry, Part-III: Quantitative organic analysis, By Arthur I, Vogel.
3. Laboratory manual of Organic Chemistry by B. B. Dey and M. V. Sitaraman.
4. Practical Organic Chemistry by Mann F. G. and Saunders.
5. Natural products: A laboratory guide by Raphael Ikhan.

## PHYSICAL CHEMISTRY PRACTICALS

### Objectives

**COURSE CODE: 21CHD53**

**[64 HOURS]**

- To understand the significance of various factors influencing the reaction rate in proposing the reaction mechanism.
- To understand electrochemical and spectrophotometric methods of quantification of samples, and also determination of physico-chemical parameters of some important samples.

### Course Outcome

- Students can able to develop experimental skill and interpretation of plausible mechanisms of reactions.
- Gain practical knowledge on the theoretical basis of electrochemistry, thermodynamics, and spectrophotometry experiments.
- This helps in academics, research and industries.

### Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Electrochemical and spectrophotometric tools are used to conduct the experiments.

## Course experiments

### PART-A

1. Determination of order of reaction for the acid hydrolysis of methyl acetate and evaluation of activation parameters.
2. Evaluation of Arrhenius parameters for the reaction between  $K_2S_2O_8$  and KI (First order reaction).
3. Study of kinetics of autocatalytic reaction between oxalic acid and  $KMnO_4$  and determine the order of reaction with respect to  $KMnO_4$ .
4. Kinetics of saponification of ethyl acetate by conductivity method and study the effect of dielectric constant of the medium (using  $CH_3OH$ ).
5. Study of effect of salt (ionic strength) on the kinetics of reaction between potassium persulphate and potassium iodide (second order reaction).
6. Spectrophotometric kinetics of oxidation of indigocarmine (IC) by chloramine-T (CAT) – Determination of order of reaction with respect to [CAT] and [IC].
7. To study the acid catalysed kinetics of oxidation of glycine by chloramine-T (CAT) - determination of order of reaction with respect to [CAT] and [glycine].
8. Study the phase diagram of three component system (Glacial acetic acid-Chloroform-water system / Glacial acetic acid-Acetone-Water system).
9. Study the rate of corrosion and inhibition efficiency of an inhibitor (thiourea) on mild steel/Al/Cu by weight loss method.

### PART-B

1. Conductometric titration of orthophosphoric acid against NaOH.
2. Conductometric titration of a mixture of HCl,  $CH_3COOH$  and  $CuSO_4$  against NaOH.
3. Conductometric titration of thorium nitrate with potassium tartarate.
4. Potentiometric titration of mixture of weak acids (acetic acid and monochloroacetic acid) against NaOH.
5. Determination of  $pK_a$  values of phosphoric acid by potentiometric / pH metric method.

- Potentiometric titration of mixture of KCl+KBr+KI against AgNO<sub>3</sub>.
- Potentiometric titration of FAS against ceric sulphate and sodium metavanadate, determine the concentration of FAS and redox potential.
- Potentiometric titration of lead nitrate against EDTA and determine the concentration of lead nitrate solution.
- Determination of *pK* value of an indicator (methyl orange/methyl red).
- Spectrophotometric analysis of a mixture of (a) KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
- Study of complex formation between ferric salt and salicylic acid.

### References

- Practical Physical Chemistry – A.J. Findlay.
- Experimental Physical Chemistry – F. Daniels *et al.*
- Selected Experiments in Physical Chemistry – Latham.
- Experiments in Physical Chemistry – James and Prichard.
- Experiments in Physical Chemistry – Shoemaker.
- Advanced Physico-Chemical Experiments – J. Rose.
- Practical Physical Chemistry – S.R. Palit.
- Experiments in Physical Chemistry – Yadav, Geol Publishing House.
- Experiments in Physical Chemistry – Palmer.
- Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
- Experimental Physical Chemistry – R.C. Das and B. Behera, Tata Mc Graw Hill.

## SOFT CORE

### DISSERTATION/PROJECT WORK–SOFT CORE

#### COURSE CODE: 21CHD54

### Course Outcome

After studying this course, a student will be to:

- Carry out literature survey on the problem/s to be solved.
- Learn and follow suitable research methodologies to propose and to perform Experiments.
- Attain the state of ability to take up research work.
- Better understanding about research articles, patents, book chapters or books on relevant research problem.
- Acquire skills of writing research reports in the form of articles or thesis.

Student may take up Project Work/ Dissertation under the guidance of the faculty of the department during the IV Semester as a Soft Core course.

**SOFT CORE**  
**AUTOMATED METHODS AND REAL SAMPLE ANALYSIS**  
**COURSE CODE: 21CHD55**

**Course content**

**Objectives**

- To understand the instrumentation and applications of automated methods of analysis.
- To familiarize with analysis of real samples and clinical analysis.

**Course Outcome**

- Understand various types of automated methods of analysis.
- Identify activities that can be fully or partially automated.
- Automated chemical analysis will be very helpful in the clinical as well as pharmaceutical field to perform the purity analysis of the sample, although the sample size is very small, expensive and fast analysis.

**Pedagogy**

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned numerical problems to understand the concepts.

**UNIT-I**

**[16 HOURS]**

**Automated methods of analysis:** An overview, definition, distinction between automatic and automated systems, advantages and disadvantages by automation, types of automated techniques. Nondiscrete techniques, segmented flow methods and basic equipment, special techniques and devices, theoretical considerations and problems, applications. Single channel and multi channel auto analysers, BUN analyzers, automatic glucose analyzers and ammonia in water analyzers, COD analyzers, CFA in industry. Non-segmented flow methods: Flow injection analysis. Principles, types of dispersion, factors affecting dispersion, applications of small, medium and large dispersions. Stopped flow methods, flow injection titrations. Discrete methods: Centrifugal fast scan analyzer, automatic multipurpose analyzers, Automatic elemental analyzer, automated analyzer based on multi layer film-principles, film structure, instrumentation applications. Comparison of discrete and non-discrete methods. Advantages of flow injection measurements over continuous flow measurements.

**UNIT-II**

**[16 HOURS]**

Analysis of real samples-real sample, choice of analytical method-defining the problem, investigating the literature, choosing or devising a method, testing the procedure, analysis of standard samples, using other methods, standard addition to the sample. Accuracy in the analysis of complex materials.

**Decomposing and dissolving the sample-** sources of error in decomposing and dissolution. Decomposing samples with inorganic acids. Microwave decomposition. Combustion methods for decomposing organic samples. Decomposition of inorganic materials with fluxes.

**Clinical Analysis-** Introduction, features of clinical analysis. Composition of blood, collection and preservation of samples. Common determinations - serum electrolytes, blood glucose and blood urea nitrogen, uric acid, albumin and globulins, acid and alkaline phosphates, barbiturates,

chloride, sodium and potassium, bicarbonate, serum creatinine and cholesterol. Urine analysis- Principle components. Sample collection and preservation. Determination of creatinine, chloride, uric acid, ammonia, ascorbic acid, bilirubin and calcium.

### References

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, NewYork.
2. Analytical Chemistry, G.D. Christian, 5th ed., 2001 John Wiley & Sons, Inc,India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition,1993 prenticeHall, Inc. NewDelhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney,J.D. Barnes and M.J.K. Thomas, 6th edition, Third Inidan Reprint.2003 PearsonEducation Pvt. Ltd., NewDelhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California,1990.
6. Principles and practice of analytical chemistry. Fifield andKealey.
7. Instant Notes of Analytical Chemistry, Kealey and Haines, Viva Books Pvt.Ltd.,2002.

## **BIOINORGANIC PHOTOCHEMISTRY** **COURSE CODE: 21CHD56**

### Objectives

- To understand the photochemistry of inorganic compounds.
- To familiarize with the applications of fluorescents and chromogenic sensing and labeling.
- To learn photodynamic inactivation of microorganisms.

### Course Outcome

- Basic concepts of photochemistry and photochemical reactions.
- Understand many organometallic compounds as fluorescent agents in the detection of cations, anions and toxic ions in the living system.
- Theory of photodynamics, and photocatalysis.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## **Course content**

### **UNIT-I**

**[16 HOURS]**

#### **Introduction, Philosophy of bioinorganic photochemistry**

**Fundamentals:** Light and matter. Nature of light, Accessible light sources and Interaction between light and matter.

**Formation and properties of electronic excited states:** Wave mechanics and quantum numbers and Electronic excitation.

**Photophysical deactivation of electronic excited states:** Spontaneous deactivation, Quenching and Coordination and organometallic compounds.



**Photochemical reactions:** Photochemical reaction channels, Intramolecular photoreactions, Photodissociation and photoionization, Photoisomerization, Intermolecular photoreactions, the coordination compound specificity. Ligand field photochemistry, Photochemistry from LC or LLCT states, Inner-sphere charge transfer photochemistry, Outer-sphere charge transfer photochemistry, Photosensitized reactions, Homogeneous photocatalysis.

**Natural photo-processes involving inorganic compounds**

**From interstellar space to planetary atmospheres:** Homogeneous systems: from interstellar space to planetary atmospheres and primitive soup models. Heterogeneous photochemistry in ice phases.

## UNIT-II

[16 HOURS]

**Applications: Fluorescent and chromogenic sensing and labeling:** Cations as targets in biochemical sensing Cations common in biological systems, Fluorescent detection of toxic cations, Fluorescent and chromogenic sensing of anions, Common anions and Toxic anions. Optical detection of neutral molecules. Nanoparticles in biochemical sensing and labeling.

**Therapeutic strategies;** Photobio-stimulation, Photo-activation of drugs, Photodynamic therapy, Mechanisms of PDT and PTT. Photosensitizers, Inorganic photosensitizers, Supporting role of metal ions in photodynamic therapy, and Combination of polypyrrolic photosensitizers and metallo-pharmaceuticals, Recent PDT development and Nanomedical methods.

**Photodynamic inactivation of microorganisms:** Bacteria, Viruses, Fungi and Parasites.

**Phototoxicity and photoprotection:** Chemical and physical photoprotection. Inorganic sunscreens.

**Photocatalysis in environmental protection:** Development of homo- and heterogeneous methods. Homogeneous photocatalysis and heterogeneous photocatalysis. Water and air detoxification. Other applications of photocatalysis.

### References

1. Bioinorganic Photochemistry- Grazyna Stochel, Malgorzata Brindell, Wojciech Macyk, Zofia Stasicka, Konrad Szacilowski. Wiley Publishers (2009).
2. Photochemistry and Photophysics of Coordination Compounds I-Volume Editors: Balzani, V., Campagna, Springer Publications. Vol.280, 2007.
3. Photochemistry and Photophysics of Coordination Compounds II - Volume Editors: Balzani, V., Campagna, Springer Publications. Vol.281, 2007.

## MEDICINAL CHEMISTRY

COURSE CODE: 21CHD57

### Objectives

- To familiarize with the methods of isolation, structural elucidation and synthesis of carotenoids and vitamins.
- To learn the basics of medicinal chemistry.
- To understand the synthesis and applications of synthetic drugs.

### Course Outcome

- To acquire the knowledge of biological significances of Carotenoids and vitamins.
- Understand the pharmacodynamics, pharmacokinetics and chemotherapy of several drugs.
- Synthesis and mechanism of drug actions of antimalarial, anticancer agents and cardiovascular drugs.

## Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

## Course content

### UNIT-I

[16 HOURS]

**Carotenoids:** Methods of isolation. Structure elucidation and synthesis of  $\beta$ -carotene. Structural relationship of  $\alpha$ -,  $\beta$ - and  $\gamma$ -carotenes.

**Vitamins:** Introduction, constitution, synthesis and biological significance of thiamine, riboflavin, pyridoxine, biotin, ascorbic acid, vitamin A1 & A2, E1 and E2, B12 and K groups.

### UNIT-II

[16 HOURS]

**Medicinal chemistry:** Introduction, pharmacodynamics, pharmacokinetics, chemotherapy, metabolites antimetabolites, agonists and antagonists. Classification of drugs on the basis of therapeutic action. Concept of pro drug and soft drug. Theories of drug activity: Occupancy theory, rate theory, induced fit theory, concept of drug receptors. Evaluation methods: Free-Wilson analysis, Hansch-analysis,  $ID_{50}$  and  $IC_{50}$  (mathematical derivation of equation excluded).

**Antipyretics:** Aspirin, paracetamol, phenacetin, novalgin and their mechanism of action.

**Antimalarials:** Structure, synthesis and mechanism of action of quinine and chloroquine.

**Hypnotics:** Analgesics and sedatives: phenobarbital, chlordiazepoxide, meprobamate.

**Stimulants:** Structure, action and synthesis of caffeine.

**Antineoplastics:** Structure, pharmacological action and synthesis of 5-fluorouracil, chlorambucil, cyclophosphamide and podophyllotoxin.

**Cardiovascular drugs:** Introduction, synthesis of diltiazem, verapamil, methyldopa, atenolol and oxprenolol.

### References

1. Organic Chemistry, VI edition, Robert T. Morrison, Robert N. Boyd.
2. Organic Chemistry, Vol-II by I. L. Finar.
3. A text book of synthetic drugs, O. D. Tyagi and M. Yadav.
4. Synthetic drugs, Gurdeep R. Chatwal.
5. Medicinal chemistry by Graham Patrick.

## QUANTUM CHEMISTRY AND BIOSENSORS

COURSE CODE: 21CHD58

### Objectives

- To understand the applications of quantum mechanics to HMO theory.
- To learn the basics of biosensors and their applications.

### Course Outcome

- Applications of quantum chemical methods in the theoretical evaluation of energies of molecules and reactions.
- Development of chemical and biochemical sensors and their applications in the determination of biomolecules.

### Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are also used in class room teaching.
- Students will be assigned to solve the numerical problems.

## Course content

### UNIT-I

**16 HOURS]**

**Applications of quantum mechanics:** Variation theorem: Statement and proof, application of variation theorem to a particle in one dimensional box, linear oscillator, H and He-atoms. Molecular orbital theory, LCAO-MO approximation, application to hydrogen molecule ion ( $H_2^+$ ), energy levels of  $H_2^+$ , bonding and antibonding molecular orbitals, energy distribution, potential energy diagrams. Valence bond theory (VB), theory of  $H_2$  molecule, Heitler-London method, energy levels, various modifications of Heitler-London wave function. Comparison of MO and VB theories. SCF method for many electron atom. Slater Orbitals –Effective nuclear charge (ENC), expressions for slater orbitals for 1s, 2s, 3s, 2p and 3d electrons (no derivation), Slater's rules for calculation of ENC. Theories of valence – Introduction, linear and non-linear variation functions, secular equations, coulombic, exchange, normalization and overlap integrals, secular determinants.

**Huckel molecular orbital theory:** Outline of method, assumptions. Application to ethylene, allyl radical, cyclopropenyl radical, butadiene, cyclobutadiene, bicyclobutadiene and benzene. Calculation of delocalization energy, charge density,  $\pi$ -mobile bond order and free valence.

### UNIT-II

**[16 HOURS]**

**Biosensors:** Introduction, electrochemical biosensors: Amperometric, potentiometric and conductometric biosensors. Optical based biosensors: Surface plasma resonance, chemiluminescence, fibre optic biosensors, piezoelectronic sensors, mass selective and thermal sensors. Bio-recognition elements in biosensors, immobilization methods, principles of biorecognition, natural, semi-synthetic and synthetic biorecognition elements. Metabolism sensors: Glucose sensors, galactose sensors. Determination alcohol, ascorbic acid, D-isocitrate, oxalate, oxaloacetate, nitrite, nitrate, carbon monoxide, glycerol, triglycerides and sucrose. Biosensors using coupled enzyme reactions.

**Applications of biosensors:** Determination of glucose in blood, survey of biosensor methods for the determination of glucose. Determination of copper (I) in water using anodic stripping voltammetry.

#### References

1. Introductory Quantum Chemistry – A.K. Chandra. Second Edition, Tata McGraw Hill Publishing Co. Ltd., (1983).
2. Quantum Chemistry – Eyring, Walter and Kimball. John Wiley and Sons, Inc.
3. Quantum Chemistry –I.N. Levine. Pearson Education, New Delhi, (2000).
4. Theoretical Chemistry – S. Glasstone. East West Press, New Delhi, (1973).
5. Quantum Chemistry – R.K. Prasad, New Age International Publishers, (1996).
6. Valence Theory – Tedder, Murel and Kettle.
7. Surface chemistry: Theory and applications, J. J. Bikertman, Academic press, (1972).
8. Chemical Kinetics, K. J. Laidler 3<sup>rd</sup> Edn., Harper International Edn., (1987).
9. Test Bok of Physical Chemistry, S. Glasston, McMillan India Ltd., 2<sup>nd</sup> Edn. (1986).
10. Physics at Surfaces, A. Zangwill, Cambridge University Press (1988).
11. Surface Crystallography, L. J. Clarke, Wiley-Interscience (1985).
12. Biosensors: Fundamentals and Applications, Bansi Dhar Malhotra and Chandra Mouli Pandey, Smither Group Co., 2017, UK.
13. Biosensors: Techniques and Instrumentations in Analytical Chemistry, Frieder Scheller and Florian Schubert, Vol. 11, Elsevier Sci. Publishers, 1992.
14. Chemical Sensors and Biosensors, Brian R. Eggins, John Wiley & Sons Ltd, UK, 2004.



**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**  
(AUTONOMOUS)  
OOTY ROAD, MYSORE-570 025

**Postgraduate Department of Commerce**

**Syllabus**

**2022 – 23**

## M.Com COURSE STRUCTURE AND SYLLABUS

BATCH 2022-23

### MINIMUM CREDITS REQUIRED FOR M.COM DEGREE

I to IV Semesters	HARD CORE COURSE		SOFT CORE COURSE		OPEN ELECTIVE COURSE		TOTAL	
	Number	Credits	Number	Credits	Number	Credits	Number	Credits
Total	12	48	7	28	1	4	20	80

### Semester wise requirements of course and credits

Semester	HARD CORE COURSE		SOFT CORE COURSE		OPEN ELECTIVE COURSE		TOTAL	
	Number	Credits	Number	Credits	Number	Credits	Number	Credits
I	4	16	1	4	-	-	5	20
II	3	12	2	8	-	-	5	20
III	2	8	2	8	1	4	5	20
IV	3	12	2	8	-	-	5	20
Total	12	48	7	28	1	4	20	80

### First Semester M.Com

Sl. No.	Course Code	Title of the course	Hard core/ Soft core/	Number of Credits			
				L	T	P	TOTAL
HC01	MCA010	Accounting Theory	HC	3	1	0	4
HC02	MCA080	Corporate Governance and Business ethics	HC	3	1	0	4
HC03	MCA090	Advanced Financial Management	HC	3	1	0	4
HC04	MCA100	Strategic Marketing	HC	3	1	0	4
SC01	MCA210	Business Policy and Environment	SC	3	1	0	4
SC02	MCA220	Statistics for Business Decisions	SC	3	1	0	4

**Note:** students can register for any one of the above soft cores.(HC:4 + SC:1=5)

### Second semester M.Com

Sl. No.	Course Code	Title of the course	Hard core/ Soft core	Number of Credits			
				L	T	P	TOTAL
HC05	MCB030	Organizational Behavior	HC	3	1	0	4
HC06	MCB050	Entrepreneurial Development	HC	3	1	0	4
HC07	MCB010	Capital Market Instruments	HC	3	1	0	4
SC05	MCB240	Human Resource Management	SC	3	1	0	4
SC06	MCB270	Management of Financial Services	SC	3	1	0	4
SC07	MCB250	Banking Technology	SC	3	1	0	4
SC	MCB	Security Analysis and portfolio Management	SC	3	1	0	4

**Note:** Students can register for any two of the above soft cores.(HC:3+SC:2=5)

### Third Semester M.Com

Sl. No.	Course Code	Title of the course	Hard core/ Soft core/ Open elective	Number of Credits			
				L	T	P	TOTAL
HC08	MCC010	International Business	HC	3	1	0	4
HC09	MCC030	Business Research Methods	HC	3	1	0	4
SC15	MCC230	Elective- Paper- 1	SC	3	1	0	4
SC17	MCC250	Elective – Paper -1	SC	3	1	0	4
OE	580	Personal Financial Management	OE	3	1	0	4

#### Note

1. Students can register for Two of the elective groups as soft core.
2. Non-commerce students can register for open-elective. (HC:2+SC:2+OE:1=5)

### Fourth Semester M.Com

Sl. No.	Course Code	Title of the course	Hard core/ Soft core/ Open elective	Number of Credits			
				L	T	P	TOTAL
HC11	MCD010	International Accounting	HC	3	1	0	4
HC12	MCD020	Current Trends in Business and Commerce	HC	3	1	0	4
SC12	MCD220	Project Work	HC	0	1	3	4
SC16	MCD230	Elective – Paper 2	SC	3	1	0	4
SC18	MCD250	Elective- Paper 2	SC	3	1	0	4

**Note: 1** Project work is a Hard Core course. Internship reports for 20 Marks, C1-20 Marks, C2-20 (VIVA-Voce) Marks for VIVA and 40 Marks for project report. Project Internship will commence in the III semester.

**Note: 2** Guiding 4 students for Project work is considered to be equal to 01 hour of class room teaching (HC: 3+SC: 2=5).

## **Elective Group**

Any two groups from the available electives shall be selected by a student at the commencement of the III Semester. Once groups are selected, no change in the selected group will be allowed later. While the first papers of the selected group will be taught in Semester III, second papers of the selected group will be taught in Semester IV as Soft Core Courses. The Department will announce in the beginning of the third semester, any two or more elective groups which will be offered during III and IV semesters depending upon the availability of faculty members and the demand for electives.

### **Group A: Financial Accounting**

1. Contemporary Areas of Financial Accounting
2. International Financial Reporting Standards (IFRS)

### **Group B: Financial Management**

1. Futures, Options & Swaps
2. Strategic Financial Decisions

### **Group C: Business Taxation**

1. Indirect Tax Laws and Practice- GST and Customs duty.
2. Corporate Tax Laws and Planning

### **Group D: Cost Management**

1. Cost Accounting for Decision Making
2. Cost Management

**PROGRAM OUTCOME:**

- PO1 Understand role of accounting and finance in the present business scenario.
- PO2 Identify the latest trends in banking and finance
- PO3 Use wide varieties of tools and techniques to meet the emerging opportunities and challenges
- PO4 Become an entrepreneur based on the knowledge gained.
- PO5 Strengthen the knowledge base to take up CA/ICWA/ICS and other competitive examination
- PO6 Acquire the ability to engage in independent & lifelong learning in the broader context of social and technical changes.
- PO7 Accept the challenges of business world
- PO8 Enhance logical thinking and decision making ability

**PROGRAM SPECIFIC OUTCOME:**

- PSO1 Inculcate the knowledge of business and the techniques of managing the Business with special focus on Accounting, finance, and financial services
- PSO2 Identify knowledge based accounting principles and the latest application oriented corporate accounting methods.
- PSO 3 Develop decision making skill through costing methods and practical application of management accounting principles.
- PSO 4 Enhance taxation skills through a thorough understanding of tax laws



## M.COM- SYLLABUS

### First Semester

#### HC01: MCA010 ACCOUNTING THEORY

- 1. Course Description:** The course provides the coverage of the meaning of accounting theory, its types, approaches to formulate accounting theory; the IASB's conceptual framework; recognition, measurement and disclosure of elements of financial statements.
- 2. Course Outcome:**
  - CO1 Acquaint a set of logical principles for evaluation and development of sound accounting practices.
  - CO2 knowledge on conceptual framework of accounting theory
  - CO3 Critical thinking skills to analyze and interpret accounting transactions.
  - CO4 Understand the recognition, measurement and disclosure principles of elements of financial statements.
- 3. Pedagogy:** Course activities consist of lectures, case study analysis, group discussions, seminar presentation, assignment writing and tests. Reading and analysis of annual reports of companies will be the integral part of instruction.
- 4. Course Contents:**

**Module 1: The Meaning of Accounting Theory:** The meaning of accounting theory; relationship with accounting research and practice. Types of accounting theories- syntactical, semantical and behavioral theories. Approaches to formulation of Accounting Theory. Ownership theories - proprietary, entity and fund theories.

**Module 2: The Conceptual Framework of Accounting:** The IASB Framework for the Preparation and Presentation of Financial Statements-preface, purpose and scope; Users and their information needs; Objectives of financial statements; Underlying concepts and assumptions; Qualitative characteristics of financial statements; Constraints on relevant and reliable information; True and fair view; the elements of financial statements; Structure and format of financial statements. The accounting cycle.

**Module 3: Recognition, Measurement and Disclosure of Elements of Income Statement:** The concept of revenue and expense; their recognition principles and processes, measurement methods and disclosure issues. Recognition, measurement and disclosure of gains and losses from extraordinary items, unusual items, discontinued operations, effects of changes in accounting principles, and prior period items. Problems. Case studies on annual reports of companies.

**Module 4: Recognition, Measurement and Disclosure of Elements of Balance Sheet:** Definition of asset, liability and owners' equity; their types and characteristics. Recognition, measurement and disclosure of long-term and short-terms assets and liabilities, owners' equity and retained earnings. Problems. Case studies of annual reports of companies.

#### References:

- Anthony R.N., D.F. Hawkins and K.A. Merchant, *Accounting: Text and Cases*, McGraw Hill, 1999  
Richard G. Schroeder, Myrtle W. Clark and Jack M. Cathey, *Financial Accounting Theory and Analysis: Text Readings and Cases*, John Wiley and Sons, 2005.  
Ahmed Riahi Belkaoui, *Accounting Theory*, Quorm Books, 2000.  
Jawahar Lal, *Accounting Theory and Practice*, Himalaya Publishing House, 2008.

L.S. Porwal, *Accounting Theory*, TMH, 2000.

Thomas R.Dyckman, Charles J Davis, Roland E.Dukes, *Intermidate Accounting*, Irwin McGraw-Hill.

Eldon S. Hendriksen, *Accounting Theory*; [www.iasb.org](http://www.iasb.org). [www.icaai.org](http://www.icaai.org). [www.dca.gov.in](http://www.dca.gov.in)

## **HC02:MCA080 CORPORATE GOVERNANCE AND BUSINESS ETHICS**

### **Course Outcome:**

- CO1 Understand the concept of corporate governance
- CO2 knowledge about corporate ethics and cultural influences
- CO3 Acquire knowledge of corporate social responsibility and accountability
- CO4 Analyze the role of E-governance in present scenario.

### **Pedagogy:**

The subject matter will be presented through lecture, class discussion, student presentation, guest lectures and laboratory experiences.

**Module 1:** Business ethics: Ethics; Doctrine of Trusteeship: Unethical practices; Good ethics and Good Business. Corporate Ethics: Concept and Importance – Benefits of corporate Ethics- Corporate Philosophy and Culture – Managing Ethics and Legal Compliance – Case Analysis.

**Module 2: Social Responsibility of Business;** Doctrine of Social Responsibilities of Business, Dimensions of Social Responsibility, and Assumptions of S.R. Corporate Social Responsibility: Corporate Crimes – Company and Society Relations – corporate Social Challenges – Corporate Accountability – Business and Ecology –Case Analysis.

**Module 3: Concept of Corporate Governance:** It's Importance –Agency Theory – Governance model - Benefits of Good Corporate Governance – Present Scenario – Case Studies.

**Module 4: Corporate Governance In India:** Reforming BOD –Birla Committee – Naresh Chandra Committee – Narayana Murthy Committee – Audit Committee – Corporate Governance Code – The Future Scenario , E-Governance Importance, Requirements and Challenges in Present Scenario – Case Studies.

### **References:**

Business ethics by L.P. Hartman, (Tata Mc Graw Hill)

Business ethics by W.H.Shaw, (Thomson)

Corporate management and Accountability by L.C. Gupta (Mc Millan Institute for FM and Research, Chennai-1974)

Strategic Management by Hill, Ireland and Horkisson (Thomson)

Business and society by Keith Davis (Mc Graw Hill)

Corporate Governance – Fernando.

Business ethics and corporate Governance – Bansal Sandeep, Bansal Sanjiv, Bansal Rama – Kalyani Publishers.

**1. Course Description:**

Financial management is a functional area in general management. This subject is focusing on introduction, scope and importance of financial management, investment decisions, capital structure decisions, dividend decisions and working capital management.

**2. Course Outcome:**

- CO1 Understand financial management concepts and its important functions.
- CO2 Learn the process of evaluation of projects
- CO3 Understand capital structure theories
- CO4 Identify the dynamics of financial markets

**3. Pedagogy:**

Students must work out assigned individual topics, present seminars and participate in case studies or group discussions.

**Course Contents:**

**Module 1:** Introduction : Meaning, Scope, and functions of Financial Management. Corporate Objectives-Profit Maximization and Wealth Maximization, their social implications.

**Module 2:** Capital Budgeting Decision – Importance – Challenges – NCF estimation DCF Techniques- NPV vs IRR – Multiple IRR Problem- Modified IRR (MIRR) – Capital Rationing.

**Module 3:** Risk Analysis in Capital Budgeting- Approaches to risk absorption- Expected Net Present Value (ENPV) - Payback method - Risk-Adjusted Discount rate - Use of Normal Distributions - Sensitivity analysis - Measurement of Project risk- Risk Analysis of Project Portfolios.

**Module 4:** Capital Structures Decision – Traditional View – MM's theory- Factors impacting leverage decision. Cost of capital – Cost of equity – Cost of preferred capital- Cost of debt- Cost of retained earnings – WACC- Marginal cost of capital

**References:**

- Pandey, I.M. financial Management, Vikas Publishing House, New Delhi.
- Khan M.Y. and Jain P.K. Financial Management, Tata McGraw Hill, New Delhi.
- Kishore, R., Financial Management, Taxmans Publishing House, New Delhi.
- Chandra, Prasanna; Financial Management TMH, New Delhi.
- Horn, Van; Financial management and Policy, Prentice Hall of India.
- Brigham & Houston, Fundamentals of Financial Management, Thomson Learning, Bombay.
- Richard Brealey and Stewart Myers, Principles of Corporate Finance, Tata McGraw Hill, 2000.
- V K Bhalla, Financial Management and Policy: Text and Cases, Annual Publishers, 2002.

## HC04: MCA100      STRATEGIC MARKETING

### 1. Course Outcome:

- CO1    Understand the marketing strategy formulation
- CO2    Learn the steps in implementation of marketing strategies.
- CO3    Analyze different marketing strategy
- CO4    Learn about formulation and evaluation of marketing strategy

**2. Pedagogy:** Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

### 3. Course Contents:

**Module 1:** Marketing Management –Core Concepts, scope and importance of marketing management evolution of modern marketing concepts; objectives of marketing; marketing mix; Marketing Strategy Formulations – Key Drivers Of Marketing Strategies - Strategies For Consumer Marketing — Services Marketing – Competitor Analysis - Analysis of Consumer Markets – Strategic marketing planning.

**Module 2:** Marketing Mix Decisions -Product Planning And Development – Product Life Cycle – New Product Development And Management – Market Segmentation – Target m And Positioning of products – Channel Management – Advertising And Sales Promotions – Pricing Objectives, Policies And pricing strategies.

**Module 3:** Buyer Behavior - Buyer Behavior – buying Influencing Factors – Buyer Behavior Models – Online Buyer Behavior - Building And Measuring Customer Satisfaction – Customer Relationships Management – study of banking and automobile industries -Customer Acquisition, Retaining, Defection.

**Module 4:** Marketing Research & Trends In Marketing-Marketing Information System – Research Process – Concepts and Applications: Product – Retail Research – Customer Driven Organizations - Ethics in marketing –Online marketing trends.

### References:

1. Marketing Management: Philip Kortler and Kevin Lane Keller, PHI 14th Edition, 2012
2. Marketing management-Text and Cases: KS Chandrasekar, Tata McGrawHill-Vijaynicole, First edition, 2010.
3. Marketing: Paul Baines, Chris Fill and Kelly Page, Oxford University Press, 2nd Edition, 2011.
4. Marketing – An Innovative approach to learning and teaching- A south Asian perspective: Lamb, hair, Sharma, Mc Daniel, Cengage Learning — 2012

## **SC01: MCA210            BUSINESS POLICY AND ENVIRONMENT**

### **1. Course Outcome:**

- CO1            Insight on policy formation
- CO2            Understand the environmental factors that influence business
- CO3            Knowledge and significance of corporate social responsibility
- CO4            Identify the Principles of Business ethics

### **2. Pedagogy:**

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

### **3. Course Contents:**

**Module 1:**     Introduction: Business Policy: Importance of business policy-essentials of business policy-classification of business policy- Vision, Mission, Objectives –Types of Policies: Production policy-personnel policy- Financial policy-Marketing Policy-case studies.

**Module 2:**     Business in a Social System, Business and Economic system –Business Objectives-External Business Environment.

**Module 3:**     Business Environment: Internal Environment of Business-External Environment-Economic-Political-Socio-Cultural-Technological Environment –case studies

**Module 4:**     Business Ethics: Principles of Business Ethics; Doctrine of trusteeship; unethical practices; good ethics and good business. Social responsibility of business; Doctrine of social responsibility: Rationale of social responsibility; control of monopoly and restrictive and unfair trade practices.

### **References:**

A concept of corporate planning-, Russel Ackoff, Newyork wiley

Business policy and strategic management- Tokyo, McGraw hill

Strategic Management-Text and Cases- V.S.P. Rao and V. Harikrishna

Strategic Management-Azar Kazmi

Strategic Management-Francis Cherunillam

Strategic Management-Subba Rao.

**1. Course Description:**

The course comprises of probability theories, sampling techniques, time series analysis and multivariate analysis.

**2. Course Outcome:**

- CO1 Knowledge about application of probability theory and sampling in different areas of commerce
- CO2 Analyze the various methods of theoretical probability distribution
- CO3 Application of different tools in taking business decisions
- CO4 Learn the advanced application oriented tests – F Distribution and Anova

**3. Pedagogy:**

Class room teaching of basic statistical models shall be followed by solving problems involving business applications. Assigned problems are to be worked on an individual basis, followed by group discussion of case problems.

**4. Course Contents:**

**Module 1: Probability:** Meaning, terminology, types and rules. Random variables and use of expected value in decision making. Binomial, Poisson and Normal probability distributions- their characteristics and applications in business decisions.

**Module 2: Sampling:** Meaning of sample and population. Probability and non-probability methods of sampling. Use of random digits to choose random samples. Sampling from normal and non-normal populations. The Central limit theorem. Use of sampling in business decisions

**Module 3: Time Series Analysis :** Variations in time series. Cyclical, seasonal and irregular variations. Trend analysis. Application of time series analysis in forecasting.

**Module 4: Multivariate Analysis:** Multiple regression and correlation analysis. Analysis of Variance. Application of multivariate analysis in business decisions. Using Statistical Package for Social Sciences (SPSS) to solve problems.

**References:**

- Wonnacott and Wonnacott: “Statistics for Business and Economics” Wiley Publications
- Wonnacott and Wonnacott: “Econometrics” Wiley Publications
- Sanchetti and Kapoor: “Statistics”
- Morris Hamber: “Statistical Analysis for Decision Making”
- Richard Livin and David Robin: “Statistics for Management

## Second Semester

### HC05: MCB030 ORGANISATIONAL BEHAVIOUR

#### 1. Course Outcome:

- CO1 Understand individual behaviour in the organization
- CO2 Acquire the knowledge about foundation of individual behaviour
- CO3 Learn and apply skills in motivation
- CO4 Evaluate individual behaviour in group and resolve the conflicts

#### 2. Pedagogy:

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

#### 3. Course Contents

**Module 1:** Introduction: Meaning-Definitions and scope of organizational behavior-people-Organizational structure-technology and environment-OB as a Behavioral science-Contributing Discipline to OB-Psychology-Sociology-social psychology-Anthropology-Political science-OB and Management-Comparative roles in organization-Case studies.

**Module 2:** Foundations of Individual Behavior: Biological Characteristics-Age-Sex-Marital Status-Number of Dependents-Tenure-Ability-Intellectual Abilities- Physical Abilities-The Ability-Job fit personality-personality determinants-Personality Traits-Major Personality Attributes influencing OB-Matching personality and Jobs-Values, attitudes, and Job satisfaction: Importance of Values-Sources of Value system-Sources and types of Attitudes- learning –Theories of learning shaping values -Case Studies.

**Module 3:** Motivation: The concept of Motivation-Early Theories of Motivation-Hierarchy of Needs theory-theory X and Theory Y-Hygiene theory-contemporary theories of motivation-ERG Theory-three needs theory-cognitive evaluation theory and others –case studies.

**Module 4:** Foundation of group behavior: Defining and classifying groups-group process-group tasks-cohesive groups-group dynamics-leadership-nature and importance-functions-styles-communications-nature and types-effective communication-Roles of Formal and informal communication-Conflict management-The process of conflict-types of conflict-functional and dysfunctional conflict-resolution of conflict-case studies.

#### References:

Organisational Behaviour: Concept, Theory and Practice-Nirmal Singh

Organisational Behaviour - Fred Luthans

Organisation Theory and Behaviour - V S P Rao and PS Narayana

Organisational Behaviour - Niraj Kumar

Organisational Behaviour – K. Aswathappa

Management of organisational change –Harigopal

**Course Outcome:**

- CO1 Analyze the foundations and different dimensions of Entrepreneurial Development
- CO2 Acquaint the skills of an young entrepreneurs
- CO3 Analyze the techniques of project planning, implementation and execution.
- CO4 Identify the institutional support to entrepreneurs.

**Pedagogy:** A combination of Lectures, Case Analysis, Group Discussion, Seminars, Assignments, etc.

**Module – 1:** Entrepreneurship: Need, Factors affecting Entrepreneurial Development, Entrepreneurial Motivation, Conceptual Model of Entrepreneurship, Entrepreneur Vs Intrapreneur, and Classification of Entrepreneurs. Micro, Small and Medium Enterprises (MSMEs): Meaning and Definitions of MSMEs, Features, Scope, Objectives, Problems and Government Schemes; and MSMEs Act, 2006.

**Module – 2:** Entrepreneurial Development Programs and Small Business: Role of Government in Organizing such Programs, Women and Rural Entrepreneurs. Small Business: Concept and Definition, Role of Small Business in Modern Indian Economy, Steps for starting a Small Industry, Registration as SSI, Role of SIDBI, Advantages and Problems of SSIs, Institutional Support Mechanism in India, EDI, Incubation Centers, Incentives and Facilities, and Government Policies for SSIs.

**Module – 3:** Project: Definition, Characteristics, Types, Steps in identification of Projects, Project Life Cycle. Project Management – Meaning and Importance, Role of Project Manager. Project Appraisal - Technical Appraisal, Environment Appraisal, Market Appraisal and Managerial Appraisal. Project Identification - Environment for Business Opportunities, Idea Generation, Short Listing and Selection of Product/Service, Stages in Venture Appraisal.

**Module – 4:** Project Planning: Identifying Strategic Project Variables; Project Financing: Project Cost Estimation and Working Capital Requirement, Sources of Fund, Preparation of Projected Income Statement, etc; Implementation of Projects - Graphic representation of Project Activities, Project Scheduling, MIS in Project, Problems of Project Implementation.

**Reference**

1. Singh Narendra, Project Management and Control, Himalaya Publishing House.
2. Prasanna Chandra, Projects: Planning, Analysis, Selection, Implementation and Review, Tata McGraw Hill.
3. P. Gopala Krishnan and V. E Rama Moorthy, Project Management, MacMillan India.
4. Chandra Prasanna, Project Preparation, Appraisal and Implementation, Tata McGraw Hill.
5. A. N Desai, Entrepreneurship Management, Ashish Publishing House.
6. Vasanth Desai, The Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.
7. Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall of India.
8. Hall B. L, Pickle and Yance, Small Business Management, John Wiley & Sons, USA.
9. Kenneth R. Van Vloorthis, Entrepreneurship and Small Business Management, Allyn and Bacon. Kuvempu University, Master of Commerce (Regular), 2017-18 51
10. C. M. Bamback and J. R. Manscusu, Entrepreneurship and Venture Management, Prentice Hall of India.
11. Yound, Trevour L, Planning and Implementing Project, Sterling Publishing Ltd.
12. C. A Dailey, Entrepreneurship Management, McGraw Hill.



**1. Course Description:**

Capital markets in recent times are flooded with new and innovative instruments enhancing vibrancy and volume of capital markets. Every advanced programme in commerce should consist of a course in analysis and evaluation of various instruments traded in capital markets today.

**2. Course Outcome:**

- CO1 Understand the role of capital markets
- CO2 Critically evaluate the various capital market instruments like Stock, bonds etc
- CO3 Identify the dynamics of global capital markets
- CO4 Understand the concept and use of Derivatives in risk management.

**3. Pedagogy:**

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

**4. Course Contents:**

**Module 1:** Origin, Nature and Role of Capital Markets -Globalization of Capital markets- Capital Markets in India - Stock exchanges.

**Module 2:** Stocks, Bonds, Debentures – Types of Debentures, Private Placement, Guidelines for IPO – ADRs - GDRs – ETFs –Units of Mutual funds

**Module 3:** Derivatives- Basic features – Role of Derivatives markets - Forwards and Futures - Commodity Futures – stock Futures and Index futures.

**Module 4:** Options - Stock options and Index options-Swaps – Currency Swaps and Interest Rate Swaps.

**References:**

Financial institutions and markets- by Bhole (TMH).

Financial markets- by M.Y.Khan (Vivek).

Financial Derivatives – Dr.G.Kotreshwar

## SC05: MCB240 HUMAN RESOURCE MANAGEMENT

### 1. Course Outcome:

- CO1 Knowledge about human resources, their significance and management in organizations
- CO2 Analyze human resource planning
- CO3 Learn the steps in HRD
- CO4 Understand reward system and appraisal of individual

### 2. Pedagogy:

Teaching method comprises of lecture sessions and tutorials. Lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content.

### 3. Course Contents:

**Module 1:** Environmental context: New economic policy and changing business-technological –socio-economic and political and legal environment, structural reforms and their implications for HRM in India-Response of the management-worker and unions to structural reforms and their implications for HRM in India-Response of the management –Worker and unions to structural adjustment. Concepts of human resource management-Meaning-Objectives-Scope and functions-Perspective of HRM: linking corporate strategies and policies with HRM Organization of HRM department.

**Module 2:** Human Resources planning and Procurement; Job analysis and evaluation-job description-job specification -job rotation and job enrichment. Human resource planning- importance-objectives and problems. Recruitment-meaning-recruitment policy, sources –factors affecting selection decision-selection procedure. Human resource information system.

**Module 3:** Human resource development: Meaning-concepts of HRD-objectives of training-organization of training programmers-methods-advantages and limitations of training. Evaluation of training program HRD for total quality management. Transfer policy Promotion policy-Demotion and Discipline-consequences of indiscipline –disciplinary procedure.

**Module 4:** Compensation/Rewards system: Significance of reward system in business organisation. Compensation system in practice-systems of promoting -factors determining employee compensation and rewards-dearness allowance, employee benefits-bonus-laws on wages, bonus and social security-managerial compensation. Performance Appraisal: concepts, objectives philosophy and process of performance appraisal system- counseling.-career planning and management.

### References:

1. Human Resource Management: Strategies and Action -Armstrong
2. Human Resource Management -Dr.Ashwathappa
3. Personnel and Human Resource Management -D.A. Deonz and F.P. Robins
4. Personnel Management - Edwin Phillip
5. Human Resources Management—L.M. Prasad

**1. Course Description:**

This course is all about Financial Services industry analysis, trends, globalization and government policy. It also includes an analysis of future of Financial Services, particularly in respect of investment banking, micro-finance/insurance and angel investing.

**2. Course Outcome:**

- CO1 Understand and appreciate the role of financial services industry
- CO2 Grasp the trends in financial services industry particularly the impact of globalization of Financial Services
- CO3 Analyze the factoring services and securitization system.
- CO4 Gain insight into the future of Financial Services industry

**3. Pedagogy:**

Students must work out assigned individual topics, present seminars and participate in case studies or group discussions.

**4. Course Contents:**

**Module 1:** Concept and Scope of Financial Services – Marketing of Financial Services Problems and Prospects of Financial Services Industry in India.

**Module 2:** Globalization of Financial Services – GATS – Functions and the Role of GATS Evaluation of Government's policy towards globalization.

**Module 3:** An Overview of Trends in Financial Services in India – Lease Financing; Types, History and Development of Lease Financing, Structure of Leasing Industries, Factoring and International Factoring, Securitization- meaning, features, process, IPO Management – Venture Capital; Features, Methods of Venture Financing, Initiatives – Credit Rating; functions –Credit Rating Agencies. Portfolio Management Services.

**Module 4:** Future of Financial Services Industry – Micro Finance/Insurance – Angel investing – Investment Banking.

**References:**

1. Financial Markets and Institutions – Bhole L. M. (Tata McGraw Hill)
2. Indian Financial System – Theory and Practice – Khan M.V (Vikas Publishing)
3. Financial Management and Control – Chakraborty S.K (Mc Milan)
4. New Issues Markets - Khan M.Y (Allied Publishers)
5. Emerging Scenario of Financial Services – Gordon & Natarajan (Himalaya Publishing House)
6. Financial Services in India - M.A. Kohok (Himalaya Publishing House)
7. Management of Financial Services – Avadhani (Himalaya Publishing House)

**SC07:MCB250****BANKING TECHNOLOGY**

1. **Course description:** The course deals with study of technology adaption in banking, besides providing scope of practical side of banking

2. **Course Outcome:**

- CO1 Understand the recent developments in banking technology
- CO2 Assess the impact of technology on banks
- CO3 Identify the available payment channels and their delivery system.
- CO4 Verify the global developments in banking technology.

3. **Pedagogy:** LTP model, field survey, summary and group discussions.

4. **Course Contents:**

**Module 1:** Branch Operation and Core Banking - Introduction and Evolution of Bank Management – Technological Impact in Banking Operations – Total Branch Computerization – Concept of Opportunities – Centralized Banking – Concept, Opportunities, Challenges & Implementation . – Case study: Analysis of Recent Core Banking Software.

**Module 2:** Delivery Channels - Overview of delivery channels – E – Lounge establishment - Phone Banking – Call centers – Internet Banking – Mobile Banking – Payment Gateways – Card technologies – MICR electronic clearing

**Module 3:** Interbank Payment System - Interface with Payment system Network – Structured Financial Messaging system – Electronic Fund transfer – RTGSS – Negotiated Dealing Systems & Securities Settlement Systems – Electronic Money – E Cheques

**Module 4:** Global developments in banking technology - Information technology in finance and service delivery. Impact of technology on banks – protecting the confidentiality information system audit. Audit measures in computerized environment information system security and disaster management.

**References:**

1. Financial Services Information Systems - Jessica Keyes Auerbach publication; 2nd edition (March 24, 2000)(Text Book)
2. Kaptan S S & Choubey N S., “E-Indian Banking in Electronic Era”, Sarup & Sons, New Delhi, 2003
3. Vasudeva, “E – Banking”, Common Wealth Publishers, New Delhi, 2005
4. Turban Rainer Potter, Information Technology, John Wiely & Sons Inc
5. Banking Technology - Indian Institute of Bankers Publication.

## **SC : MCB SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT**

### **1. Course Outcome:**

CO1	Knowledge about practical aspects of investment analysis
CO2	Understand the functions of SEBI
CO3	Analyze the various investment alternatives
CO4	Learn the skills to construct investment portfolio

### **2. Pedagogy:**

In the LTP framework the Lecture sessions focus on building conceptual clarity and providing basic information on the nature and role of nonprofit sector. The reinforcement through Tutorial sessions focus on group exercises related to Indian nonprofit sector. Practical exercises involve field reports by students, both at individual and group levels.

### **3. Course Contents:**

**Module 1:** Investment Setting - Securities – Sources of investment information – Security market indications – Security Contract regulation Act. Investor Protection. Over view of capital market, Institutional structure in capital market, Reforms and state of capital market, New issue market and problems, Securities and Exchange Board of India (SEBI), Debt Market.

**Module 2:** Fundamental Analysis - Economic Analysis – Economic forecasting and stock Investment Decisions – Forecasting techniques. Industry Analysis – Industry classification. Economy and Industry Analysis. Industry life cycle – Company Analysis Measuring Earnings – Forecasting Earnings – Applied Valuation Techniques – Graham and Dodds investor ratios.

**Module 3:** Technical Analysis - Fundamental Analysis Vs Technical Analysis – Charting methods – Market Indicators. Trend – Trend reversals – Patterns - Moving Average – Exponential moving Average – Oscillators – ROC Momentum – MACD – RSI – Stoastics.

**Module 4:** Portfolio Theory – Portfolio Construction – Diagnostics Management – Performance Evaluation – Portfolio revision- Mutual Funds.

### **References:**

1. Donald E.Fischer & Ronald J.Jordan, 'Security Analysis & Portfolio Management', Prentice Hall of India Private Ltd., New Delhi 2000.
2. V.A.Avadhani – 'Securities Analysis and Portfolio Management', Himalaya Publishing House, 1997.
3. V.K.Bhalla, 'Investment Management', S.Chand & Company Ltd., Seventh Edition, 2000.
4. Punithavathy Pandian, 'Security Analysis & Portfolio Management' – Vikas Publishing House Pvt., Ltd., 2001.

## Third Semester

**HC08: MCC010**

## INTERNATIONAL BUSINESS

### 1. Course Outcome:

- CO1 Understand the scope of international business along with drivers of globalization
- CO2 Analyze different aspects of International Business environment and the issues associated with them.
- CO2 Identify policy and practice skills related to international business
- CO3 Identify the various modes of entry in international business.
- CO4 Learn the functioning of WTO, MNC's etc.

### 2. Pedagogy:

The course would be taught under LTP method. The lecture sessions are designed to be interactive with the student expected to come prepared with basic reading suggested before every session. The tutorial sessions are basically group exercises with each designated group handling a prescribed module for presentation and interaction, in a three-way interactive process. It basically involves preparing field reports and presenting them for plenary discussions.

### 3. Course Contents:

**Module 1:** Introduction: International Marketing-Trends in International Trade-Reasons for Going International-Global Sourcing and Production Sharing-International Orientations-Internationalization Stages and Orientations-Growing Economic Power of Developing Countries-International Business Decision-Case Studies.

**Module 2:** International Business Environment: Trading Environment-Commodity Agreements-Cartels-State Trading-Trading Blocks and Growing Intra-Regional Trade-Other Regional Groupings-SAARC-GATT/WTO and Trade Liberalization-The Uruguay Round-Evaluation-UNCTAD and WTO negotiation

**Module 3:** Multinational Corporations: Definition-Organizational Structures-Dominance of MNC's-Recent Trends-Code of Conduct-Multinationals in India-Case Studies.

**Module 4:** India in the Global Setting: India an Emerging Market-India in the Global Trade-Liberalization and Integration with Global Economy-Obstacles in Globalization-Factors Favoring Globalization-Globalization Strategies. Trade Policy and Regulation in India: Trade Strategies-Trade Strategy of India-Export-Import Policy-Regulation and Promotion of Foreign Trade in India-Case studies.

### References:

- Chadha.G.K : WTO and Indian Economy
- G.S.Batra & R.C.Dangwal : International Business : New Trends
- Jean Pierre & H.David Hennessay : Global Marketing Strategies
- Justine Palu : International Business
- Francis Cheruniulam : International Business

**1. Course Outcome:**

- CO1 Evaluate various research decisions
- CO2 Learn the methods of data collection
- CO3 Analysis and interpretation of data
- CO4 Equip the skills of report writing

**2. Pedagogy:**

The lecture sessions focus on providing conceptual understanding and analytical setting for select aspects of the course content. This session focuses on student involved and student driven content study. Identified groups of students make presentations and interact with both the faculty and the other students. The aspects reinforced through lecture and tutorial is taken up for practical study. Here the students would undertake field exercises related to different aspects of the course content.

**3. Course Content:**

**Module 1: Introduction:** Objectives and Role of Business Research–Distinct Features of Business Research-Theoretical Setting for Business Research–Ethical Issues in Business Research.

**Module 2: Research Process:** Developing a Research Proposal–Exploratory Research and Qualitative Analysis–Sources of Data- Methods of data collection–Techniques of Communicating with Respondents.

**Module 3: Managing Research Assignment:** Questionnaire Design-Sampling and Fieldwork Techniques-Measurement and Scaling Concepts-Attitude Measurement.

**Module 4: Analysis and Presentation:** Application of Univariate, Bivariate and Multivariate methods of Statistical Analysis-Methods of Business Research Report Writing–Language-Referencing-Bibliography.

**References:**

Business Research Methods, William G. Zikmund, The Dryden Press

Research for Development: A Practical Guide, Sophie Laws, VISTAAR Publications

Methodology in Social Research, Partha Nath Mukherjee, Sage Publications

## GROUP C: BUSINESS TAXATION

### Elective Paper-1

#### SC11: MCC230 INDIRECT TAX LAW AND PRACTICE

#### Goods and Services Tax and Customs Duty

1. **Course Description:** This paper is to educate the taxation students about Indian Tax System, its background, and its operation in the global competitive market. The importance and administration of the indirect taxes in the Indian market oriented economy and its role in achieving the objectives of modern welfare government. To understand the relevance of GST in the present Indian Tax Scenario.

#### 2. Course Outcome:

- CO1 Understand the significance and contribution of indirect taxes (GST) in the Indian and global economy.
- CO2 Comprehend the principles of taxation and incidence process of indirect taxes in market orientated economy.
- CO3 Understand the implications of indirect taxes on the taxable capacity of consumers, dealers and society at large.
- CO4 Become tax consultants for tax planning, tax management, payment of tax and filling of tax returns
- CO5 Understand the impact of GST on Domestic, National and International Trade.

#### 3. Pedagogy:

- 1) Lecture:
- 2) Tutorial and bridge class\*(Non tax students)
- 3) Live leading cases pending and deciding in the high court and supreme courts.
- 4) Practical work: Tax planning, Tax management, filing of various tax returns and working as consultants and tax adviser for small companies nearby dealers and companies relating to GST and Customs
- 5) Compulsory Activities– Compute minimum **FIVE** firms GST returns and file online and submit the copy of the same to the Department.

#### 2. Course Contents:

**Module 1:** Constitutional Provision for Indian tax system. Public finance: public expenditure and public revenue. Principles & objectives of taxation in the modern welfare government. Indian tax structure, different types of taxes- taxes under indirect tax family in India, methods of taxations, tax reforms and recent tax reforms committees and its recommendations and fiscal discipline.

**Module 2:** GST-Genesis, History, Constitutional Background of GST, GST Bills, GST- Central and State Financial relations, Finance commissions, Salient features of GST, Tax Reforms and GST in India, Tax compliance, GST administrative structure both central and state level, Advantages of GST- Economy, Governments, dealers and consumers, E-Commerce and GST GST-Issues, challenges and problems.- **Legal case study.**



**Module-3:** Taxes under GST- levy and incidence of GST, Value of Tax event, Rates and Schedules, CGST, SGST, IGST, Criteria for GST, GST on Exports, Imports and SEZ supplies input credit, Payment of Taxes, Returns Filing, Assessment and Audit of Accounts, under GST, GST refund, Appeals and Revision, Prosecution and Appellate Tribunals. –**Legal Case studies.**

**Module: 4:** Customs Duty: Customs Act, 1962 and Rules, regulations Circulars and Notifications; Customs Tariff Acts, and the related Rules. Principles governing levy of customs duty, types of duties at global scenario. Basic principles of classification of goods and valuation of goods, special provisions regarding baggage, goods imported or exported by post, and stores. Duty drawback schemes, GATT and WTO objectives principles in customs duty.- **Legal Case studies.**

**References:**

- 1) Indirect Taxes- Law and Practice: V.S.Datey
- 2) Karnataka GST Manuals
- 3) GST Ready Reckoner
- 4) Bare Acts of Customs, Customs Tariff Acts, GST
- 5) Public Fiancé- Mahaveer Thagy
- 6) Public Finance Prof.H.Doltan
- 7) GST Bill/Act 2016
- 8) CST Law and Practice-SS Gupta
- 9) Basic of GST-Nitya Tax association Taxman
- 10) GST Manual- Taxman publication
- 11) Indian GST for Beginneers –Jayaram Hiregange and Deepak Rao
- 12) CA Practical Manuals
- 13) [www.gstindia.com](http://www.gstindia.com)

## GROUP D: COST MANAGEMENT

### Elective Paper-1

#### SC17: COST ACCOUNTING FOR DECISION MAKING

##### 1. Course Description:

This course provides the coverage of concept of cost behavior analysis, break even analysis, multi product break even analysis, graphs, marginal costing and managerial decisions and direct costing.

##### 2. Course Objectives:

The course in marginal costing and decision making is aimed at equipping the students with the knowledge and skill relating to marginal costing as a tool for evaluating a wide range of managerial decisions involving make-or-buy, pricing, export offers, temporary short-term of operations, discontinuance of a product line, etc.,

##### 3. Pedagogy:

Course activities consist of lectures, case study analysis, group discussions, seminar presentation, assignment writing and tests. Solving problems and evaluating decisions involving the financial and cost data of selected firms will be integral part of instruction.

##### 4. Course Contents:

**Module 1: Introduction:** Meaning- terminology- Scope & Concepts- Cost Behavior Analysis- Break Even Analysis- Approaches of Break Even Analysis in relation to cost & revenue. Factors- Multiproduct Break Even Analysis- Assumptions Underlying Break Even Analysis- Limitations of Break Even Analysis- Case Studies.

**Module 2: Contribution Concepts & Short term Profitability Analysis:** Profitability Analysis Under Constrained Conditions- Profit- Volume Ratio & its Uses- Profit Volume Graphs – Case Studies.

**Module 3: Marginal Costing & Managerial Decisions:** Profit Planning- Pricing Decision – Production Decision – Make and Buy Decision Joint & By-product Decision – Distribution Cost Analysis- Case Studies.

**Module 4: Standard Costing:** Objectives-Principles-Determination of Standards for Material-Labor- Direct Expenses & Overhead Costs-Variable and Fixed Costs-Case Studies.Variance Analyses: Material, Labor, and Overhead Variances-sales & Profit Variances-Disposition of Variances-Assessing the Significance of Standard Cost Variance-Standard Cost Accounting-Case Studies.

##### References:

1. Management Accountancy: J. Batty : ELBS
2. Cost Accounting- A Managerial Emphasis: C.T.Horngel :
3. Cost Analysis for Management Decisions: M.R.S. Murthy : Tata Mc Graw Hill
4. A Dictionary of Managerial Finance, G. Kotreshwar, Chandana Publications(2014), Mysore

**1. Course Description:** This course is designed to provide a deeper understanding of Personal Financial Management. It focuses on basics of personal financial management, personal savings and investment plans, computation of return and risk factor of personal savings and investments, retirement savings plans.

**2. Course Outcome:**

CO1: Understand personal financial management process.

CO2: Plan personal budget effectively.

CO3: Recognize the significance of financial planning in the changing personal and financial environment.

CO4: Assess the merits of various investment alternatives of personal financial planning.

**3. Pedagogy:** Method of instruction consists of lectures, case study design and analysis, group discussions, seminar presentation, writing assignments and tests. Interaction individual investors with different profiles by age, income, sex, occupation, and region.

**4. Course Contents:**

**Module 1: Basics of Personal Financial Management:** Basics of Personal Financial Management: Budget, The Personal Financial Planning Process, Preparation of Personal Budget, Personal Financial Statements, Personal Income Tax Planning. Case studies on personal financial planning of individuals.

**Module 2: Personal Savings & Investment:** Investment Criteria- liquidity, safety and profitability. Savings instruments of Post Office and Banks. Chit Funds. Investment in Shares, Debentures, Corporate and Government Bonds, Mutual Fund. Investment in Physical Assets – Real Estate, Gold and Silver, Gold certificates. Risk and Return associated with these investments. Case studies on risk and return perception of retail investors on various investments.

**Module 3: Computation of Return and Risk of Personal Investment:** Present Value and Future Value of a Single Amount and an Annuity. Computation of interest, dividend and capital gains on personal investments. Impact of leverage on return. Personal tax planning,

**Module 4: Retirement Savings Plans:** Retirement Savings Plans:, Gratuity plans from the government. Life Insurance types. Health insurance. Pension Plans- Defined Contribution Plan and Defined Benefit Plan. Provident Fund, Gratuity. Life Insurance Plans. General Insurance Plans. Reverse Mortgage Plans.

**References:**

Personal Finance by Jack R. Kapoor, Les R. Dlabay and Robert J. Hughes, Tat McGraw-Hill Publishing Company Ltd. New Delhi.

Financial Education by Reserve Bank of India – rbi.org.

Personal Finance columns in The Economic Times, The Business Line and Financial Express Daily News Papers.

Information Broachers of Post Offices, Banks, Mutual Funds, Insurance Companies

Internet Sources- BSE, NSE, SEBI, RBI, IRDA, AMFI etc.

**HC11: MCD010**

**INTERNATIONAL ACCOUNTING**

**1. Course Description:** This course is designed to provide a deeper understanding of international accounting issues related to global financial reporting. It focuses on major diversities and challenges of financial reporting in the global arena, harmonization and international financial reporting standards. It also covers accounting for foreign currency transactions and major translation methods. It focuses on main issues in international financial statement analysis.

**2. Course Outcome:**

- CO1 Understand international accounting issues related to global financial reporting.
- CO2 Examine, analyze and assess theoretical and practical aspects of accounting harmonization.
- CO3 Identify major diversities and challenges of financial reporting in the global arena and IFRS.
- CO3 Learn the techniques of international financial statement analysis

**3. Pedagogy:** Method of instruction consists of lectures, analysis of international financial statements, group discussions, seminar presentations, writing assignments and tests. Reading and analysis of annual reports of multi-national organizations will be integral part of instruction.

**4. Course Contents:**

**Module 1: International Financial Reporting:** Definition and scope of international accounting. Main causes of diversity in international financial reporting. Harmonization vs. standardization. Rationale for and obstacles to harmonization. Role of regional and international organizations engaged in accounting harmonization – EU, ASEAN, IASB, IFAC, IOSCO, OECD, U.N., etc. Case studies on current evidence on accounting harmonization at regional level and global level.

**Module 2: International Financial Reporting Standards (IFRS):** The structure of IFRS. Process of IFRS Standard Setting. Constraints. Conceptual Framework for Financial Reporting under IFRS. Hierarchy of Standards. IFRS adoption or convergence. Case studies on compliance with IFRS by Indian Companies and MNCs.

**Module 3: Accounting for Foreign Exchange Rate Fluctuations:** An overview of foreign currency markets and exchange rates. Foreign exchange exposures. Accounting for spot and forward foreign currency transactions. Foreign currency translation methods- current rate method, current/non-current method, monetary/non-monetary method and temporal method. IFRS on foreign currency exchange accounting. Case studies on the annual reports of companies.

**Module 4: International Financial Statement Analysis:** Main issues in international financial statement analysis –understandability, availability, reliability, comparability and timeliness of financial information. Language, terminology and format. Techniques of financial statement analysis-horizontal, vertical, trend and ratio analysis. Analysis of income statement, balance sheet and cash flow statements of multinational corporations.

**References:**

- International Accounting by Shirin Rathore, Prentice-Hall of India, New Delhi
- Comparative International Accounting by Christopher Nubs and Robert Parker, Pearson Education Asia, New Delhi.
- International Accounting: A User Perspective by Shahrokh M. Saudagaran, South-Western Thomson Learning, Australia.
- International Accounting by A.K.Das Mohapatra, Prentice-Hall of India, New Delhi

The Analysis and use of Financial Statements by Gerlad I.White, Ashwinipaul C.Sondhi and Dov Fried, John Wiley, New York.

The Economic Times, The Business Line and Financial Express daily papers.

Research Journals on International Accounting.

Internet Sources; [www.iasb.org](http://www.iasb.org). [www.worldbank.org](http://www.worldbank.org). [www.unctad.org](http://www.unctad.org). etc.,.

## **HC12: MCD020 CURRENT TRENDS IN BUSINESS AND COMMERCE**

### **Course Outcome:**

- CO1 Understand changing business and financial environment
- CO2 Equip the skills required for competitive examinations and JRF, NET and SLET
- CO3 Develop analyzing and decision making skills on current topics of business
- CO4 Identify the reforms in areas of banking, insurance, capital markets and taxation.

**Pedagogy:** LTP Model of facilitating learning process, working out MCQ's and group discussions.

### **Course contents:**

1. All the compulsory subjects of M.Com programme.
2. The study of trends in the area of business and commerce – Trading, manufacturing, Finance, Capital Market, Foreign Trade, Foreign Exchange, Industrial relations, International Business and Collaborations, Taxation, Internal Marketing Scenario.
3. Trends in Inflation, Economics Development, Employment, Industry and Agriculture, World Economics and Trade Problems; Social, Economic and Political event in the Country and the world.

### **Reference:**

1. Reserve bank of Indian Bulletin
2. Yojana
3. The Economic Times Daily
4. Business Line Daily
5. Business Standards
6. Business India

## GROUP C: BUSINESS TAXATION

### Elective Paper-2: SC12: MCD230 CORPORATE TAX LAW AND PLANNING

**1. Course Description:** This course is focus on different heads of income, taxable in the hands of companies, computation of gross total income, deduction, exemptions, set off and carry forward of loss. Tax planning relating to various managerial decisions for reducing the tax burden, allocation of investments, and maximize the company wealth. As a tax consultant of the corporate tax laws of the company to give advice to the drawing officers regarding TDS, advance payment of tax and remittances of tax, for his employees.

#### 2. Course Outcome:

- CO1 Understand the incidence of tax on residential status of the companies
- CO2 Understand the different types of companies under corporate income tax act.
- CO3 Know the different sources of income for corporate assesses.
- CO4 Become a manger of a company/tax consultant and reduce the tax burden and maximize the company's wealth
- CO5 Understand the impudence of tax planning with various managerial decisions

#### 3. Pedagogy:

1. The course content is covered class room lecture, remedial class for non tax students, student's seminar, case discussion, and work out the problem on the company problems as student, as consultant and as a tax authority and also visiting company and tax office for practical exposure.
2. Compulsory Activities - Each candidate must compute the returns and file online-at least two corporate assesses.

#### 4. Course Content:

**Module 1: Definition of company**-Indian company, Domestic Company, Foreign Company, Widely Held Company, Closely held company, Residential Status of a company and incidence of Tax.

**Module 2: Computation of Taxable income of companies**- Computation of table income under different heads of income-House property, Profit and gain from business or profession, Capital gain and income other sources, carry forward and set off of losses in case of companies. Deduction from Gross Total income. Minimum Alternative Tax.-**Legal Case study**.

**Module 3: Tax Planning**- Tax avoidance and tax evasion. Tax planning with corporate dividend, Dividend policy- bonus shares. Tax planning with reference to specific managerial decisions- Make or Buy, Own or Lease, Purchase by installment or by Hire, Repair, Replace, Renewal or Renovation, shout down or continue.- **Legal Case study**.

**Module 4: Procedure for assessment**- Deduction of Tax at Source, Advance payment of Tax, Tax returns, refunds appeals and revision.- **Legal Case study**. Each student must compute the returns and file online-at least two corporate assesses.

#### References:

Direct Taxes-Dr.H.C. Mehrotra and Dr.S.P.Goyal Sahitya Bhavn New Delhi.

Direct Taxes law and practice-Bhagavathi Prasad, Vishva Prakashana, New Delhi.

Direct Taxes Aggarval P.K "Tax Planning for Companies" Hind Law Publishers, New Delhi.

Corporate Tax Planning and Management, Lakhotia, Vision Publishers.

**GROUP D: COST MANAGEMENT**  
**Elective Paper-2 -SC18: COST MANAGEMENT**

**1. Course Description:**

This course provides the coverage of a broader framework of various tools and strategies used for cost management and control.

**2. Course Objectives:**

The course is aimed at helping the students to:

- (i). Understand the scope and need for cost control and management.
- (ii) . Familiarize themselves with the basic cost control and management tools.,
- (iii). Understand the importance of statistical tools and operation research in cost control and management.

**3. Pedagogy:**

Course activities consist of lectures, case study analysis, group discussions, seminar presentation, assignment writing and tests.

**4. Course Contents:**

**Module 1: Cost Management**-Nature; Cost Management System; Cost Management ; Components of CM. Activity-Based Management [ABM]: Concept and Uses; Relationship between Activity – Based Costing and ABM; Operational ABM and Strategic ABM; Techniques of ABM; Implementation Steps in ABM.

**Module 2: Pricing Strategies**- Factors Influencing Pricing Decisions; Short run Vs. Long Run Pricing Strategy; Cost-Based Pricing; Economic Approach to Pricing; Pareto Analysis in Pricing Decisions. Activity-Based- Budgeting (ABB): ABB and Traditional Budgeting; ABB Process; Capacity Utilization; Role of ABB in Cost Management.

**Module 3:** Designing Costing Systems for Job and Process Oriented manufacturing environments – Cost Estimation and Regression Analysis – and cost volume profit Analysis.

**Module 4: Application of Operation Research and Statistical Tools in cost management:** Linear Programming, Network Analysis, Assignment, Transportation and Time Series Analysis- Time series analysis including moving totals and averages.

**References:**

1. Cost Management : A strategic Emphasis, Blocher,Chen,Lin Mc Graw Hill
2. Welsh, Glenn A. : Profit, Planning and Control(prentice Hall)
3. Standard Costing : J. Batty
4. Cost Analysis for Management Decisions: M.R.S. Murthy , Tata Mc Graw Hill
5. Managerial Accounting : Calvin Engler, Irwin Publication
6. Cost Accounting A Managerual Emphasis: Charles T Horngren, Srikant, PHI.
7. Advanced Management Accounting: Robert S Kaplan Anthony A. Alkinson Prentice Hall of India, New Delhi
8. Management & Cost Accounting : Cohn Drury International Thomson Business Press
9. Principles & Practices of Cost Accounting : Ashish K. Bhattacharya A. H. Wheeler publisher
10. Quantitative Techniques in Management: N.D. Vohra Tata McGraw Hill Book Co. Ltd.
11. Cost Management strategy for business decision: Ronald Hilton and Michal Maher, 3rd Editions, Macgraw Hill.







# ASSOCIATE COLLEGE OF ARTS, COMMERCE & SCIENCE

The Autonomous College of Arts, Commerce & Science  
Approved by UGC, New Delhi

Recognized by UGC with 20% seats

Approved by UGC as "Category II" College in Government

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## PG DEPARTMENT OF COMPUTER SCIENCE

Proceedings of the B.A.U. Meeting - 11<sup>th</sup> Jan 2021

Reviewed the Syllabus of Postgraduate, Technical and Open Elective Courses

### MEMBERS

Sl. No.	Name	Signature
1	Dr. Gauri P. S. Chairperson and Professor MCA in Computer Science University of Mysore, Mysore	
2	Dr. Prasad B. H. P. Professor and HOD Department of Computer Science and Engineering M. S. Ramaiah Institute of Technology, Bangalore MCA in Computer Science MCA in Computer Science MCA in Computer Science	
3	Dr. H. S. Srinivasan Assistant Professor Dept of Computer Science and Applications JSS College, Mysore University Mysore - 570 005 E-mail: srinivasan_h@jssmss.edu 9880000000	
4	Dr. S. Srinivas Assistant Professor PG Department of Computer Science JSS College of Arts, Commerce and Science City Road, Mysore	
5	Dr. V. S. Srinivasan Assistant Professor and HOD PG Department of Computer Science JSS College of Arts, Commerce and Science City Road, Mysore	



**MINISTRY OF EDUCATION, MALAYSIA**

**DEPARTMENT OF EDUCATION, MALAYSIA**  
**AGENCY FOR EDUCATIONAL RESEARCH AND INNOVATION**  
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**AGENCY FOR EDUCATIONAL RESEARCH AND INNOVATION**

**AGENCY FOR EDUCATIONAL RESEARCH AND INNOVATION**

No.	Name	Signature
1	Dr. Ahmad Zahid Hamid Minister of Education, Malaysia	
2	Dr. Ahmad Zahid Hamid Minister of Education, Malaysia	



**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE  
(AUTONOMOUS)**

**OOTY ROAD, MYSURU-570 025**

**(Autonomous under University of Mysore: Re-accredited by NAAC with 'A' Grade)**

**Choice Based Credit System and CGPA**

**MASTERS DEGREE**



**Syllabus**

**2021-23**

**Postgraduate Department of Computer Science**

JSS College of Arts, Commerce and Science

Ooty Road, Mysore-25

**2021-2023**

## **PROGRAMME: MASTER OF SCIENCE IN COMPUTER SCIENCE**

### **2 Years /4 Semesters (under CBCS-CAGP)**

#### **ADMISSIONS:**

- i) 50% seats of the total intake for M.Sc., Computer Science Programme of the College will be filled-up by University of Mysore through Centralized Admission Cell as per University regulations.
- ii) Remaining 50% seats will be filled-up by the College under College Quota.

#### **ADMISSION REQUIREMENT**

**Eligibility** - All students who have 45% (40% for SC/ST) in their B.Sc degree (from Recognised University/ Open University) with Mathematics as one subject and any one-two among Electronics, Instrumentation, Computer Science or Computer Maintenance and Physics as other subject. OR Student with B.Sc (IT) are permitted provided they have not studied Mathematics in their 2 years PUC. OR Diploma (in Electronics, Computer Science and Information Technology) holders with B.Sc (IT) are permitted if they have SSLC level Mathematics. OR BCA degree from recognized University OR equivalent to this from any other recognized University in India or abroad is also permitted.

#### **PROGRAMME OUTCOMES:**

**After Completing the M.Sc Program Students will be able to:**

- PO1. Identify, formulate, and solve computer science problems
- PO2. Design, implement, test, and evaluate a computer system, component, or algorithm to meet desired needs
- PO3. Receive the broad education necessary to understand the impact of computer science solutions in a global and societal context
- PO4. Communicate effectively
- PO5. Success in research or industry related to computer science
- PO6. Have solid knowledge in computer science and engineering, including programming and languages, algorithms, theory, databases, etc.
- PO7. Integrate well into and contribute to the local society and the global community related to computer science
- PO8. Practice high standard of professional ethics
- PO9. Draw on and integrate knowledge from many related areas

**PROGRAMME SPECIFIC OUTCOMES:**

PSO1. Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software.

PSO2. Serve as the Computer Engineers with enhanced knowledge of computers And its building blocks. Work as the Hardware Designers/Engineers with the knowledge of Networking Concepts.

PSO3. Work as the System Engineers and System integrators Serve as the System Administrators with thorough knowledge of DBMS.

PSO4. Work as the Support Engineers and the Technical Writers

PSO5. Work as IT Sales and Marketing person.

PSO6. Serve as the IT Officers in Banks and cooperative societies.

PSO7. Computer Scientist in research and R & D laboratories.

PSO8. Faculty for Graduate and Under graduate Colleges.

**MSc. in Computer Science 2021-23****I Semester**

<b>Course</b>	<b>L:T:P</b>	<b>Credit Value</b>
HC1 (Data Structures and Algorithms)	3:0:1	4
HC2 (System Software)	2:1:1	4
HC3 (Computer Networks)	2:1:1	4
SC1		4
SC2		4
<b>TOTAL</b>		<b>20</b>

**II Semester**

<b>Course</b>	<b>L:T:P</b>	<b>Credit Value</b>
HC4 (Analysis and Design of Algorithms)	2:1:1	4
HC5 (Operating System and Unix)	2:0:2	4
HC6 (Computer Graphics)	3:0:1	4
SC3		4
SC4		4
<b>TOTAL</b>		<b>20</b>

**III Semester**

<b>Course</b>	<b>L:T:P</b>	<b>Credit Value</b>
HC7 (Software Engineering)	3:1:0	4
HC8 (Theory of Languages)	3:1:0	4
HC9 (Database Management System)	2:1:1	4
SC5 / Term Work		4
SC6 (Open Elective ****)		4
<b>TOTAL</b>		<b>20</b>

**IV Semester**

<b>Course</b>	<b>L:T:P</b>	<b>Credit Value</b>
HC10 (Major Project)	0:1:7	8
SC7		4
SC8		4
<b>TOTAL</b>		<b>16</b>

**\*\*\*\* Open Elective Course: III Semester**

<b>Course</b>	<b>L:T:P</b>	<b>Credit Value</b>
OE- Computer Fundamentals / Programming with C	2:0:2	4

**HARD CORE:**

<b>Sl. No.</b>	<b>Course</b>	<b>L:T:P</b>	<b>Credit Value</b>
1	Data Structures and Algorithms	3:0:1	4
2	System Software	2:1:1	4
3	Computer Networks	2:1:1	4
4	Analysis and Design of Algorithms	2:1:1	4
5	Operating System and Unix	2:0:2	4
6	Computer Graphics	3:0:1	4
7	Software Engineering	3:1:0	4
8	Theory of Languages	3:0:1	4
9	DBMS	2:1:1	4



**SOFT CORE:**

<b>Sl. No.</b>	<b>Course</b>	<b>L:T:P</b>	<b>Credit Value</b>
1	Principles of Programming Language and C	2:1:1	4
2	Internet Technology	2:0:2	4
3	Java Programming	2:0:2	4
4	Multimedia	3:1:0	4
5	Microcontroller	3:1:0	4
6	Discrete Mathematics	3:1:0	4
7	Simulation and Modeling	3:1:0	4
8	Operations Research	3:1:0	4
9	Mobile Communication	3:1:0	4
10	C++	2:0:2	4
11	Pattern Recognition	3:0:1	4
12	Image Processing	2:1:1	4
13	Software Testing	3:0:1	4
14	Computational Techniques	3:0:1	4
15	Graph Theory	3:1:0	4
16	OOAD	2:1:1	4

17	Probability and Statistics	3:1:0	4
18	Data Mining	2:1:1	4
19	Artificial Intelligence	3:1:0	4
20	.NET Technologies	2:0:2	4
21	Object Oriented Modeling and Design with UML	2:1:1	4
22	Android Application Development	2:0:2	4
23	Advanced Database Management Systems	2:1:1	4
24	Compiler Design	3:0:1	4

## SCHEME OF EXAMINATION AND ASSESMENT:

In view of the CBCS syllabus, Each Course is Assess with Components . Component 1 (C1), Component 2 (C2), and Component 3 (C3),

The following is the scheme which will be followed for the assessment of marks for both theory (HC/ SC/ OE) as well as practicals (HC/ SC) irrespective of the Credits associated with each Course. Thirty percent of the marks will be assessed for the internals (C1 and C2) and remaining seventy percent will be for the semester end examinations (C3). Each Course carries 100 marks and hence thirty marks for internal assessment and remaining seventy marks will be for Semester End Examinations. Out of thirty marks for internals, fifteen marks will be allotted to each C1 and C2 components.

Each theory Course (HC/ SC/ OE) consists of three components namely C1, C2 and C3. C1 and C2 are designated as Internal Assessment (IA) and C3 as Semester End Examination. Each Course (HC/ SC/ OE) carries 100 Marks and hence the allotment of marks to C1, C2 and C3 Components will be fifteen, fifteen and seventy marks respectively. i.e.,

C1 Component : 15 Marks	Internal Assessment Marks
C2 Component : 15 Marks	
C3 Component : 70 Marks	Semester End Examination
Total :	100 Marks

The above will be followed in common for all the theory (HC/ SC/ OE) Courses in all the four semesters.

## **DATA STRUCTURES & ALGORITHMS**

**3:0:1**

**Course Code: CSA100**

**Course Outcomes:** At the end of the course students will be able to:

- CO1. Select appropriate data structures as applied to specified problem definition.
- CO2. Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures.
- CO3. Implement Linear and Non-Linear data structures.
- CO4. Implement appropriate sorting/searching technique for given problem.
- CO5. Design advance data structure using Non Linear data structure.

### **UNIT I: Introduction**

Introduction to Stages in Problem Solving, Difference between Data Type, Data Structure and Storage Structure, Formal Definition of Data Structure, Classification of Data Structure  
Analysis of Algorithms: Algorithm, Time Complexity and Space Complexity, O-Notation, Omega Notation and Theta Notation.  
Primitive Data Structure: Integer, Real, Character and Boolean and Its Storage Representation

### **UNIT II: Non-Primitive Data Structures**

Arrays: Introduction to Array Data Structure and Its Representation, Sparse Matrix Representation. Introduction to Structures  
Stacks: Introduction, Implementation Using Arrays, Applications - Tower Of Hanoi, Expression Evaluation, Conversion of Expressions

### **UNIT III: Stacks and Queues**

Queue: Introduction, Types – Ordinary, Circular, Doubly Ended, Priority, Implementation Using Arrays

Linked List: Introduction, Types, Operations, Implementation of Stacks and Queues Using Linked List

#### **UNIT IV: Non-Linear Data Structures**

Graphs: Introduction, Basic Terminologies, Graph Representation – Adjacency and Incidence Matrix Representation

Trees: Introduction, Binary Tree Representation – Array and Linked List Representations, Traversals – Preorder, In-order, Post order, Binary Search Tree, Introduction to B-Trees

Hash Tables: Direct Address Tables, Hash Tables, Hash Functions, Open and Closed Addressing

#### **References:**

1. Data Structures and Algorithms, 2<sup>nd</sup> Edition, 2006 , Andrew Tanenbaum
2. “An Introduction to Data Structures, with Applications” McGraw Hill, Kongakusha 1976, Trembley and Sorenson
3. “Data Structures” SBCS Publication, 1980, Horowitz and Sahni
4. Data Structures using c, A K Sharma
5. Data Structures and program design in C, Kruse Robert L
6. Data Structures and analysis in C, Mark Allen Weiss
7. Data Structures and Algorithms, Alfred V AHO and Jeffrey D Ullman

**SYSTEM SOFTWARE**

**2:1:1**

**Course Code:CSA110**

**Course Outcomes:**

At the end of the course students will be able to:

CO1. Understand fundamentals of language processing and grammar

CO2. Apply knowledge of compilation and code optimization steps to mimic a simple compiler

CO3. Demonstrate the working of various system software like assembler, loader, linker, editor and device driver

**UNIT 1**

Background: Machine Structure, Evolution of the components of a programming system, evolution of operating system, operating system user view point functions, facilities

General Machine Structure, General Approach to a new machine, Machine Structure – 360 and 370, Assembly Language

**UNIT 2**

Assemblers: General design procedure, design of an assembler.

Macro language and macro processor, macro instructions, features of macro, implementation

**UNIT 3**

Loaders, different types of loaders, loader schemes, design of an absolute loader, design of direct linking loader.

Compilers: Structure and phases

**UNIT 4**

Lex and yacc: The Simplest lex Program, Recognizing Words with Lex, Parser-Lexer

Communication, Regular Expressions, Grammars, Shift/Reduce Parsing, Structure of lex and yacc Programs, Programs in lex and yacc

**References:**

1. Systems Programming by Donovan
2. Principles of Compiler design by Ullman
3. System programming by Dhamdhare
4. Lex and yacc by John R Levine, Tony Mason and Doug Brown
5. System Software- Prof. Liland L Beck.
6. System Software- Prof. John R Levine

**COMPUTER NETWORKS**

**2:1:1**

**Course code:CSA120**

**Course Outcomes:**

At the end of the course students will be able to:

CO1. Master the terminology and concepts of the OSI reference model and the TCP-IP reference model.

CO2. Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.

CO3. Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks

CO4. Acquire knowledge of Application layer and Presentation layer paradigms and protocols.

CO5. Study Session layer design issues, Transport layer services, and protocols.

CO6. Gain core knowledge of Network layer routing protocols and IP addressing.

CO7. Study data link layer concepts, design issues, and protocols.

CO8. Read the fundamentals and basics of Physical layer, and will apply them in real time applications.

CO9. Familiar with wireless networking concepts

CO10. Familiar with contemporary issues in networking technologies

CO11. Familiar with network tools and network programming

**UNIT 1**

**USES OF COMPUTER NETWORK:** Business Applications, Home Applications, Mobile Users, Social Issues

**NETWORK HARDWARE:** Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, Home Networks, Internetworks

**NETWORK SOFTWARE:** Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Service, Service Primitives, the Relationship of Services to Protocols

**REFERENCE MODELS:** The OSI Reference Model, The TCP/IP Reference Model, A comparison of OSI and TCP/IP Reference Model

## **UNIT 2**

### **THE PHYSICAL LAYER**

**THE THEORETICAL BASIS FOR DATA COMMUNICATION:** Fourier Analysis, Bandwidth-Limited Signals, The Maximum Data Rate of a Channel

**GUIDED TRANSMISSION MEDIA:** Magnetic Media, Twisted Pairs, Coaxial Cable, Fiber Optics

**WIRELESS TRANSMISSION:** The Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared and Millimeter Waves, Light wave Transmission

**COMMUNICATION SATELLITES:** Geostationary Satellites, Medium-Earth Orbit Satellites, Low-Earth Orbit Satellites, Satellites versus Fiber

### **THE DATA LINK LAYER**

**DATA LINK LAYER DESIGN ISSUES:** Services Provided to the Network Layer, Framing, Error Control, Flow Control

**ERROR DETECTION AND CORRECTION:** Error-Correcting Codes, Error-Detecting Codes

**ELEMENTARY DATA LINK PROTOCOLS:** A Utopian Simplex Protocol, A Simplex Stop-and-Wait Protocol

**SLIDING WINDOW PROTOCOLS:** A One-Bit Sliding Window Protocol, A Protocol Using Go-Back-N

## **UNIT 3**

### **THE MEDIUM ACCESS CONTROL SUBLAYER**

**THE CHANNEL ALLOCATION PROBLEM:** Static Channel Allocation, Dynamic Channel Allocation

**MULTIPLE ACCESS PROTOCOLS:** ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols

**ETHERNET:** Ethernet Cabling, Manchester Encoding, The Ethernet MAC sub layer protocol, the binary exponential back off algorithm, Ethernet Performance, Switched Ethernet, IEEE 802.2: Logical Link Control

### **THE NETWORK LAYER**

**NETWORK LAYER DESIGN ISSUES:** Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit and Datagram Networks



ROUTING ALGORITHMS: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing

CONGESTION CONTROL ALGORITHMS: Approaches to Congestion Control, Traffic-Aware Routing, Admission Control, Traffic Throttling, Traffic Shaping

INTERNETWORKING: How Networks Differ, How Networks Can Be Connected, Tunneling, Internetwork Routing, Fragmentation

THE NETWORK LAYER IN THE INTERNET: The IP Protocol, IP Addresses, IPv6

#### **UNIT 4**

THE TRANSPORT LAYER

THE TRANSPORT SERVICE: Services Provided to the Upper Layers, Transport Service Primitives

ELEMENTS OF TRANSPORT PROTOCOLS: Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing, Crash Recovery

THE INTERNET TRANSPORT PROTOCOLS: UDP: Introduction to UDP, Remote Procedure Call, Real-Time Transport Protocols

THE INTERNET TRANSPORT PROTOCOLS: TCP: Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modeling, TCP Sliding Window, TCP Timer Management

THE APPLICATION LAYER

DNS—THE DOMAIN NAME SYSTEM: The DNS Name Space, Resource Records, Name Servers

ELECTRONIC MAIL: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery

NETWORK SECURITY:

CRYPTOGRAPHY: Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, Two Fundamental Cryptographic Principles

SYMMETRIC-KEY ALGORITHMS: DES—The Data Encryption Standard, Cipher Modes

PUBLIC-KEY ALGORITHMS: RSA, Other Public-Key Algorithms

DIGITAL SIGNATURES: Symmetric-Key Signatures, Public-Key Signatures

MANAGEMENT OF PUBLIC KEYS: Certificates

**Reference Books:**

1. Computer Networks, 5th Edition, Prentice Hall, 2006, Andrew S. Tanenbaum & David J. Wetherall
2. Data & Computer Communications, 6th Edition, Pearson Education, 2002, William Stallings
3. Computer Networks: 3rd Edition, Elsevier, 2003, Larry L. Peterson & Bruce S. Davie
4. Data Communication & Networking, 4th Edition, Mc Graw Hill, 2006, Behrouza Forouzan
5. Computer & Networks with Internet Applications, 4th Edition, Pearson Education, 2004, Douglas E. Comer

**ANALYSIS AND DESIGN OF ALGORITHMS**

**2:1:1**

**Course Code:CSB060**

**Course Outcomes:**

At the end of the course students will be able to:

- CO1. Analyze different scenarios for running time of algorithms using asymptotic notations and Design using Recursion.
- CO2. Apply divide and conquer strategy for design of various algorithms.
- CO3. Develop algorithms for well known problems using greedy methods.
- CO4. Describe and apply dynamic-programming approach for designing graph and matrix based algorithms.
- CO5. Understand the concept of backtracking for traversal and search algorithms.
- CO6. Apply the knowledge earned to determine the efficiency of algorithms considering time and space tradeoffs.

**UNIT 1**

**INTRODUCTION:** Algorithm specification, pseudo code conventions

**PERFORMANCE ANALYSIS:** Space Complexity, Time Complexity, Asymptotic Notation, Mathematical Analysis: Recursive and Non recursive algorithms

**BRUTE FORCE –** Bubble Sort, Selection Sort, Sequential Search, String Matching

**UNIT 2**

**DIVIDE- AND – CONQUER:** General Method, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Strassen's Matrix Multiplication

**THE GREEDY METHOD:** The General Method, Knapsack Problem, Tree Vertex Splitting, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees - Prim's Algorithm, Kruskal's Algorithm, Optimal Storage on Tapes, Optimal Merge Patterns, Single-Source Shortest Paths.

**UNIT 3**

**DYNAMIC PROGRAMMING:** The General Method, Binomial Coefficient, Multistage Graphs, All Pairs Shortest Paths Single-Source Shortest Paths: General Weights, String Editing, 0/1 Knapsack, the Traveling Salesperson Problem

**BACKTRACKING:** The General Method, the 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles

#### UNIT 4

Elementary Graph Problems: Depth First Search, Breadth First Search, Topological Sort

NP-Hard and NP-Complete Problems: Basic Concepts, Nondeterministic Algorithms, The Classes NP-Hard And NP-Complete

NP-Hard Graph Problems: Clique Decision Problem (CDP), Node Cover Decision Problem, Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP), AND/OR Graph Decision Problem (AOG)

#### References:

1. Analysis and Design of Algorithms: Horowitz Sahani
2. Analysis and Design of algorithms: Trembly
3. Introduction to Algorithms: Thomas H. Cormen
4. Analysis and Design of Algorithm: Padma Reddy
4. Introduction to the design and analysis of algorithm: Anany Levitin.
5. Design and analysis of algorithm: S Shridhar.

**OPERATING SYSTEM and UNIX**

**2:0:2**

**Course Code:CSB070**

**Course Outcomes:**

At the end of the course student will be able to:

- CO1. Understand device drivers
- CO2. Write applications with improved performance and stability
- CO3. Write set of small commands and utilities that do specific tasks well
- CO4. Run multiple programs each at the same time without interfering with each other or crashing the system.
- CO5. Implement Commands of UNIX.
- CO6. Implement various file processing commands and shell Programming.

**UNIT 1**

Introduction to Operating System, Operating System Structures

Process Management: Processes, CPU Scheduling

**UNIT 2**

Deadlocks, Storage Management: Memory management, Virtual Memory, File-System Interface

**UNIT 3**

Introduction: Why UNIX? The Unix Environment, UNIX Structure, accessing UNIX, UNIX commands

File Systems: File Names, File Types, Regular Files, Directories, File System Implementation, Operations unique to directories, Operations unique to regular files, Operations common to both.

Vi editor, local commands, range commands in vi, global commands in vi, rearrange text in vi, ex editor.

**UNIT 4**

Introduction to shells: Unix Session, Standard Streams, Redirection, pipes, tee command, command execution, command line editing, quotes, command substitution, job control, aliases, variables, predefined variables, options, shell/environment customization.

Security and file permission: User and groups, Security levels, changing permissions, User masks, Changing ownership and group, Regular expressions: Atoms, Operators, grep: operation, grep family, Searching for file content, sed and awk.

C Shell Programming: Basic script concepts, Expressions, Decision making selections,, Built in commands, Scripting techniques, Shell environment & Script, Script examples

### **References:**

1. Unix and Shell Programming, Behrouz A Forouzan and Richard F.Gilberg, 2<sup>nd</sup> Edition, 2003, Thomson.
2. System Programming and Operating Systems, Dhamdhare. D.M., 4<sup>th</sup> Edition, TataMcGraw Hill, 2006
3. A Practical Guide to Linux, Mark G. Sobell, 1<sup>st</sup> Edition, 2002, Pearson Education (Chapters:1 to 5, 8, 10, 11, 15)
4. UNIX: The Complete Reference, Kenneth Rosen and others, 2<sup>nd</sup> Edition, 2002,Osborne/McGraw Hill
5. Design of the UNIX Operating System, Maurice J Bach.
6. Operating System: A Modern Perspective , Gary J Nutt.

**COMPUTER GRAPHICS**

**3:0:1**

**Course code:CSB080**

**Course Outcomes:**

At the end of the course students will be able to:

CO1. Utilize the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.

CO 2. Learn the basic principles of 3- dimensional computer graphics.

CO3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.

CO4. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

CO 5. Implement the applications of computer graphics concepts in the development of computer games, information visualization, and business applications.

CO6. Comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles

**UNIT 1**

Introduction, Video Display Devices, Refresh Cathode-Ray Tubes, Raster-Scan Display, Random-Scan Displays, Color CRT Monitors, Flat-Panel Displays, Raster Scan Systems, Input devices.

Output primitives: Points & Lines, Line Drawing Algorithms, Loading the Frame Buffer, Circle Generating Algorithms, Pixel Addressing and Object Geometry

**UNIT 2**

Two dimensional transformations Basic & other transformations, Matrix representations, Homogeneous coordinates Composite transformations, General-pivot-point transformations.

Three Dimensional Transformations: Introduction to 3D Translation, Rotation & Scaling, Other Transformations, Modeling and Co-ordinate Transformations.

### UNIT 3

Three Dimensional Viewing :Viewing Pipeling, window to viewport transformations, Projections, Types of projections.

Graphical User Interface & Interactive Input Methods : The User Dialogue, Windows & Icons, feedback, Input of Graphical Data, Interactive Picture Construction Techniques, Basic Positioning Methods, Constraints, Grids, Gravity Field, Rubber-Band Methods, Dragging, Painting & Drawing

### UNIT 4

Curves & Surfaces: Properties, Bezier curves properties, Design techniques, Bezier surfaces, Displaying curves & surfaces

Hidden line removal algorithms

Introduction to fractals, Serpinsky's triangle, Construction, Koch curves.

Windowing & Clipping: Clipping operations, Line clipping algorithms, point clipping, text clipping, polygon clipping algorithms, Exterior clipping

#### Reference:

1. "Computer Graphics", Pearson Education, Donald D. Hern and M. Pauline Baker
2. "Principles of Interactive Computer Graphics" McGraw Hill 1989, W. M. Newman and Robert Sproull
3. "Computer Graphics a Programming Approach" McGraw Hill 1987, Steven Harrington
4. "Schaums outline of theory and problems of Computer Graphics" 2<sup>nd</sup> printing 1987, 1986 Edition, Roy A Plastock and Gardon Kelley
5. "Procedural Elements of Computer Graphics" McGraw Hill 2<sup>nd</sup> edition 1990, David F Frogers and J Alan Adams
6. Computer Graphics, James.D.Foley, A Vandam etal



**SOFTWARE ENGINEERING**

**3:1:0**

**Course Code:CSC040**

**Course Outcomes:**

At the end of the course students will be able to:

CO1. Understand the nature of software development and software life cycle process models, agile software development, SCRUM and other agile practices.

CO2 Learn methods of capturing, specifying, visualizing and analyzing software requirements.

CO3. Understand concepts and principles of software design and user-centric approach and principles of effective user interfaces.

CO 4. Basics of testing and understanding concept of software quality assurance and software configuration management process.

CO 5. Understand need of project management and project management life cycle.

CO 6. Understand project scheduling concept and risk management associated to various types of projects.

**UNIT 1**

INTRODUCTION TO SOFTWARE ENGINEERING: Software and Software Engineering, phases in Software Development, Software Development Process models, Agile modeling, Introduction to metrics.

**UNIT 2**

SOFTWARE REQUIREMENT SPECIFICATION: Role of SRS, Problem Analysis, Requirement specification, validation, metrics, Monitoring and control

PLANNING A SOFTWARE PROJECT: Cost Estimation, Project Scheduling, Staffing personal planning, Team Structure, Software Configuration Management, Quality Assurance Plans, Project Monitoring plans, Risk Management.

**UNIT 3**

SYSTEM DESIGN: Design Objectives, design principles, Module level Concepts, Design methodology – object oriented approach Design Specification, Verification, Metrics, monitoring and control.

DETAILED DESIGN: Module Specification, Detailed design and process design Language, Verification

#### UNIT 4

CODING: Programming practice, Verification, Metrics

TESTING: Testing Fundamentals, Fundamental testing, Structural Testing. Testing process  
Clean Room approach

#### References:

1. “An Integrated approach to the Software Engineering” 2ed. Narosa Publishing House, New Delhi, 2002, Pankaj Jalote
2. Software Engineering Principles & Practice - 3rd Edition, Tata Mc Graw Hill Companies – 2006, Waman S Jawadekar
3. Software Engineering A Practitioner’s Approach - 6<sup>th</sup> Edition McGraw Hill – 2005, Roger S Pressman
4. Software Engineering - 7<sup>th</sup> Edition : Pearson Education Ltd- 2006, Sommerville

**THEORY OF LANGUAGES**

**3:1:0**

**Course Code:CSC070**

**Course Outcomes:**

At the end of the course students will be able to:

CO1. Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.

CO2. Understand, design, analyze and interpret Context Free languages, Expression and Grammars.

CO3. Design different types of Push down Automata as Simple Parser.

CO4. Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.

**UNIT - 1**

**INTRODUCTION TO FINITE AUTOMATA:** Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata.

**FINITE AUTOMATA, REGULAR EXPRESSIONS:** An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions

**UNIT - 2**

**REGULAR LANGUAGES, PROPERTIES OF REGULAR LANGUAGES:** Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Equivalence and minimization of automata.

**CONTEXT-FREE GRAMMARS AND LANGUAGES:** Context –free grammars; Parse trees; Ambiguity in grammars and Languages.

**UNIT – 3**

**PUSHDOWN AUTOMATA:** Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata.

**PROPERTIES OF CONTEXT-FREE LANGUAGES:** Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFL

#### UNIT - 4

TURING MACHINE: The turing machine; Extensions to the basic Turing Machines;

UNDECIDABILITY: A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem

#### REFERENCES:

1. Introduction to Automata Theory, Languages and Computation – John E.. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman:, 3rd Edition, Pearson education, 2007.
2. Fundamentals of the Theory of Computation: Principles and Practice – Raymond Greenlaw, H.James Hoove, Morgan Kaufmann, 1998.
3. Introduction to Languages and Automata Theory – John C Martin, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2007.

**DATABASE MANAGEMENT SYSTEM**

**2:1:1**

**Course Code:CSC060**

**Course Outcomes:**

At the end of the course students will be able to:

- CO1. Explain the features of database management systems and Relational database.
- CO2. Design conceptual models of a database using ER modelling for real life applications and also construct queries in Relational Algebra.
- CO3. Create and populate a RDBMS for a real life application, with constraints and keys, using SQL.
- CO4. Retrieve any type of information from a data base by formulating complex queries in SQL.
- CO5. Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.
- CO6. Build indexing mechanisms for efficient retrieval of information from a database

**UNIT 1**

Introduction and conceptual modeling databases and Database users, Data modeling using the entity relationship (ER) model, the enhanced entity – relationship (EER) model.

**UNIT 2**

Relational model: Concepts constraints, Languages, Design and programming.

The relational data model and relational database constraints, Relational algebra and relational calculus, Introduction to SQL Programming technique

**UNIT 3**

Database design theory and methodology functional dependencies and Normalization for relational database, Relational database design algorithms and further dependencies, practical database design methodology and use of UML diagrams.

**UNIT 4**

Introduction to transaction processing concepts and theory recovery

**REFERENCES**

1. Fundamentals of database system – 5<sup>th</sup> Edition – Ramez elmasri, Navathe – Person edition
- 2 .An introduction to database system – 8<sup>th</sup> Edition – C. J. Date, Kannan – Person Education
- 3.Database system concepts – 5<sup>th</sup> Edition – Korth, Sudarshan – McGraw Bill Edition

4. Database Management System- Raghuramakrishnan.
5. An Introduction to Database System- Bipin Desai
6. Principles of Database System- J D Ullman

## Softcore:

### PRINCIPLES OF PROGRAMMING LANGUAGES AND ‘C’

2:1:1

#### Course Code:

#### Course Outcomes:

At the end of the course students will be able to:

- CO1. Analyzing semantic issues associated with function implementations, including variable binding, scoping rules, parameter passing, and exception handling.
- CO2. Implementation techniques for interpreted functional languages.
- CO3. Using object-oriented languages.
- CO4. Familiar with design issues of object-oriented and functional languages.
- CO5. Familiar with language abstraction constructs of classes, interfaces, packages, and procedures.
- CO6. Familiar with implementation of object-oriented languages.
- CO7. Familiar with using functional languages

#### UNIT 1: Preliminaries

Reasons for studying concepts of programming languages, Programming domains, Language evaluation criteria, Implementation methods Names, Bindings, Type Checking, and Scopes Introduction, Names, Variables, The concept of Binding, Type Checking, String Checking, Type Compatibility, Scope, Scope and Lifetime, Referencing Environments, Named Constants, Variable Initialization.

#### UNIT 2: Data Types

Introduction, Primitive Data types, Character String Types, User-Defined Ordinal Types, Array Types and Associative Arrays, Record Types, Union Types, Set Types, Pointes Types.

Expression, Assignment Statements and Statement Level Control Structures

Introduction, Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational And Boolean Expressions, Short-Circuit Evaluation, Assignment Statements, Mixed-Mode assignment.

### UNIT 3

Compound Statements, Selection Statements, Iterative Statements, Unconditional Branching, Guarded Commands, Conclusion.

Subprograms: Introduction, fundamentals, design issues, local referencing environments, parameter passing methods, overloaded programs, generic subprograms, coroutines, user defined overloaded operators

### UNIT 4

C LANGUAGE: C Fundamentals, Operation data input and output, Control statements, Function Storage classes, Arrays, Pointers, structures and unions, Enumeration, Command line parameters, Macros, 'C' processor.

#### **Reference:**

1. Concepts of Programming Languages, Eight Edition, Pearson, Robert W. Sebesta
2. Foundation for Programming Languages, John C Mitchell
3. Principles of Programming Language, Chopra Rajiv
4. Principles of Programming Language, Dowek
5. Types and Programming Languages, Benjamin C Pierce
6. Programming Languages: Principle and Practices ,3<sup>rd</sup> Edition, Kenneth C Louden



## **INTERNET TECHNOLOGY**

**2:0:2**

**Course Code:CSD220**

### **Course Outcomes:**

At the end of the course students will be able to:

- CO1. Develop analytical ability in network technology.
- CO2. Create quality websites
- CO3. Work individually as a web designer and set up their own business
- CO4. Get the job opportunities in most companies for professional web designers and build websites more visually elegant and interactive
- CO5. Implement interactive web page(s) using HTML, CSS and JavaScript.
- CO6. Design a responsive web site using HTML5 and CSS3.

### **UNIT 1**

Fundamentals: introduction to the Internet, WWW, Web Browsers, Web Servers, URL, Multipurpose Internet Mail Extensions (MIME), HTTP, Security, Introduction to HTML: Origins and Evolution, Basic Syntax, Document Structure, Basic tags, Images, Links, Lists, Tables, Forms, Frames.

### **UNIT 2**

Introduction to XML: Syntax of XML, XML Document Structure, Document Type Definition.

Introduction to XHTML: Origins and Evolution, Basic Syntax, Document Structure, Basic tags, Images, Links, Lists, Tables, Forms, Frames, Syntactic difference between HTML and XHTML.

Cascading Style Sheets (CSS): Introduction, levels of style sheets, Selector Forms, Property value forms, Font properties, Color, Alignment of Text, Box model, Background Images, <span> and <div> tags.

### **UNIT 3**

The basics of JavaScript: Overview, Object Orientation and JavaScript, General syntactic characteristics, Primitives, Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Objects, Arrays, Functions, Constructors, Errors.

JavaScript and XHTML Documents: Element access, Events and Event Handling, Handling Events from Body elements, Handling Events from Button elements, Handling Events from Text Box and password elements.

Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating Mouse Cursor, Reacting to Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements.

#### **UNIT 4**

Introduction to PHP: Origins and Uses, Overview, General Syntactic Characteristics, Primitive, Operations and Expressions, Output, Control Statements, Arrays, Functions, Form Handling, Cookies.

#### **REFERENCES:**

1. Programming the World Wide Web – by Robert W. Sabesta 4<sup>th</sup> Edition Pearson Publications
2. HTML and XHTML the Complete Reference.
3. How to program the World Wide Web – by Deitel and Deitel
4. Mastering in HTML – by Ray and Ray.
5. Web programming and Internet Technologies: An E Commerce approach- By Porter ` Seobey and Pawan Lingras.
6. Internet Technology and Information services by Joseph Miller

**JAVA Programming**

**2:0:2**

**Course Code:CSA270**

**Course Outcomes:**

At the end of the course students will be able to:

- C01. Understand concept of Object Oriented Programming & Java Programming Constructs.
- C02. Understand basic concepts of Java such as operators, classes, objects, inheritance, packages ,Enumeration and various keywords.
- C03. Understand the concept of exception handling and Input/Output operations.
- C04. Design the applications of Java & Java applet.
- C05. Analyze & Design the concept of Event Handling and Abstract Window Toolkit.

**UNIT 1**

History and evolution of Java, An overview of Java, Data types, variables and arrays, Operators, Control statements- Introducing classes ,A closer look at methods and classes, Inheritance, Packages and interfaces.

**UNIT 2**

Exception handling, Multithreaded Programming, Enumeration, Autotoxins, I/O, Applets

**UNIT 3**

Networking, Event handling, Swings.

**UNIT 4**

String handling, Collection framework, Introduction to J2EE, Java servlet, Java server pages (JSP) and HTML, JDBC objects.

**REFERENCES:**

1. The complete reference Java – 7<sup>th</sup> Edition – Herbert Schildt – Tata Mcgraw hill Edition.
2. The complete reference J2EE – Jem Keogh – Tata Mcgraw hill Edition.
3. Object Oriented Programming with Java- M T Somashekara, D S Guru and K S Manjunatha.
4. The Complete Reference 7<sup>th</sup> Edition Herbert Schiidt
5. Introduction to Java Programming – E Balaguruswamy
6. Head First Java – 2<sup>nd</sup> Edition
7. Core Java- Horst Mann, C S –8<sup>th</sup> Edition-Cornell.

8. Core Servlet and Java Server pages- Hall, M-Brown L

## **MULTIMEDIA**

**3:1:0**

### **Course Code:**

### **Course Outcomes:**

At the end of the course students will be able to:

- CO1. Understand various file formats for audio, video and text media.
- CO2. Develop various Multimedia Systems applicable in real time.
- CO3. Design interactive multimedia software.
- CO4. Apply various networking protocols for multimedia applications.
- CO5. Develop understanding of technical aspect of Multimedia Systems

### **UNIT 1**

Introduction to Multimedia (MM) Communication, Scope, Range, Feasibility and Challenges of MM Communication Key aspects of MM: Compression, Coding, Transmission and Replay.

### **UNIT 2**

Types of Compression: Quantization, Coding as PCM, DPCM, ADPCM. Simple Encoder and Decoders based on PCM Samples. Introduction to Transform domain Compression. Introduction to Audio part of MPEG, Psychoacoustics

### **UNIT 3**

Compression in Spatial Domain Algorithms for Data Compression in Transform Domain: DCT. Variable Length Coding, Huffman code. Variable Length Coding: Arithmetic Coding. Introduction to JPEG 2000 Standard, Encoders-Decoders based on this. Audio Compression and MPEG Audio

### **UNIT 4**

Fundamental concepts of Video. MPEG Architecture Details: Audio-Video- Systems. Video Coding standard related to H.263 and H. 264. MPEG- 1, 2 Video. MPEG- 4 : Video. Streaming and Transport Issues: Multiplexing, Synchronization and File formats. Errors in MPEG and Error handling, Concealment. Buffer structures and Buffer Management

Introduction to MPEG-7 and MPEG-21., HDTV. Content based Image Retrievals and Digital Libraries.

**References:**

1. Fundamentals of Multimedia, 2<sup>nd</sup> Ed, Pearson, 2005, Ze-Nian Li and Mark Drew
2. Multimedia Communications., Pearson, 2005, Fred Halsall
3. Introduction to Data Compression, 3<sup>rd</sup> Ed, Morgan Kaufman (India Ed), 2005, Khalid Sayood
4. The DATA compression; The Complete Reference, 3<sup>rd</sup> Ed, Springer (India Ed), 2006, David Solomon
5. Multimedia foundations: A Core Concepts of for Digital Design, Vic Cost Ello
6. Multimedia: Making it work, 9<sup>th</sup> edition, Tay Vaughan

## **MICROCONTROLLERS**

**3:1:0**

### **Course Code:**

### **Course Outcomes:**

At the end of the course students will be able to:

- CO1. Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontroller.
- CO2. Design the interfacing for 8051 microcontroller.
- CO3. Understand the concepts of ARM architecture.
- CO4. Demonstrate the open source RTOS and solve the design issues for the same.
- CO5. Select elements for an embedded systems tool.
- CO6. Understand the concept and architecture of embedded systems

### **UNIT 1**

Introduction, Numbering system and binary arithmetic,

### **UNIT 2**

The 8051 Architecture, Basic assembly language programming concepts, Moving data,

### **UNIT 3**

Logical operations, Arithmetic operations Jump and call instructions

### **UNIT 4**

An 8051 Microcontroller design, Applications

### **References**

1. “The 8051 Microcontroller”, 3<sup>rd</sup> Edition, Thomson India edition, 2007, Kenneth Ayala
2. “Programming and customizing the 8051 microcontroller”, Tata McGraw-Hill edition, 2006, Myke prick
3. “The 8051 Microcontroller and embedded systems”, Pearson India, 2006, Muhammad Ali Mazidi & Janice Gillispie Mazidi,
4. Microcontroller and Embedded System, Mazidi, M A- Mazidi
5. Microcontroller: Architecture, Programming and application, Ayala, Kenneth

## **DISCRETE MATHEMATICS**

**3:1:0**

**Course Code:CSA260**

### **Course Outcomes:**

At the end of the course students will be able to:

- CO1. Construct simple mathematical proofs and possess the ability to verify them.
- CO2. Have substantial experience to comprehend formal logical arguments .
- CO3. skillfull in expressing mathematical properties formally via the formal language of propositional logic and predicate logic.
- CO4. Specify and manipulate basic mathematical objects such as sets, functions, and relations and will also be able to verify simple mathematical properties that these objects possess.
- CO5. Apply basic counting techniques to solve combinatorial problems .
- CO6. Use various techniques of mathematical induction (weak, strong and structural induction) to prove simple mathematical properties of a variety of discrete structures

### **UNIT 1**

Set Theory: Sets and Subsets. Operations on sets, Countable and uncountable sets, The addition principal, the concept of probability.

Mathematical Logic: Propositions, Logical Connectives, Tautologies; Contradictions, Logical equivalence, Application to switching networks, Duality, Commentates NAND and NOR, Converse, Inverse and Contrapositive, Rules of inference.

### **UNIT 2**

Open statements; Quantifiers, Logical Implication involving Quantifiers, Statements with more than one variable, Methods of proof and disproof, Mathematical Induction.

### **UNIT 3**

Relations and Ordering: Cartesian products of sets, Relations, Paths in relations and digraphs, Operations on relations, Composition of relations, Properties of relations, Equivalence relations, Partial orders, Total Orders, External elements in posets, Lattices.

Functions: Functions, Types of functions, Composition of function, Invertible functions, Permutation Function.

### **UNIT 4**

Fundamental principles of counting: Principles of inclusion and exclusion: The rule of sum and product, Permutations, combinations: The binomial theorem, combinations with repetition,

Ramsey number, the Catalan numbers, sterling number and bell numbers, Generalizations of principles, the pigeonhole principle, Derangements-Nothing is in its Right place, Rook polynomials, Arrangements with Forbidden positions.

**References:**

1. Discrete Mathematics by Dr. Chandrashekar S .
2. Discrete and combinational Mathematics by Ralph P. Grimaldi, 5th edition, Addison Wesley, 2004
3. Discrete mathematical structures by Kolman, Robert C Busby and Sharon., 6th Edition, Prentice Hall, 2008
4. Discrete Mathematics and Application by Kenneth H Rosen.
5. Discrete Mathematics by Norman L Biggs.



**SIMULATION & MODELLING**

**3:1:0**

**Course Code:**

**Course Outcomes:**

At the end of the course students will be able to:

- CO1. Understand the definition of simulation and how to develop and analyze a simulation model
- CO2. Understand the fundamental logic, structure, components and management of simulation modeling
- CO3. Demonstrate knowledge of how to use Arena
- CO4. Build a simulation model with basic operations and inputs
- CO5. Build a simulation model with detailed operations
- CO6. Perform statistical analysis of output from terminating simulation

**UNIT 1**

Introduction, Simulation of prepursuit problem, A system & its model, Simulation of an inventory problem, The basic nature of simulation

Simulation of continuous systems: A chemical reactor, Numerical integration vs continuous system simulation, Selection of an integration formula, Runge Kutta integration formulas, simulation of a servo system, Simulation of a water reservoir system, Analog vs digital simulation

**UNIT 2**

Discrete system simulation

Fixed time-step vs event to event model, On simulating randomness, Generation of random numbers, Generation of non uniformly distributed random numbers, Monte Carlo computation vs stochastic simulation

**UNIT 3**

Simulation of queuing systems

Rudiments of queuing theory, simulation of single server queue, Simulation of two server queue, Simulation more general queues.

Simulation of PERT network

#### UNIT 4

Network model of a project, Analysis of an activity network, Critical path computation, Uncertainties in activity duration, Simulation of an activity network, Computer program for simulation, Resource allocation and cost considerations, Inventory control & forecasting Elements of inventory theory, More complex inventory models, simulation examples, Generation of Poisson & erlang variates, Forecasting & regression analysis  
Design and Evaluation of Simulation Experiments  
Length of simulation runs, Variance reduction techniques, Experimental layout, validation

#### References:

1. System Simulation with Digital Computer Narsingh Deo
2. System Simulation and Modeling - Sengutta
3. Computer Methods for solving Dynamic Separation problems- C D Holland and A I Liapis.
4. Fundamentals of Modeling separation Process- C D Holand.
5. Process Modeling-M M Denn

**OPERATIONS RESEARCH**

**3:1:0**

**Course Code:**

**Course Outcomes:**

At the end of the course students will be able to:

CO1: Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.

CO2: Apply the concept of simplex method and its extensions to dual simplex algorithm.

CO3: Solve the problem of transporting the products from origins to destinations with least transportation cost.

CO4: Convert and solve the practical situations into non-linear programming problem.

CO5: Identify the resources required for a project and generate a plan and work schedule

**UNIT 1**

Introduction: formulation of LP problems, graphical solution of LP problems, General formulation of L P problems, Slack & Surplus variables, Standard form, Matrix form, Simplex method, Revised Simplex method, Dual simplex

**UNIT 2**

Assignment model, Transportation model, Game theory

Probability: Introduction, Basic terms of probability, The Addition law of probability, discrete & continuous, variables, random variables, probability distribution of random variables, Mean variance& standard deviation, Mathematical expectation of a random variable.

**UNIT 3**

Queuing theory

Introduction, queuing system, distribution, Kendall's Notation, Classification, model I (m/m/1).

**UNIT 4**

Project management by PERT CPM

Introduction, history, Applications, Basic steps, Network diagram representation, rules of drawing network diagram, labeling Fulkerson's I-J rule, Time estimates & Critical path, PERT, Resource allocation, Uses of PERT/CPM.

**References:**

1. Operations Research - S D Sharma
2. Operations Research - R K Gupta & D S Hira
3. Introduction to Operation research – Frederick S Hillier ,Gerald J and Liberman.
4. Operation research: An Introduction by Hamdy A Taha.
5. Operation research: Application and algorithm by Wayne L Winston.

**MOBILE COMMUNICATION**

**3:1:0**

**Course Code:**

**Course Outcomes:**

At the end of the course students will be able to:

- CO1. Design a mobile cellular network
- CO2. Optimize a radio channel system
- CO3. Select the apt diversity scheme for a given wireless system to improve the performance.
- CO4. Perform efficient spectral allocation using multiple access techniques such as CDMA, and OFDM.
- CO5. Select the correct MAC protocol and routing algorithm for mobile ad-hoc networks.
- CO6. Optimize the mobile ad-hoc network, MAC protocols and routing algorithms as per application.

**UNIT 1**

Introduction, Applications, History of wireless communication, reference model, Wireless transmission, Frequencies for radio transmission, signals, Antennas, Signal propagation Multiplexing, Modulation, Spread spectrum

**UNIT 2**

Cellular Systems, Medium Access control, Motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison.

**UNIT 3**

Telecommunications Systems, GSM, DECT, TETRA, UMS & IMT 2000  
Satellite Systems, history, Applications, Basics, Classical TCP improvements, TCP over 2.5/3G wireless networks, performance enhancing proxies

**UNIT 4**

Support for mobility, File Systems World Wide Web, Wireless Application protocol

**References:**

1. Cellular and Mobile Communication- Krishna.
2. Cellular Mobile Communication – V S Bhagat
3. Cellular and Mobile Communication- V Jeyasri Arokiamary.
4. Wireless Communication and Networks – William Stallings.

5. Cellular Communication; A Comprehensive and practical guide- Nishith Tripathi and Jeffreyreed.

**C++**

**2:0:2**

**Course Code:**

**Course Outcomes:**

At the end of the course students will be able to:

CO1 . Understand the features of C++

CO2. Understand the relative merits of C++ as an object oriented programming language

CO3. Understand how to produce object-oriented software using C++

CO4. Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism

CO5 Understand advanced features of C++ specifically stream I/O, templates and operator overloading

### **Unit I**

Quick overview of C : Expressions - Statements - Arrays and Null-Terminated Strings – Pointers - Functions – Structures, Unions, Enumerations and User-Defined Types – C Style Console I/O – File I/O -.

### **Unit II**

An Overview of C++ - Classes and Objects – Arrays, Pointers, References, and the Dynamic Allocation Operators

### **Unit III**

Function Overriding, Copy Constructors and Default Arguments – Operator Overloading - Inheritance – Virtual Functions and Polymorphism

### **Unit IV**

Templates – Exception Handling - The C++ I/O System Basics

**References :**

JSSCACS

1. The Complete Reference C++, 4<sup>th</sup> Edition, Tata-McGraw-Hill, 2003, Herbert Schildt
2. Object Oriented Programming with C++ , M T Somashekara, D S Guru, H S Nagendraswamy and K S Manjunatha
3. C++ Premier, 5<sup>th</sup> Edition. Stanley B Lippman
4. C++ Programming language, E Balaguruswamy
5. The C++ programming language, 4<sup>th</sup> Edition, Bjarne Stroustrup



**PATTERN RECOGNITION**

**3:0:1**

**Course Code:**

**Course Outcomes:**

At the end of the course students will be able to:

- C01. Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
- C02. Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
- C03. Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
- C04. Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
- C05. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

**UNIT 1**

Machine perception, pattern recognition systems, Design Cycle, Learning and adaption, models of Pattern recognition

**UNIT 2**

Bayesian Decision Theory

Introduction, Bayesian, Decision theory- Two category classification, classifiers-Two category case and multi category case, missing and noisy features.

**UNIT 3**

Nonparametric Techniques

Introduction, Density estimation, Parzen window, KN neighbor estimation, The nearest neighbor rule, Metrics and Nearest Neighbor Classification, Error analysis of nearest decision rule

**UNIT 4**

Introduction, Heirarchical clustering techniques, partitional clustering techniques Dimensionality reduction techniques Introduction, principle component analysis, Fisher Linear Dicriminant Analysis, Spectral clustering based dimensionality reduction

**References:**

1. Pattern Classification, 2<sup>nd</sup> edition, Wiley publications, R. O Duda, P.E. Hart and D G Stork,
2. Pattern Recognition and Image Analysis, Prentice Hall of India, Pvt Ltd, Earl Gose, Richard, Johnsonbaugh, Steve Jost
3. Pattern Recognition and machine Learning, Cristopher M Bishop,
4. Pattern Recognition ( Blue Ant) – Willian Gibsom.
5. Pattern Recognition, 4<sup>th</sup> Edition- Sergios Theodoridis and Konstantios Koutroumbas

## **IMAGE PROCESSING**

**2:1:1**

### **Course Code:**

### **Course Outcomes:**

At the end of the course students will be able to:

- C01. Analyze general terminology of digital image processing.
- C02. Examine various types of images, intensity transformations and spatial filtering.
- C03. Develop Fourier transform for image processing in frequency domain.
- C04. Evaluate the methodologies for image segmentation, restoration etc.
- C05. Implement image process and analysis algorithms.
- C06. Apply image processing algorithms in practical applications.

### **UNIT I**

Introduction, digital image fundamentals

### **UNIT II**

Image enhancement in the spatial domain, Image enhancement in the frequency domain

### **UNIT III**

Image restoration, color image processing

### **UNIT IV**

Wavelets and multi-resolution processing image compression

### **References:**

1. Digital Image Processing-Rafel C.Gonzalez and Richard E Words.
2. The Image Processing hand Book- John C Cruss.
3. Fundamentals of Digital Image Processing- Anil K Jain.
4. Digital Image Processing –Jayaraman S.
5. Digital Image Processing- Sanjay M Shah Munesh Chandra Trivedi

**SOFTWARE TESTING**

**3:0:1**

**Course Code:**

**Course Outcomes:**

At the end of the course students will be able to:

CO1.Check Various test processes and continuous quality improvement

CO2.Verify Types of errors and fault models

CO3.Check Methods of test generation from requirements

CO4.Check Behavior modeling using UML: Finite state machines (FSM)

CO5.Test generation from FSM models

CO6.Input space modeling using combinatorial designs

**UNIT 1**

Assessing Testing Capabilities and Competencies, Building a software Testing Environment: Building a software Testing Strategy, Establishing a Software Testing Methodology, Determining your Software Testing Techniques, Selecting and Installing Software Testing Tools.

**UNIT 2**

The Eleven-Step Testing Process: Eleven-Step Testing Process Overview, Step1: Access Project Management Development Estimate and status, Step2: Develop Test Plan, Step3: Requirement Phase Testing,

**UNIT 3**

Step4: Design Phase Testing, step 5: Requirement Phase Testing, Step6: Execute Test and Record Results,

**UNIT 4**

Step7: Acceptance Test Results Step8: Report Test Results, Step9: Testing Software Installing, Step10: Test Software Changes, Step11: Evaluate Test Effectiveness.

**REFERENCES:**

1. Effective Methods for Software Testing, William E. Perry, 2<sup>nd</sup> Edition 2003, Wiley
2. *Surviving the Top Challenges of Software Testing*, New York: Dorset House, 1997.,  
Rice, Randall and Peery, William E.,
3. A practitioner's Guide to Software Test Design, By Lee Copelane.
4. The Art of Software Testing By Glenford Myers.
5. Testing Object System: Models, Patterns and Tools by Robert V Binder.

**GRAPH THEORY**

**3:1:0**

**Course Code:CSB270**

**Course Outcomes:**

At the end of the course students will be able to:

CO1. Explain basic concepts in combinatorial graph theory

CO2. Define how graphs serve as models for many standard problems

CO3. Discuss the concept of graph, tree, Euler graph, cut set and Combinatorics.

CO4. See the applications of graphs in science, business and industry.

**UNIT 1**

Introduction to Graph theory: Basic terminologies—direct & undirect graphs, walks, paths & circuits, sub-graphs and complements, Graph Isomorphism, vertex degree and regular graphs,

**UNIT 2**

Konigsberg bridge problem & Euler graphs. Hamilton graphs & traveling salesman problem, planar graphs- definition & examples, Bipartite & Kuratowskis graphs, Euler's formula & detection of planarity, Dual of Planar graphs,

**UNIT 3**

Graph Coloring: Proper coloring & chromatic number of graphs, Chromatic polynomial, four color problems, Trees: Optimization & Matching: Trees; Definition & Properties, Rooted & binary rooted trees, ordered trees & trees sorting. Weighted trees & prefix codes

**UNIT 4**

Spanning trees, optimization, Networks, Cutset, Edge & Vertex connectivity of a graph, Max-flow Min-cut theorem and its applications, Matching theory and its applications

**References:**

1. Graph Theory, V.K Balakrishnan, Schaum Series, McGrawHill, 1997
2. Graph Theory, by Frank Harary, Westview Press, 1994.
3. Introduction to Graph Theory, Douglas B west.
4. Hand Book of Graph Theory, Jonathan L Gross and Jay Yellen.
5. Graph Theory with application to Engineering and Computer science, Narsingh Deo.

**OOAD**

**2:1:1**

**Course Code:**

**Course Outcomes**

At the end of the course students will be able to:

CO1. Analyse, design, document the requirements through use case driven approach.

CO2. Identify, analyse, and model structural and behavioural concepts of the system.

CO3. Develop, and explore the conceptual model into various scenarios and applications.

CO4. Apply the concepts of architectural design for deploying the code for software  
Implementation of Object Oriented concepts using C++

**UNIT II**

Introduction, Object orientation, OO development, OO themes, OO modeling ,History. Modeling, Abstraction, Models .Class Modeling Object & class, Link & Association concepts, Generalization & Inheritance, sample Class Model, Navigation of class models. Advanced class modeling: advanced object & class concepts, Association end N ary Association, Aggregation, Abstract Classes, Multiple Inheritance, Meta Data, Reification, Constraints, Derived Data.

**UNIT III**

State modeling: Events, States, Transitions & Conditions, State Diagrams, State Diagram behavior. Advanced state modeling, interaction modeling.

**UNIT IV**

System design: Overview of System design, Estimating performance, making a Reuse plan, Breaking a System into Subsystems, Identifying concurrency, Allocation of subsystems, Management of Data Storage.

**Reference:**



1. Object Oriented Analysis and Design – Blaha, Rambaugh.
2. Object Oriented Analysis and Design with the Unified Process- W Satzinger, Robert B Jackson and Stephen D Burd.
3. Object Oriented Analysis and Design with application, 3<sup>rd</sup> edition- Grady Booch, Robert A Maksimchuk, Michael W Engel
4. Object Oriented Analysis and Design with application- Grady Booch.

## **PROBABILITY AND STATISTICS**

**3:1:0**

### **Course Code:**

### **Course Outcomes**

At the end of the course students will be able to:

- CO1. Apply probability theory to set up tree diagrams
- CO2. Apply probability theory via Bayes' Rule
- CO3. Describe the properties of discrete and continuous distribution functions
- CO4. Use method of moments and moment generating functions
- CO5. Assess the consistency, efficiency and unbiasedness of estimators
- CO6. Apply method of maximum likelihood estimation
- CO7. Apply the Central Limit Theorem
- CO8. Use statistical tests in testing hypotheses on data

### **UNIT 1**

Introduction, basic terminology, Interpretation of probability: Axioms of probability, Some elementary theorems, Conditional probability, Mathematical Expectation

### **UNIT 2**

Probability Distributions: Introduction, Discrete probability distributions continuous probability distributions, The expected value of a random variable Chebyshev's Theorem

### **UNIT 3**

Sampling distributions, Populations and samples, Sampling distribution, The sampling distribution of the mean, sampling distributions of proportions, sampling distributions of mean, chi squared distribution, F distribution.

### **UNIT 4**

Estimation and inference theory, introduction, point estimation, interval distribution, bayesian estimation, test of hypot, Introduction to ANOVA.

### **References:**

1. Probability and Statistics: Bheeshma Rao
2. Probability and Statistics, 4<sup>th</sup> edition, Degroot, Schervish.
3. Probability and Statistics for Engineering and Science, 8<sup>th</sup> edition, Jay L Devore.
4. Probability and Statistics, Michael Akritas.

5. An Introduction to Probability and Statistics, 3<sup>rd</sup> edition, Vijay K Rohatgi and A K MD Ehsanes Saleh.

**DATA MINING**

**2:1:1**

**Course Code:CSD230**

**Course Outcomes:**

At the end of the course students will be able to:

- CO1. Demonstrate an understanding of the importance of data mining and the principles of business intelligence
- CO2. Organize and Prepare the data needed for data mining using pre preprocessing techniques
- CO3. Perform exploratory analysis of the data to be used for mining.
- CO4. Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.
- CO5. Define and apply metrics to measure the performance of various data mining algorithms.

**UNIT 1**

Introduction, what kind of patterns can be mined? which technologies are used? which kind of applications are targeted?, major issues in Data mining.

Getting to know your data: Data objects and attribute types, basic statistical description of data, Data Visualisation, Measuring Data similarity and dissimilarity.

**UNIT 2**

Data Preprocessing: data cleaning, Data integration, Data Reduction, Data transformation and Data Discretization

**UNIT 3**

Mining frequent patterns, Associations and correlations: Basic concepts, Frequent mining methods, pattern Evaluation methods, Pattern mining in Multilevel multi dimensional space, Decision tree induction.

**UNIT 4**

Cluster analysis, partitioning methods, heirarchical methods, density based methods, grid based methods, evaluation of clustering.

**References:**

1. Data Mining: Concepts and Techniques, Third Edition, Jaiwei Han, Micheline Kamber, Jian Pei.
2. Learning Data Mining with Python, 2<sup>nd</sup> edition, Robert Layton.
3. Data Mining; The Text book, Charu C Aggarwal.
4. Data Mining, 4<sup>th</sup> edition: Practical Machine learning Tools and Techniques by Lan H Witten and Fibe Frank.
5. Introduction to Data Mining – Pang- Ning Tan and Micheal Steinbach

## **ARTIFICIAL INTELLIGENCE**

**3:1:0**

### **Course Code:**

### **Course Outcomes**

**CO 1.** At the end of the course students will be able to:

CO 1. Create appreciation and understanding of both the achievements of AI and the theory underlying those achievements.

CO 2. Know concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems

CO 3. Review the different stages of development of the AI field from human like behavior to Rational Agents.

CO4. Impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.

CO5. The basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.

CO6. Introduce advanced topics of AI such as planning, Bayes networks, natural language processing and Cognitive Computing.

### **UNIT 1**

AI problems, AI techniques, defining the problem as state space search, production systems, problem characteristics

Heuristic Search: Generate and test, hill climbing, BFS, Problem Reduction, Constraint Satisfaction, Means-End Analysis

### **UNIT 2**

Knowledge Representation: Representations and mappings, approaches to knowledge representation

procedural v/s declarative knowledge, normal forms in predicate logic and clausal forms, non-monotonic reasoning

Declarative Representations: semantic nets, conceptual dependency, frames, scripts

### UNIT 3

Game playing: minimax search procedure, adding alpha-beta cut offs

Planning: An Example Domain – the blocks world, Components, goal stack planning

### UNIT 4

Expert systems: expert systems v/s conventional computers, expert system shells, explanation based learning.

Learning: Learning from observation - Inductive learning – Decision trees – Explanation based learning – Reinforcement Learning, Neural Networks, Introduction to Natural Language Processing.

#### References:

1. Artificial Intelligence, Third Edition, Elaine Rich, Kevin Knight, Shivashankar B Nair, Tata McGraw-Hill.
2. Introduction to Artificial Intelligence, Wolfgang Ertl.
3. Artificial Intelligence, 2<sup>nd</sup> edition, Stuart Russel, peter Norvig.
4. Artificial Intelligence, Jeorge F Luger
5. Artificial Intelligence, Saroj kaushik

## **.NET TECHNOLOGIES**

**2:0:2**

**Course Code:CSB280**

### **Course Outcomes**

At the end of the course students will be able to:

- CO1. Design web applications using .NET
- CO2. Use .NET controls in web applications.
- CO3. Debug and deploy .NET web applications
- CO4. Create database driven .NET web applications and web services

### **Unit 1**

Benefits of .NET Framework, Architecture of .NET Framework 4.0, Components of .NET Framework 4.0: CLR, CTS, Metadata and Assemblies, .NET Framework Class Library, Windows Forms, ASP .NET.

Need of C#, C# Pre-processor Directives, Creating a Simple C# Console Application, Identifiers and Keywords. Data Types, Variables and Constants: Value Types, Reference Types, Type Conversions, Boxing and Unboxing, Variables and Constants. Expression and Operators: Operator Precedence, Using the :: (Scope Resolution) Operator and Using the *is* and *as* Operators. Control Flow statements: Selection Statements, Iteration Statements and Jump Statements.

### **Unit 2**

Arrays and Strings: One Dimensional and Multidimensional Arrays, Jagged Arrays  
Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, Creating an Array of Objects, Using the Nested Classes, Defining Partial Classes and Method, Returning a Value from a Method and Describing Access Modifiers. Static Classes and Static Class Members. Properties: Read-only Property, Static Property, Accessibility of accessors and Anonymous types. Indexers, Structs: Syntax of a struct and Access Modifiers for structs. Strings: Constructing Strings, Operating on Strings, Arrays of Strings, The String Class

### **Unit 3**

Encapsulation: Encapsulation using accessors and mutators, Encapsulation using Properties.  
Inheritance: Inheritance and Constructors, Sealed Classes and Sealed Methods, Extension methods. Polymorphism: Compile time Polymorphism/Overloading, Runtime Polymorphism/



Overriding. Abstraction: Abstract classes, Abstract methods. Interfaces: Syntax of Interfaces, Implementation of Interfaces and Inheritance.

Delegates: Creating and using Delegates, Multicasting with Delegates. Events: Event Sources, Event Handlers, Events and Delegates, Multiple Event Handlers. Exception Handling: The try/catch/finally statement, Checked and Unchecked Statements.

#### **Unit 4**

Introduction, Windows Forms, Life Cycle, Event Handling: A Simple Event- Driven GUI, Visual Studio Generated GUI Code, Delegates and Event- Handling Mechanism, Another Way to Create Event Handlers, Locating Event Information. Control Properties and Layout, Labels, TextBoxes and Buttons, GroupBoxes and Panels, CheckBoxes and RadioButtons, ToolTips, Mouse-Event Handling, Keyboard-Event Handling. Menus, MonthCalendar Control, ListBox Control, CheckedListBox Control, ComboBox Control, TreeView Control, ListView Control, TabControl Control ; Building an Multiple Document Interface (MDI) Application. Introduction to ADO.NET

#### **References:**

1. Programming in C# 4.0, Tata McGraw Hill, Hebert Shildt
2. C# with .net 4.0 by Andrew Troelsen
3. Programming in C# , 3<sup>rd</sup> Edition, E Balaguruswamy
4. The Complete Reference C#, Herbert Schildt.
5. The Complete Reference ASP.NET, Robert Standefer III

**OBJECT ORIENTED MODELING AND DESIGN WITH UML**

**2:1:1**

**Course Code:**

**Course Outcomes**

At the end of the course students will be able to:

CO1. Design & Programming course is a unique course that teaches students how to use object-oriented techniques to build software.

CO2. Gathering requirements & end with implementation.

CO3. Analyze and design classes, their relationships to each other in order to build a model of the problem domain.

CO4. Use common UML diagrams throughout this process, such as use-case, class, activity & other diagrams.

CO5. Create The diagrams through a free tool.

CO6. Capture and manage requirements.

**Unit I**

INTRODUCTION : Object-Oriented Analysis and Design - Iterative, Evolutionary, and Agile. -

Case Studies : The NextGen POS System - INCEPTION : Inception is Not the Requirements

Phase – Evolutionary Requirements - Use Cases – Other Requirements:NextGen Example

**Unit II**

ELABORATION ITERATION 1: Basics – Domain Models – System Sequence Diagrams –

Operation Contracts – Requirements to Design-Iteratively – Logical Architecture of UML

Package Diagrams

**Unit III**

On to Object Design – UML Interaction Diagrams – UML class Diagrams - GRASP : Designing

Objects with Responsibilities – Object Design Example with GRASP:NextGen POS system –

Designing for Visibility – Mapping Designs to Code

**Unit IV**

ELABORATION ITERATION 2: UML Tools and UML as Blueprint – Quick Analysis Update:

NextGen POS – Iteration 2: More Patterns – GRASP: More Objects with Responsibilities –

applying GoF Design Patterns

**Reference:**

1. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005, Craig Larman,
2. Advanced Object Oriented Analysis and Design using UML , James J Odell.
3. Object Oriented Analysis and Design , Mike O-Docherty.
4. Object Oriented Modeling and Design with UML, 2<sup>nd</sup> edition, Michael R Blaha, James R Rumbaugh.
5. Object Oriented Systems and Analysis and Design using UML, Simon Benneth, Steve McRovv and Ray Farmer.

## **ANDROID APPLICATION DEVELOPMENT**

**2:0:2**

### **Course Code:**

### **Course Outcomes**

At the end of the course students will be able to:

- CO1. Describe and compare different mobile application models/architectures and patterns.
- CO2. Apply mobile application models/architectures and patterns to the development of a mobile software application.
- CO3. Describe the components and structure of a mobile development framework (Google's Android Studio).
- CO4. Apply a mobile development framework to the development of a mobile application.
- CO5. Demonstrate advanced Java programming competency by developing a maintainable and efficient cloud based mobile application

### **Unit 1**

Introduction to Android & Open Handset Alliance

Installation of Android Studio and other Development Environments like Gradle.

Understanding Android File System.

Creating First Android Application

Understanding Intent, Activity, Service, Content Providers, Broadcast Receivers.

Understanding Android Application, Manifests, Layouts, Drawables, Styles, Android Activity, View

Understanding Android XML based layout (Linear Layout, Relative Layout, Frame Layout).

Introduction to Android Life Cycle Events

initialization and Button Click Listeners.

### **Unit 2**

Development of Simple app containing Dialog Box, Intents, Toast, Spinners, Listeners examples.

Android Listview / GridView and Adapters

Android Date Picker Dialog, Time Picker Dialog

Launching sub Activity

Building Custom ListView and Understanding Adapters in detail

Understanding SQLite database. Populating database.

Developing simple app by using SQLite database (insert, delete, update)

### **Unit 3**

Working with web server basics

Background loading, AsyncTask , Using Threads

Developing simple app by downloading image from web and showing it in ImageView

Understanding Importance of External Libraries and demonstration of simple external library

Image lazy loading, Image loading in list view, grid view

### **Unit 4**

Working with Google Maps

ViewPager

Introduction to fragment, add, remove, replace fragment

ViewPager

Side Navigation Drawer

Action bar/ Toolbar

ViewPager Adapter / Swipe View

### **References:**

1. Android Programming for Beginners by John Horton.
2. Professional Android 4 application development by Reto Meir.
3. Android Book by Lan F Darwin.
4. Learning Android Building application for The Android Market by Marko Gargenta.
5. Programming Android Java programming for the new generation of Mobile Devises by Zigurd Mellieks

**ADVANCED DATABASE MANAGEMENT SYSTEM**

**2:1:1**

**Course Code:**

**Course Outcomes**

At the end of the course students will be able to:

- CO1. Evaluate and Apply Advanced Database Development Techniques.
- CO2. Evaluate Database Systems.
- CO3. Administer Database Systems.
- CO4. Design & Implement Advanced Database Systems.

**Unit 1**

Disk storage, Basic file Structures and hashing, indexing structures for files.  
Algorithms for query optimization.

**Unit 2**

Physical database design and tuning, Introduction to transaction, Concurrency control techniques.  
Concept for object databases, Object databases standard and design, database security.

**Unit 3**

Enhanced datamodels for advanced applications, distributed databases and client server architectures, Emerging database technologies and applications.

**Unit 4**

Definition of NoSQL, History of NoSQL and Different NoSQL products, NoSQL Basics. Exploring one among MongoDB/CouchDB/Cassandra along with Java/Ruby/Python interface : Interfacing and Interacting with NoSQL, NoSQL Storage Architecture, CRUD operations, Querying, Modifying and Managing NoSQL Datastores, Indexing and ordering datasets

**References:**

1. Fundamentals of Database System :5<sup>th</sup> Edition ,Navathe

2. Database Management System, Panneerselvam R.
3. Database Management System, Raghu Ramakrishnan and Johannes Gehrke.
4. Data Schemes: Models and algorithms (Advances in Database Systems), Charu C Aggarwal.
5. Multilevel secure Transaction Processing (Advances in Database system), Vijay Atluri and Sushin Jajodia.

## **COMPILER DESIGN**

**3:0:1**

### **Course Code:**

### **Course Outcomes**

At the end of the course students will be able to:

- CO1. Construct a parse tree, or explain why no parse tree exists, given a BNF grammar and a string over the appropriate alphabet.
- CO2. Implement a lexical analyzer from a specification of a language's lexical rules.
- CO3. Compute the FIRST set for a BNF grammar.
- CO4. Compute the FOLLOW set for a BNF grammar.
- CO5. Determine FIRST intersect FIRST constraint satisfaction - determine if a BNF grammar satisfies the constraint on intersection of FIRST sets required for single-symbol-lookahead, top-down, lookahead parsing ()
- CO6. Determine FIRST intersect FOLLOW constraint satisfaction - determine if a BNF grammar satisfies the constraint on intersection of FIRST and FOLLOW sets required for single-symbol-lookahead, top-down, lookahead parsing ()

### **Unit-1**

Introduction, Classification of grammars. Context free grammars. Deterministic finite state automata (DFA) Non-DFA.

Lexical analysis :Language processors; The structure of a Compiler; The evolution Of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics. Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

### **Unit-2**

SyntaxAnalysis

Introduction; Context-free Grammars; Writing a Grammar. Top-down Parsing; Bottom-up Parsing.



Introduction to LR Parsing: Simple LR; More powerful LR parsers (excluding Efficient construction and compaction of parsing tables) ; Using ambiguous grammars; Parser Generators.

### **Unit-3**

Intermediate Code Generation

Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch-statements; Procedure calls.

Run-Time Environments

Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

### **Unit-4**

Code Generation

Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator  
Code optimization. Folding, redundant sub-expression evaluation. Optimization within iterative loops.

#### **References:**

1. Compilers Principles, Techniques and Tools, 2nd Edition, Addison-Wesley, 2007, Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman
- 2."The Theory and Practice of Compiler Writing". McGraw Hill, New York, 1985, Tremblay, et. al
3. Principles, Techniques and Tools of Compilers.- Allen I Holob.
4. Elements of Compiler Design.- Meduna
5. Compiler Design - K Muneeswaran.

**OPEN ELECTIVES**

**2:0:2**

**OP1: COMPUTER FUNDAMENTALS**

**Course Code:**

**Course Outcomes:**

At the end of the course students will be able to:

- CO1. Use technology ethically, safely, securely, and legally.
- CO2. Identify and analyze computer hardware, software, and network components.
- CO3. Design basic business web pages using current HTML/CSS coding standards.
- CO4. Install, configure, and remove software and hardware.
- CO5. Use systems development, word-processing, spreadsheet, and presentation software to solve basic information systems problems.

**UNIT 1**

**INTRODUCTION**

Computer, Characteristic of Computer, History of Computer, Components of Computer  
Key Factors of Computers: Hardware, Software - types of Software (Application and system), forms of software (firmware, shareware, freeware), Translator - Assembler, Compiler and Interpreters. Computer Application – Business, Scientific, Entertainment and educational.

**CLASSIFICATION OF COMPUTERS**

Mode of operations – Analog, Digital and hybrid Computers  
Size and capabilities – Micro, Mini, Main frame and Super computer

**UNIT 2**

**MEMORY UNITS**

Primary memory - RAM, ROM, PROM, EPROM, EEPROM, Flash memory  
Secondary memory – Magnetic disk (Hard disk, Zip disk, Jaz disk, Super disk)  
Optical disk (CD, CD – R, CD – RW, DVD), Magneto-optical disk device

**COMPUTER PERIPHERALS DEVICES AND INTERFACES**

Input devices – Working principle of Keyboard and mouse, Functional capabilities of Scanner, Digital Camera, OMR, OCR, touch pad, touch screen. Output Devices – Monitor, Printer, Plotter and projector.

Processors, Classification of Processors on speed, Motherboard, Power Supply, I/O Ports and its Maintenance

### **PROGRAMMING LANGUAGES**

Machine, Assembly language and High Level Language

### **UNIT 3**

Introduction to Windows, Elements of Word Processing, Spread Sheet, Presentations .

Nudi/Baraha.

### **UNIT 4: INTERNET**

Basics of Internet: www, HTTP, DNS, IP address, Email, Web browsers, Search Engines

HTML: Introduction to HTML, CSS

E-Commerce: Introduction, Types, Advantages of e-commerce, Applications, survey on popular e-commerce sites

E-governance, Introduction to Cyber Ethics

### **References:**

1. Computer Fundamentals (6<sup>th</sup> Edition) – Rajaraman.
2. Computer's Today – Suresh K Basandra.
3. Computer Fundamentals-P K Sinha
4. Computer System Architecture (3<sup>rd</sup> Edition) PHI-2002. Chapters 3.3 & 3.4- Morris Mano,
5. Digital Principles and application (4<sup>th</sup> Edition) – Malvino Leach, Tata Mc Graw-Hill Edition
6. Computer System Architecture (3<sup>rd</sup> Edition) – Morris Mano, PHI
7. Microsoft office 365-Katherine Murray.
8. Microsoft office 2016- Nita Rutkosky, Denise Seguin, Audrey Rutkosky Roggenkamp
9. The Complete reference HTML by Herbert Schildt
10. Learn to program HTML and CSS for beginners
11. HTML black book –Steven Holzner.





**JSS MAHAVIDYAPEETA**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**(Autonomous)**

**OOTY ROAD, MYSURU- 570 025**

**Syllabus for B.Sc. programmes (NEP)**

- **Physics and Mathematics**
- **Mathematics and Computer Science**

**CHOICE BASED CREDIT SYSTEM**

**For B.Sc programmes**

- **Physics, Mathematics and Chemistry**
- **Physics, Mathematics and Computer Science**
- **Physics, Mathematics and Electronics**
- **Physics, Mathematics and Computer Maintenance**

**With effective from (I to IV Semester)**

**2022-23**

**CBCS ( V and VI Semester)**

**DEPARTMENT OF MATHEMATICS**

## List of Courses with Credit Pattern B.Sc.

Sem	programme	Programme code	Course code	Title of the course	Course type	Credit Pattern L:T:P	Total credit	Teaching hrs/week	Evaluation pattern			
									C1	C2	C3	Total Marks
I	PM	BScPhMa32	FSA43032	Algebra-I and Calculus-I	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSA43332	Algebra-I and Calculus-I Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
	MCs	BScMaCs34	FSA43034	Algebra-I and Calculus-I	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSA43334	Algebra-I and Calculus-I Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
			FSA840	Mathematical Aptitude-I	OE-Theory	3:0:0	3	3	20	20	60	100
			FSA850	Business Mathematics-I	OE-Theory	3:0:0	3	3	20	20	60	100
		FSA860	Optional Mathematics- I	OE-Theory	3:0:0	3	3	20	20	60	100	
II	PM	BScPhMa32	FSB43032	Algebra-II (Number Theory) and Calculus-II	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSB43332	Algebra-II (Number Theory) and Calculus-II Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
	MCs	BScMaCs34	FSB43034	Algebra-II (Number Theory) and Calculus-II	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSB43334	Algebra-II (Number Theory) and Calculus-II Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
			FSB840	Mathematical Aptitude-II	OE-Theory	3:0:0	3	3	20	20	60	100
			FSB850	Business Mathematics-II	OE-Theory	3:0:0	3	3	20	20	60	100
		FSB860	Optional Mathematics- II	OE-Theory	3:0:0	3	3	20	20	60	100	

Sem	programme	Programme code	Course code	Title of the course	Course type	Credit Pattern L:T:P	Total credit	Teaching hrs/week	Evaluation pattern			
									C1	C2	C3	Total Marks
III	PM	BScPhMa32	FSC43032	Algebra-III and Differential Equations-I	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSC43332	Algebra-III and Differential Equations-I Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
	MCs	BScMaCs34	FSC43034	Algebra-III and Differential Equations-I	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSC43334	Algebra-III and Differential Equations-I Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
			FSC840	Mathematical Aptitude -III	OE-Theory	3:0:0	3	3	20	20	60	100
			FSC850	Discrete Mathematics-I	OE-Theory	3:0:0	3	3	20	20	60	100
IV	PM	BScPhMa32	FSD43032	Real Analysis-I and Differential Equations-II	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSD43332	Real Analysis-I and Differential Equations-II Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
	MCs	BScMaCs34	FSD43034	Real Analysis-I and Differential Equations-II	DSC-Theory	4:0:0	4	4	20	20	60	100
			FSD43334	Real Analysis-I and Differential Equations-II Practical	DSC-Practical	0:0:2	2	4	10	15	25	50
			FSD840	Mathematical Aptitude -IV	OE-Theory	3:0:0	3	3	20	20	60	100
			FSD850	Basics of Number Theory	OE-Theory	3:0:0	3	3	20	20	60	100

Sem	programme	Programme code	Course code	Title of the course	Course type	Credit Pattern L:T:P	Total credit	Teaching hrs/week	Evaluation pattern			
									C1	C2	C3	Total Marks
V	PCM	BScPCM01	DME47001	Linear algebra	DSE-I Theory	4:0:0	4	4	15	15	70	100
			DME27101	Linear algebra Practical	DSE-I Practical	0:0:2	2	4	15	15	70	100
			DME47201	Matrices	DSE-II Theory	4:0:0	4	4	15	15	70	100
			DME27301	Matrices Practical	DSE-II Practical	0:0:2	2	4	15	15	70	100
	PMCs	BScPMCs02	DME47002	Linear algebra	DSE-I Theory	4:0:0	4	4	15	15	70	100
			DME27102	Linear algebra Practical	DSE-I Practical	0:0:2	2	4	15	15	70	100
			DME47202	Matrices	DSE-II Theory	4:0:0	4	4	15	15	70	100
			DME27302	Matrices Practical	DSE-II Practical	0:0:2	2	4	15	15	70	100
	PMCM	BScPMCM03	DME47003	Linear algebra	DSE-I Theory	4:0:0	4	4	15	15	70	100
			DME27103	Linear algebra Practical	DSE-I Practical	0:0:2	2	4	15	15	70	100
			DME47203	Matrices	DSE-II Theory	4:0:0	4	4	15	15	70	100
	PME	BScPME04	DME27303	Matrices Practical	DSE-II Practical	0:0:2	2	4	15	15	70	100
			DME47004	Linear algebra	DSE-I Theory	4:0:0	4	4	15	15	70	100
			DME27104	Linear algebra Practical	DSE-I Practical	0:0:2	2	4	15	15	70	100
			DME47204	Matrices	DSE-II Theory	4:0:0	4	4	15	15	70	100
				DME27304	Matrices Practical	DSE-II Practical	0:0:2	2	4	15	15	70



Sem	programme	Programme code	Course code	Title of the course	Course type	Credit Pattern L:T:P	Total credit	Teaching hrs/week	Evaluation pattern			
									C1	C2	C3	Total Marks
VI	PCM	BScPCM01	DMF47001	Complex analysis	DSE-III Theory	4:0:0	4	4	15	15	70	100
			DMF27101	Complex analysis Practical	DSE-III Practical	0:0:2	2	4	15	15	70	100
			DMF27201	Numerical Methods	DSE-IV Theory	4:0:0	4	4	15	15	70	100
			DMF27301	Numerical Methods Practical	DSE- IV Practical	0:0:2	2	4	15	15	70	100
			DMF47401	Vector Calculus	SEC	2:0:0	2	2	7.5	7.5	35	50
	PMCs	BScPMCs02	DMF47002	Complex analysis	DSE-III Theory	4:0:0	4	4	15	15	70	100
			DMF27102	Complex analysis Practical	DSE-III Practical	0:0:2	2	4	15	15	70	100
			DMF27202	Numerical Methods	DSE-IV Theory	4:0:0	4	4	15	15	70	100
			DMF27302	Numerical Methods Practical	DSE- IV Practical	0:0:2	2	4	15	15	70	100
			DMF47402	Vector Calculus	SEC	2:0:0	2	2	7.5	7.5	35	50
	PMCM	BScPMCM03	DMF47003	Complex analysis	DSE-III Theory	4:0:0	4	4	15	15	70	100
			DMF27103	Complex analysis Practical	DSE-III Practical	0:0:2	2	4	15	15	70	100
			DMF27203	Numerical Methods	DSE-IV Theory	4:0:0	4	4	15	15	70	100
			DMF27303	Numerical Methods Practical	DSE- IV Practical	0:0:2	2	4	15	15	70	100
			DMF47403	Vector Calculus	SEC	2:0:0	2	2	7.5	7.5	35	50
	PME	BScPME04	DMF47004	Complex analysis	DSE-III Theory	4:0:0	4	4	15	15	70	100
			DMF27104	Complex analysis Practical	DSE-III Practical	0:0:2	2	4	15	15	70	100
			DMF27204	Numerical Methods	DSE-IV Theory	4:0:0	4	4	15	15	70	100
			DMF27304	Numerical Methods Practical	DSE- IV Practical	0:0:2	2	4	15	15	70	100
			DMF47404	Vector Calculus	SEC	2:0:0	2	2	7.5	7.5	35	50

## Preamble

The subject wise expert committee to draft model curriculum contents in Mathematics constituted by the Department of Higher Education, Government of Karnataka, Bangalore vide GO No. ED 260 UNE 2019 (PART-1) DATED 13.08.2021 is pleased to submit its partial report on the syllabus for the First Year (First & Second Semesters) B.Sc.(Basic/Honors) Mathematics and detailed Course Structure for B.Sc.(Honors) Mathematics and M.Sc. (One Year) Mathematics.

The committee discussed various models suggested by the Karnataka State Higher Education Council in its joint meetings with the Chairpersons of Board of Studies of all state universities in Karnataka and resolved to adopt Model IIA *Bachelor of Science (Basic)* for the subjects with practical's with Mathematics as Major/Minor.

To achieve the core objectives of the National Education Policy 2020 it is unanimously resolved to introduce computer based practical's for the Discipline Core (DSC) courses by using Free and Open Source Software's (FOSS) tools for implementation of theory based on DSC courses as it is also suggested by the LOCF committee that the papers may be taught using various Computer Algebra System (CAS) software's such as Mathematica, MATLAB, Maxima and R to strengthen the conceptual understanding and widen up the horizon of students' self-experience. In view of these observations the subject expert committee suggested the software's Python /R / wxMaxima/Scilab/Maple/MatLab/Mathematica for hands on experience of implementation of mathematical concepts in computer based lab.

The expert committee suggests the implementation this curriculum structure in all the Departments of Mathematics in Universities/Colleges in Karnataka.

The subject expert committee designed the Course Learning Outcome (CO) to help the learners to understand the main objectives of studying the courses by keeping in mind of the Programme outcomes (PO) of the graduate degree with honors in Mathematics or a graduate degree with Mathematics as a major subject.

As the Mathematics subject is a vast with several branches of specializations, it is difficult for every student to learn each branch of Mathematics, even though each paper has its own importance. Hence the subject expert committee suggests number of elective papers (for both Discipline electives and Open Electives) along with Discipline Core Courses. The BoS in Mathematics of universities may include additional electives based on the expertise of their staff and needs of the students'. A student can select elective paper as per her/his needs and interest.

The subject expert committee in Mathematics suggests that the concerned Department / Autonomous Colleges/Universities to encourage their faculty members to include necessary topics in addition to courses suggested by the expert committee.

**Name of the Degree Program** : B.Sc. Discipline  
**Course** : Mathematics  
**Year of Implementation** : 2021-22

**Programme Outcomes (PO): By the end of the program the students will be able to:**

PO 1	<b>Disciplinary Knowledge:</b> Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied Mathematics. This also leads to study the related areas such as computer science and other allied subjects
PO 2	<b>Communication Skills:</b> Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real life problems.
PO 3	<b>Critical Thinking and Analytical Reasoning:</b> The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
PO 4	<b>Problem Solving:</b> The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modeling ability, problem solving skills.
PO 5	<b>Research Related Skills:</b> The completing this programme develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO 6	<b>Information/Digital Literacy:</b> The completion of this programme will Enable the learner to use appropriate software's to solve system of algebraic equation and differential equations.
PO 7	<b>Self – Directed Learning:</b> The student completing this program will develop ability of working independently and to make an in-depth study of various notions of Mathematics.
PO 8	<b>Moral and Ethical Awareness/Reasoning:</b> : The student completing this program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.
PO 9	<b>Lifelong Learning:</b> This programme provides self directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO 10	Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

## **PROGRAMME SPECIFIC OUTCOME:**

### **Bachelor of Science in**

#### **(i) Physics and Mathematics**

#### **(ii) Mathematics and Computer Science**

**After completing the graduation in the above discipline, they are able to:**

**PSO1:** Find carrier opportunities in organization, industries/civil service exam/teaching where a high level competence in mathematics and physics is demanded

**PSO2:** Develop proficiency in the analysis of complex physical problems and the use mathematical or other appropriate technique to solve them

**PSO3:** Apply for research in Mathematics or in Physics

**PSO4:** Apply for research in Mathematics or Computer Science

**PSO5:** Find jobs at all levels in corporate field

**PSO6:** Demonstrate skills in the use of computers for control, data acquisition and data analysis in experimental investigation.

## Assessment

### Weight age for the Assessments (in percentage)

Type of Course	Formative Assessment/ Internal Assessment	Summative Assessment (S.A.)
Theory	40%	60%
Practical	50%	50%
Projects	--	--
Experiential Learning (Internship etc.)	--	--

## **THEORY EXAMINATION (For Discipline Specific Courses):**

### **Internal Assessment**

**(i) C1 Component:** 20 Marks. This will be based on test for 10 marks and seminar for 10 marks. This should be completed by the 8th week of the semester.

**C2 Component:** 20 Marks. This will be based on test for 10 marks and assignment for 10 marks. This should be completed by the 15th week of the semester.

**(ii) C3 Component (Main Examination of 2.30 hours duration):** 60 Marks. The pattern of the question paper will be as follows:

**There will be 04 questions. All questions must be answered. All questions carry 15 marks.**

### **Question Paper Pattern**

**Question 1.** This question covers unit I of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

**Question 2.** This question covers unit II of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-question

**Question 3.** This question covers unit III of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

**Question 4.** This question covers unit IV of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

## **PRACTICAL EXAMINATION (For Discipline Specific Courses):**

### **(i) Internal Assessment: 25 (10 +10+5)**

This will be based on C1-test (10 marks), C2-test (10 marks), Seminar/Practical record maintenance (5 marks)). This should be completed by the 15th week of the semester.

### **(ii) Main Examination (2 hours duration):25 (20 + 5)**

There will be 3 questions each carrying equal marks. The student has to answer any two of the 3 questions. Each student will be subjected to viva-voce examination, based on practical syllabus, for 5 marks.

## **THEORY EXAMINATION (For Open Elective (OE) papers):**

### **(i) Internal Assessment**

**C1 Component:** 20 Marks. This will be based on test for 10 marks and seminar for 10 marks. This should be completed by the 8th week of the semester.

**C2 Component:** 20 Marks. This will be based on test for 10 marks and assignment for 10 marks. This should be completed by the 15th week of the semester.

**(ii) C3 component (Main Examination of 2.30 hours duration):** 60 Marks. The pattern of the question paper will be as follows:

**There will be 03 questions. All questions must be answered. All questions carry 20 marks.**

**Question 1.** This question covers unit I of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

**Question 2.** This question covers unit II of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

**Question 3.** This question covers unit III of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

1. Minimum marks for Securing Credits: 30% in Theory Examination and 40% overall.
2. Minimum credits for getting B.Sc. Degree: As per NEP regulations.
3. Award of certificate/diploma/degree: As per NEP regulations.

# Syllabus for B.Sc. with Mathematics as Major Subject

## SEMESTER – I

<b>Algebra - I and Calculus – I</b>	
<b>Teaching Hours: 4 Hours/Week</b>	<b>Credits: 4</b>
<b>Total Teaching Hours: 56 Hours</b>	<b>Max. Marks: 100 (S.A.-60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSA43032 / FSA43034</b>

**Course Learning Outcomes:** This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non homogeneous linear of  $m$  equations in  $n$  variables by using concept of rank of matrix.
- Students will be familiar with the techniques of integration and differentiation of function with real variables.
- Students learn to solve polynomial equations.
- Learn to apply Reduction formulae.

**Unit-I: Matrix:** Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction to Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hours**

**Unit-II: Theory of equations:** Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hours**

**Unit-III: Polar Co-ordinates:** Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, circle of curvature. **14 Hours**



**Unit-IV: Successive Differentiation and Integral Calculus-I:** nth Derivative of Standard functions  $e^{as+b}$ ,  $a^s$ ,  $(ax + b)^n$ ,  $\log(ax + b)$ ,  $\sin(ax + b)$ ,  $\cos(ax + b)$ ,  $e^{as} \sin(bx + c)$ ,  $e^{as} \cos(bx + c)$ , Leibnitz theorem and its applications. Recapitulation of definite integrals and its properties. Reduction formulae for  $\int \sin^n x \, dx$ ,  $\int \cos^n x \, dx$ ,  $\int \sin^n x \cos^n x \, dx$ ,  $\int \tan^n x \, dx$ ,  $\int \cot^n x \, dx$ ,  $\int \sec^n x \, dx$ ,  $\int \operatorname{cosec}^n x \, dx$ ,  $\int x^n \sin x \, dx$ ,  $\int x^n \cos x \, dx$ ,  $\int x^n e^{as} \, dx$ ,  $\int x^n (\log x)^N \, dx$  with definite limits. **14 Hours**

**Reference Books:**

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices - A R Vasista, Krishna Prakashana Mandir.
5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
6. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston.
8. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.
10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.
11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013

<b>Algebra - I and Calculus-I Practical</b>	
<b>Practical Hours : 4 Hours/Week</b>	<b>Credits: 2</b>
<b>Total Practical Hours: 56 Hours</b>	<b>Max. Marks: 50</b> <b>(S.A.-25 + I.A.-25)</b>
<b>Course Code</b>	<b>FSA43332 / FSA43334</b>

**Course Learning Outcomes:** This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming
- Solve problem on algebra and calculus theory studied in FSA43032/FSA43034 by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

**Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested**

**Software's: wxMaxima / Scilab / Python /R.**

**Introduction to the software and commands related to the topic.**

1. Computation of addition and subtraction of matrices,
2. Computation of Multiplication of matrices.
3. Computation of Trace and Transpose of Matrix
4. Computation of Rank of matrix and Row reduced Echelon form.
5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
6. Solving the system of homogeneous and non-homogeneous linear algebraic equations.
7. Finding the nth Derivative of  $e^{ax}$ , trigonometric and hyperbolic functions
8. Finding the nth Derivative of algebraic and logarithmic functions.
9. Finding the nth Derivative of  $e^{ax} \sin(bx + c)$ ,  $e^{ax} \cos(bx + c)$ .
10. Finding the roots of the equation, factoring.
11. Finding the angle between the radius vector and tangent.
12. Finding the curvatures of the given curves.

**Open Elective  
(For Students of all Streams)**

<b>Mathematical Aptitude-I</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100 (S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSA840</b>

**Course Learning Outcomes:** This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

**Unit-I:** Number System, Types of Numbers, series (AP and GP), Algebraic operations BODMAS, Divisibility, LCM and HCF, Fraction, Simplification. **14 Hours**

**Unit-II:** Time and Distance, Problems based on Trains, Boats and Streams.

**14 Hours**

**Unit-III:** Time, work and wages, Pipes and Cistern, Problems on Clock, Problems on Calendar.

**14 Hours**

**Reference Books:**

1. Quantitative Aptitude for Competitive Examinations, R.S. Aggarwal, Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning, R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan Pratogitaprakasan, Kic X, Kiran Prakashan publishers.
4. Quantitative Aptitude for Competitive Examination, Abhijit Guha, Tata Mc Graw hill publications.

## Open Elective

(For Students of all Streams)

<b>Business Mathematics-I</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100</b> <b>(S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSA850</b>

**Course Learning Outcomes:** This course will enable the students to

- Translate the real word problems through appropriate mathematical modelling.
- Explain the concepts and use equations, formulae and mathematical expression and relationship in a variety of context.
- Finding the extreme values of functions.
- Analyze and demonstrate the mathematical skill require in mathematically intensive areas in economics and business.

**Unit-I:** Algebra – Set theory and simple applications of Venn Diagram, relations, functions, indices, logarithms, permutations and combinations. Examples on commercial mathematics. **14 Hours**

**Unit - II:** Matrices: Definition of a matrix; types of matrices; algebra of matrices. Properties of determinants; calculations of values of determinants up to third order; Adjoint of a matrix, elementary row and column operations; solution of a system of linear equations having unique solution and involving not more than three variables. Examples on commercial mathematics.

**14 Hours**

**Unit - III:** Differential Calculus: Constant and variables, functions, Limits & continuity. Differentiability and Differentiation, partial differentiation, rates as a measure, maxima, minima, Partial Derivatives up to second order; Homogeneity of functions and Euler's Theorem; Total Differentials; Differentiation of implicit function with the help of total differentials, Maxima and Minima; cases of one variable involving second or higher order derivatives; Cases of two variables involving not more than one constraint.

**14 Hours**

### Reference Books:

1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi.
2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill London.
3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.
4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi.

## Open Elective Course

(For students of Science stream who have not chosen Mathematics as one of Core subjects)

Optional Mathematics – I	
Teaching Hours : 3 Hours/Week	Credits: 3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.-60 + I.A. – 40)
Course Code	FSA860

**Course Learning Outcomes:** This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non homogeneous m linear equations by using the concept of rank of matrix.
- Students will be familiar with the techniques of differentiation of function with real variables.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Learn to apply Reduction formulae.

**Unit-I: Matrices:** Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction, Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hours**

**Unit-II: Theory of equations:** Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hours**

**Unit-III: Polar Co-ordinates:** Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- centre of curvature, circle of curvature. **14 Hours**

**Reference Books:**

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices – A. R. Vasista, Krishna Prakashana Mandir.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
6. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston of Canada Ltd.
8. Calculus – S. Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol.I & II
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.
10. Integral Calculus, Shanthinarayan, New Delhi: S. Chand and Co. Pvt. Ltd.
11. Integral Calculus, Shanthinarayan and P K Mittal, , Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013.

## SEMESTER – II

<b>Algebra – II {Number Theory} and Calculus – II</b>	
<b>Teaching Hours : 4 Hours/Week</b>	<b>Credits: 4</b>
<b>Total Teaching Hours: 56 Hours</b>	<b>Max. Marks: 100 (S.A.-60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSB43032 / FSB43034</b>

**Course Learning Outcomes:** This course will enable the students to

- Learn the concept of Divisibility.
- Learn about prime and composite numbers.
- Learn the concept of congruences and its applications.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.
- Students learn to find areas and volumes using integration.

**Unit-I: Number Theory:** Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications. **14 Hours**

**Unit-II: Differential Calculus-I:** Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital rule. **14 Hours**

**Unit-III: Partial Derivatives:** Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables. **14 Hours**

**Unit-IV: Integral Calculus-II:** Line integral: Definition of line integral and basic properties, examples on evaluation of line integrals. Double integrals: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas using double integrals. Triple integrals: Definition of triple integrals and evaluation- change of variables, volume as triple integral.

**14 Hours**

**Reference Books:**

1. Differential Calculus, Shantinarayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, New Delhi: S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shantinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. Elementary Number Theory, David M Burton, , 6th edition, McCraw Hill, 2007.
10. Topics from the Theory of Numbers , Emil Grosswald, , Modern Birhauser, 1984.
11. An Introduction to the Theory of Numbers, Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, John Willey (New York), 1991



<b>Algebra – II (Number Theory) and Calculus – II practical</b>	
<b>Practical Hours : 4 Hours/Week</b>	<b>Credits: 2</b>
<b>Total Practical Hours: 56 Hours</b>	<b>Max. Marks: 50 (S.A.-25 + I.A. –25)</b>
<b>Course Code</b>	<b>FSB43332 / FSB43334</b>

**Course Learning Outcomes:** This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming
- Solve problem on algebra and calculus by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

**Practical/Lab Work to be performed in Computer Lab**

**Suggested Software's: wxMaxima / Scilab / Python / R.**

1. Programs related to Number Theory.
2. Program to verify Mean value theorems.
3. Program for finding the Taylor's and Maclaurin's expansions of the given functions.
4. Program to verify the Euler's theorem and its extension.
5. Programs to construct series using Maclaurin's expansion for functions of two variables.
6. Program to evaluate the line integrals with constant and variable limits.
7. Program to evaluate the Double integrals with constant and variable limits.
8. Program to evaluate the Triple integrals with constant and variable limits.

**Open Elective  
(For Students of all Streams)**

<b>Mathematical Aptitude-II</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100 (S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSB840</b>

**Course Learning Outcomes:** This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

**Unit-I:** Percentage, Average, Problems based on Ages, Ratio and Proportion, Partnership and share, Mixtures. **14 Hours**

**Unit-II:** Profit, Loss and Discount, Simple Interest, Compound Interest, Shares and Debentures. **14 Hours**

**Unit-III:** Permutations and Combinations, Probability, True discount and Banker's discount. **14 Hours**

**Reference Books:**

1. Quantitative Aptitude for Competitive Examinations, R.S. Aggarwal, Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning, R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakashan publishers.
4. Quantitative Aptitude for Competitive Examination, Abhijit Guha, Tata Mc Graw hill publications.

**Open Elective**  
**(For Students of all streams)**

<b>Business Mathematics-II</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100</b> <b>(S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSB850</b>

**Course Learning Outcomes:** This course will enable the students to

- Integrate concept in international business concept with functioning of global trade.
- Evaluate the legal, social and economic environment of business.
- Apply decision-support tools to business decision making.
- Will be able to apply knowledge of business concepts and functions in an integrated manner.

**Unit - I:** Commercial Arithmetic: Interest: Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems  
Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Instalments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems. **14 Hours**

**Unit - II:** Measures of central Tendency and Dispersion: Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and give curves. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M.and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems. **14 Hours**

**Unit - III:** Correlation and regression: Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems.

**14 Hours**

**Reference Books:**

1. Practical Business Mathematics, S. A. Bari New Literature Publishing Company New Delhi
2. Mathematics for Commerce, K. Selvakumar Notion Press Chennai
3. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi
4. Business Mathematics and Statistics, N.G. Das & Dr. J.K. Das McGraw Hill New Delhi
5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge
7. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark
8. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K., Sultan Chand and Sons, New Delhi.
9. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
10. Applied Statistics, Mukhopadhyaya Parimal New Central Book Agency Pvt. Ltd. Calcutta.
11. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta.
12. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V. K., Sultan Chand and Sons, New Delhi.

## Open Elective

<b>Optional Mathematics – II</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits:3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100</b> <b>(S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSB860</b>

**(For students of Science stream who have not chosen Mathematics as one of the Core subjects)**

**Course Learning Outcomes:** This course will enable the students to

- Learn the concept of Divisibility.
- Learn about prime and composite numbers.
- Learn the concept of congruence's and its applications.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.
- To understand the concepts of multiple integrals and their applications.

**Unit-I: Number Theory:** Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications.

**14 Hours**

**Unit-II: Partial Derivatives:** Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables.

**14 Hours**

**Unit-III: Integral Calculus:** Line integral: Definition of line integral and basic properties, examples on evaluation of line integrals. Double integral: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, Triple integral: Definition of triple integrals and evaluation-change of variables, volume as triple integral. **14 Hours**

**Reference Books:**

1. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shanthinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6th edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. An Introduction to the Theory of Numbers, Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, John Willey (New York), 1991.

## SEMESTER – III

<b>Algebra - III and Differential Equations – I</b>	
<b>Teaching Hours : 4 Hours/Week</b>	<b>Credits: 4</b>
<b>Total Teaching Hours: 56 Hours</b>	<b>Max. Marks: 100</b> <b>(S.A.-60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSC43032 / FSC43034</b>

**Course Learning Outcomes:** This course will enable the students to

- enhance learning in Algebra and Differential Equations.
- apply the concepts of algebra in practical problems.
- solve various differential equations of practical interest.

### **UNIT I: Group Theory – I**

Definition and examples of groups – Some general properties of Groups, Subgroups, Group of permutations – Cyclic permutations – Even and odd permutations. Order of an element of a group – Cyclic groups problems and theorems. **14 Hours**

### **UNIT II: Group Theory – II**

Cosets, Index of a group, Lagrange's theorem, consequences, Normal Subgroups, Quotient groups – Homomorphism. – Kernel of homomorphism – Isomorphism – Automorphism – Fundamental theorem of homomorphism, Cayley's theorem. **14 Hours**

### **UNIT III: Differential Equations – I**

Recapitulation of Definition, examples of differential equations, Formation of differential equations by elimination of arbitrary constants, Differential equations of first order – Separation of variables, Reducible to separation of variables, Homogeneous differential equations, Reducible to homogeneous, Exact differential equations, Reducible to exact, Integrating factors found by inspection and the determination of integrating factors, Linear differential equations, Bernoulli's differential equations. **14 Hours**

## UNIT IV: Differential Equations – II

Equations of First order and higher degree – Solvable for  $p$ , Solvable for  $x$ , Solvable  $y$ , Clairaut's equations – Singular and General solutions. Ordinary Linear differential equations with constant coefficients – Complementary function – particular integral – Inverse differential operators. Simultaneous differential equations (two variables with constant coefficients)

**14 Hours**

### Books for References:

1. Introductory Course to Differential equations, Daniel A Murray, Sagwan Press
2. A short course in Differential equations, Earl David Rainville and Philip Edward Bedient  
Prentice Hall College Div; 6th edition.
3. Topics in Algebra, I N Herstien, Wiley
4. Contemporary Abstract Algebra, Joseph Gallian, Narosa Publishing House, New Delhi,  
Fourth Edition.
5. A brief Survey of Modern Algebra, G. D. Birkhoff and S Maclane.
6. A first course in Abstract Algebra, J B Fraleigh.
7. Algebra, Michael Artin, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
8. A First Course in Modern Algebra, Vashista, 11th ed.: Krishna Prakasan Mandir, 1980.
9. A Textbook of Modern Algebra, R Balakrishan and N.Ramabadran, 1st ed. New Delhi,  
India: Vikas publishing house pvt. Ltd., 1991.
10. Advanced Differential Equations, M D Raisinghania, S Chand and Co. Pvt. Ltd., 2013.
11. Schaum's outline of theory and problems of Differential Equations, F Ayres, 1st ed. USA  
McGraw-Hill, 2010.
12. Differential Equations, S Narayanan and T K Manicavachogam Pillay, S V Publishers  
Private Ltd., 1981.
13. Advanced Engineering Mathematics, E Kreyszig, Wiley India Pvt. Ltd.
14. Differential equation with Applications and historical notes, G F Simmons, 2nd ed.:  
McGraw- Hill Publishing Company, Oct 1991.



<b>Algebra - III and Differential Equations – I Practical</b>	
<b>Practical Hours : 4 Hours/Week</b>	<b>Credits: 2</b>
<b>Total Practical Hours: 56 Hours</b>	<b>Max. Marks: 50 (S.A.-25 + I.A. – 25)</b>
<b>Course Code</b>	<b>FSC43332 / FSC43334</b>

**Course Learning Outcomes:** This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming
- Solve problem on algebra and differential equations studied in FSC43032/FSC43034 by using FOSS software's.
- Acquire knowledge of applications of algebra and differential equations through FOSS

**Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested Software's:**  
**wxMaxima/Scilab /Python/R.**

**Introduction to the software and commands related to the topic.**

1. Generate Cayley's table.
2. Verifying whether given operator is binary or not.
3. Finding identity and inverse elements of a group.
4. Finding left and right cosets of a group.
5. Solving Differential equation using Maxima and plotting the solution.

**Open Elective  
(For Students of all Streams)**

<b>Mathematical Aptitude-III</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100 (S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSC840</b>

**Course Learning Outcomes:** This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

**Unit I:** Algebraic Expressions, Polynomials, Fundamental operations on Algebraic expressions, Factorisation, Linear equations and problems based on Ages, Quadratic equations. **14 Hours**

**Unit II:** Mensuration, Area, Volume and Surface area (Cylinder, Cone, Sphere). **14 Hours**

**Unit III:** Verbal Reasoning Direction Test, Relation Test, Venn Diagram Analysis Test, Seating puzzles. **14 Hours**

**Reference Books:**

1. R.S. Aggarwal, “Quantitative Aptitude for Competitive Examinations”, Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogita prakasan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill Publications

**Open Elective Course  
(For Students of all Streams)**

<b>Discrete Mathematics</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100 (S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSC850</b>

**Course Learning Outcomes:** This course will enable the students to

- know the concept of set theory.
- know graph theory which helps in decision making in various capacities in organization.
- Enhance the knowledge towards Electronics and computer science.

**Unit I: Basics of Set Theory**

Sets-Subsets – Notation -Inclusion and Equality of sets-The power set, Operation on sets - Venn diagram - Set identities - Ordered pairs and Cartesian products.

Relations and ordering – Properties of binary relation in a set, Relation matrix and Graph of a relation - Equivalence relations - Compatibility relations - composition of Binary relation.

**14 Hours**

**Unit II: Graph Theory**

Basic definitions - Paths and Connectedness - Matrix representation of Graphs - Trees.

**14 Hours**

**Unit III: Mathematical Logic**

Statements and Notation – Connectives – Negation – Conjunction – Disjunction - Statement formulas and Truth tables - Conditional and Bi-conditional – Tautologies - Equivalence of formulas –Tautological Implications.

**14 Hours**

**References:**

- 1) Discrete Mathematical Structures with Application to computer science, J. P. Tremblay, R. Manohar 3rd Edition – Tata McGraw Hill.
- 2) Discrete Mathematical Structures, B. Kolman, R. C. Busby and S. Rose, 3rd edition.
- 3) Introduction to discrete mathematics, C. L. Liu, McGraw Hill, 2nd edition, 1985.
- 4) Discrete Mathematics, S. A. Witala, McGraw Hill, 1987.

## SEMESTER – IV

<b>Real Analysis – I and Differential Equations – II</b>	
<b>Teaching Hours : 4 Hours/Week</b>	<b>Credits: 4</b>
<b>Total Teaching Hours: 56 Hours</b>	<b>Max. Marks: 100 (S.A.-60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSD43032 / FSD43034</b>

**Course Learning Outcomes:** This course will enable the students to

- enhance learning in Analysis and Differential Equations.
- apply the concepts of analysis in practical problems.
- solve various differential equations of practical interest.

### UNIT I: Sequences

Sequence of real numbers – Bounded and unbounded sequences – Infimum and supremum of a sequence – Limit of a sequence – Sum, product and quotient of limits – Standard theorems on limits – Convergent, divergent and oscillatory sequences – Discuss the convergence of  $\{x^n\}, \{n^{1/n}\}$  or  $\{\sqrt[n]{n}\}, \left\{1 + \frac{1}{n}\right\}^n$  and standard problems – Monotonic sequences and their properties – Cauchy's general principle of convergence. **14 Hours**

### UNIT II: Infinite Series

Infinite series of real numbers – Convergence and Divergence - Oscillation of series – Properties of convergence – Series of positive terms – Geometric series – p – series – Comparison tests – D'Alembert's ratio test – Raabe's test – Cauchy's root test – Leibnitz's test for alternating series. **14 Hours**

### UNIT III: Linear differential equations

Cauchy – Euler differential equations, Solution of ordinary second order linear differential equations with variable coefficients by various methods such as:

- (i) When a part of complementary function is given.
- (ii) Changing the independent variable.
- (iii) Changing the dependent variable.
- (iv) By method of variation of parameters.
- (v) Exact method.

Total differential equations - Necessary and sufficient condition for the equation  $Pdx + Qdy + Rdz = 0$  to be exact (proof only for the necessary part) – Simultaneous equations of the form  $dx/P=dy/Q=dz/R$ . **14 Hours**

#### **UNIT IV: Partial differential equations**

Basic concepts – Formation of a partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form  $Pp + Qq = R$ , Standard types of first order non-linear partial differential equations – Charpit's method – Homogenous linear equations with constant coefficient – Rules for finding the complementary function – Rules for finding the particular integral, Method of separation of variables (product method).

**14 Hours**

#### **Books for References:**

1. An introduction to Partial Differential Equations, G. Stephenson
2. Higher Engineering Mathematics B. S. Grewal
3. Advanced Engineering Mathematics, E Kreyszig- Wiley India Pvt. Ltd.
4. A Short Course in Differential Equations, E D Reinvile and P E Bedient –
5. Introductory Course in Differential Equations, D A Murray
6. Differential Equations, G P Simmons
7. Differential Equations (Schaum Series), F. Ayres
8. Application of Differential Equations, Martin Brown
9. Advanced Differential Equations, M D Raisinghanian, S Chand and Co. Pvt. Ltd., 2013.
10. Real Analysis, S C Malik, New Age International Private Limited
11. Text book of mathematical analysis, Leadership project, Bombay university
12. Real analysis, N P Bali, New Age International Private Limited
13. Methods of Real Analysis, Richard R Goldberg, Indian ed.

<b>Number Theory and Calculus – II Practical</b>	
<b>Practical Hours : 4 Hours/Week</b>	<b>Credits: 2</b>
<b>Total Practical Hours: 56 Hours</b>	<b>Max. Marks: 50 (S.A.-25 + I.A. – 25)</b>
<b>Course Code</b>	<b>FSD43332 / FSD43334</b>

**Course Learning Outcomes:** This course will enable the students to

- Learn Free and Open Source Software (FOSS) tools for computer programming
- Solve problem on real analysis and differential equations by using FOSS software's.
- Acquire knowledge of applications of real analysis and differential equations through FOSS

**Practical/Lab Work to be performed in Computer Lab Suggested Software's:**  
**wxMaxima/Scilab//Python/R.**

1. Test for convergence, divergence and oscillation sequences.
2. Test for convergence, divergence and oscillation series.
3. Test the convergence of the series using D'Alembert's ratio test and Raabe's test.
4. Programs on Linear differential equations with variable coefficients.
5. Programs on Partial differential equations.

**Open Elective**  
**(For Students of all Streams)**

<b>Mathematical Aptitude – IV</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100</b> <b>(S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSD840</b>

**Course Learning Outcomes:** This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

**Unit I:** Data interpretation, Data sufficiency. **14 Hours**

**Unit II:** Surds & Indices, Logarithm and its properties. **14 Hours**

**Unit III:** Non-verbal Reasoning Series Test, Analogy, Classification, Cube and Dice, Analytical Reasoning. **14 Hours**

**Reference Books:**

1. R.S. Aggarwal, “Quantitative Aptitude for Competitive Examinations”, Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogita prakasan, Kic X, Kiran Prakashan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.



## Open Elective

(For Students of all Streams)

<b>Basics of Number Theory</b>	
<b>Teaching Hours : 3 Hours/Week</b>	<b>Credits: 3</b>
<b>Total Teaching Hours: 42 Hours</b>	<b>Max. Marks: 100</b> <b>(S.A.- 60 + I.A. – 40)</b>
<b>Course Code</b>	<b>FSD850</b>

**Course Learning Outcomes:** This course will enable the students to

- Know the expansion of sum of two numbers with positive integral powers.
- General method of proving the statement.
- Learn the concept of Divisibility.
- Learn about prime and composite numbers.
- Learn the concept of congruences and its applications.

### Unit I:

Binomial Theorem, Mathematical Induction.

**14 Hours**

### Unit II: Number System

Test for Divisibility, Number of divisors and Sum of divisors of a number, Greatest Common Divisor (GCD), Least Common Multiplie (LCM), Relation between GCD and LCM, Representation of a GCD as a linear combination of given two numbers.

**14 Hours**

### Unit III: Congruence

Basic properties of congruence, Binary and Decimal representations of integers, Linear Congruences and the Chinese Remainder Theorem.

**14 Hours**

### References:

1. An Introduction to the Theory of Numbers, Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery.
2. Elementary Number Theory, David M. Burton, McGraw Hill

## SEMESTER V

**Course code: DME27001/DME27002/DME27003/DME27004**

**Credits: L:T:P=4:0:0**

**Teaching hours:4 hrs per week**

### **DSE I : Linear Algebra**

#### **Course outcome:**

After successful completion of the course, the student is able to

CO1. Understand the concept of vector space.

CO2. Understand Euclidian geometry with the help of real inner products.

CO3. Understand the orthogonal projection.

CO4. Distinguish between linear and non- linear transformations.

CO5.Understand the importance of Matrices in the study of linear transformations.

**Unit I:** Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces, Direct sum of two subspaces.

**Unit II:** Inner Product, Inner Product of any two vectors in  $V(\mathbb{R})$ , Euclidean Vectorspace, Orthogonal Vectors, Ortho normal Basis, Orthogonal Projection, Orthogonal Compliment.

**Unit III:** Linear transformations, algebra of linear transformations , matrix representation of a linear transformation, null space, range, rank and nullity of a linear transformation,

**Unit IV:** Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphism, Auto morphism, theorems, invertibility of non singular linear transformation, change of coordinate matrix.

#### References:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. S. Kumaresan – Linear Algebra
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

## Practical components –V

Course code: DME27101/DME27102/DME27103/DME27104

Credits: L:T:P=0:0:2

Time : 4 Hour per week

1. Vector space, subspace – illustrative examples.
2. Expressing a vector as a linear combination of given set of vectors.
3. Examples on linear dependence and independence of vectors.
4. Basis and Dimension – illustrative examples.
5. Verifying whether a given transformation is linear.
6. Finding matrix of a linear transformation.
7. Problems on rank and nullity.
8. Find characteristics polynomials.
9. To find Eigen values and their multiplicity.
10. Calculation of Eigen vector.
11. Change of basis.
12. Linear transformations to matrices and vice versa.
13. Matrix with respect to change of basis.
14. Orthogonal and orthonormal sets.
15. Gram- Schmidt orthogonalisation of the columns.

## SEMESTER V

**Course code: DME27201/DME27202/DME27203/DME27204**

**Credits: L: T: P = 4:0:0**

**Teaching hours: 4 hours per week**

### **DSE II: Matrices**

#### **Course outcome:**

After successful completion of the course, the student is able to

CO1. Understand the concept of matrices.

CO2. Understand Euclidian geometry with the help of real inner products.

CO3. Understand the rank of matrices

CO4. Distinguish between linear and non- linear transformations.

CO5. Understand the importance of Matrices in the study of linear transformations.

**Unit I:** Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations.

Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

**Unit II:** Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3.

Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

**Unit III:**  $R_1$ ,  $R_2$ ,  $R_3$  as vector spaces over  $R$ . Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of  $R_2$ ,  $R_3$ .

**Unit IV:** Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

Reference Books:

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
4. E. Kreyszig – Advanced Engineering Mathematics, Wiley India Pvt. Ltd

## **PRACTICAL COMPONENTS-V**

**Course code: DME27301/DME27302/DME27303/DME27304**

**Credits: L:T:P = 0:0:2**

1. Introduction to matrices and commands connected to the matrices.
2. Addition and subtraction of matrices.
3. Multiplication and transpose of matrices.
4. Power of a matrix.
5. Row reduced echelon form.
6. Rank of a matrix.
7. Adjoint of a matrix.
8. Inverse of a non-singular matrix.
9. Systems of linear equations.

## SEMESTER VI

**Course code: DMF27001/DMF27002/DMF27003/DMF27004**

**Credits: L: T: P = 4:0:0**

**Teaching hours: 4 hours per week**

### **DSE II: Complex Analysis**

#### **Course outcome:**

After successful completion of the course, the student is able to

CO1. Understand the importance of complex numbers and their geometrical representation.

CO2. Find the equations of geometrical figures in complex form.

CO3. Distinguish between differentiability and analyticity of a function.

CO4. Study the properties of various transformations.

CO5. Understand the importance of conformal mappings.

**Unit I:** Complex numbers, Polar and exponential form of complex numbers, Triangular inequality, Geometry of complex numbers, Equations of lines and circles in complex form, Functions of complex variables, Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

**Unit II:** Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, Harmonic functions, Construction of Analytic functions.

**Unit III:** Definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula, Cauchy's inequality, Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series.

**Unit IV:** Linear and Bilinear Transformations, Cross ratio of four points, Conformal mapping, Transformations of the form  $z^2$ ,  $\frac{1}{z}$ ,  $\sin z$ ,  $\cos z$ ,  $e^z$ ,  $\sinh z$ ,  $\cosh z$  etc, Laurent series and its examples, Poles and residues.

#### **References:**

1. L. V. Ahlfors – Complex Analysis
2. Bruce P. Palica – Introduction to the Theory of Function of a Complex Variable
3. Serge Lang – Complex Analysis
4. Shanthinarayan – Theory of Functions of a Complex Variable
5. S. Ponnuswamy – Foundations of Complex Analysis
6. R. P. Boas – Invitation to Complex Analysis.

7. R V Churchill & J W Brown, Complex Variables and Applications, 5th ed.: McGraw Hill Companies., 1989.
8. A R Vashista, Complex Analysis, Krishna Prakashana Mandir, 2012.

### Practical components –VI

**Course code: DMF27101/DMF27102/DMF27103/DMF273F104**

**Credits: L:T:P = 0:0:2**

1. Declaring a complex number and graphical representation.
2. Complex numbers and their representations, operations like addition, multiplication, division, modulus, graphical representations of polar form.
3. To plot the complex functions and analyze the graph  
(i)  $f(z) = z$ , (ii)  $f(z) = z^3$ , (iii)  $f(z) = (z^4 - 1)^{1/4}$
4. Some problems on Cauchy – Riemann equations (polar forms).
5. Implementation of Milne – Thomson method of constructing analytic functions (simple examples).
6. Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
7. Verifying real and imaginary parts of an analytic function being harmonic (in polar coordinates)
8. Examples connected with Cauchy's integral theorem.
9. To compute the poles and corresponding residues of complex functions.
10. Illustrating the angle preserving property in a transformation.
11. Illustrating the circles are transformed to circles by a bilinear transformation.
12. To perform conformal mapping and bilinear transformations.

## SEMESTER VI

Course code: DMF27201/DMF27202/DMF27203/DMF27204

Credits: L: T: P-4:0:0

Teaching hours: 4 hours per week

### DSE III: Numerical Methods

#### COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1. Understand the importance numerical methods.

CO2. To determines the numerical solutions of algebraic and transcendental equations

CO3.To finds the numerical solutions of first order linear differential equations

CO4. To evaluate integrals of rational, radical and other functions over an interval to any desired degree of accuracy

CO5. To determine the values of unknown functions from the given data by using interpolation ormulae.

**Unit I:** Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOF iterative methods.

**Unit II:** Lagrange and Newton interpolation: linear and higher order, finite difference operators. Numerical differentiation: forward difference, backward difference and central Difference.

**Unit III :** Numerical Integration: general quadrature formula, trapezoidal rule, Simpson's rule (1/3 and 3/8 th ), weddle's rule.

**Unit IV:** Numerical solutions of first order linear differential equations-Euler-Cauchy method Euler's modified method Runge-kutta fourth order method

#### Reference Books:

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3. Introduction to Numerical analysis by S.S.Shasthri
4. B.S Grewal Higher engineering mathematics
5. E.Kreyszig-Advanced Engineering Mathematics, Wiely India Pvt. Ltd



## **RACTICAL COMPONENTS-VI**

**Course code: DMF27301/ DMF27302/DMF27303/DMF27304**

**Credits: L:T:P:0:0:2**

1. Newton Gregory forward interpolation.
2. Lagrange interpolation.
3. Simpson's one-third method.
4. Simpson's three-eighth method.
5. Bisection method.
6. Regula-Falsi method.
7. Newton-Raphson method.
8. Modified Euler's metod.
9. Runge Kutta second order method.
10. Runge Kutta fourth order method.

## **Vector Calculus**

**Course code: DMF27401/DMF27402/DMF27403/DMF27404**

**Credits: L: T: P = 2:0:0**

**Teaching hours: 2 hours per week**

### **Skill Enhancement Course (SEC - II)**

Unit I: Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.

Unit II: Gradient, divergence and curl, Standard derivations and Exercise ,

References:

1. Murray R Spiegel – Theory and problems of vector calculus.
2. Shanthinarayan and J N Kapur – A text book of Vector calculus.
3. B.S Grewal – Higher engineering mathematics.
4. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

**Question Paper Pattern**  
**(For Discipline Course Papers)**

**MATHEMATICS**

**Time: 2.30 Hours**

**Max. Marks: 60**

**1. Answer any three questions.**

**5X3=15**

- a.
- b.
- c.
- d.
- e.

**2. Answer any three questions.**

**5X3=15**

- a.
- b.
- c.
- d.
- e.

**3. Answer any three questions.**

**5X3=15**

- a.
- b.
- c.
- d.
- e.

**4. Answer any three questions.**

**5X3=15**

- a.
- b.
- c.
- d.
- e.

**Question Paper Pattern**  
**(For Open Elective Papers)**  
**MATHEMATICS**

**Time: 2.30 Hours**

**Max. Marks: 60**

**1. Answer any four questions.**

**5X4=20**

a.

b.

c.

d.

e.

f.

**2. Answer any four questions.**

**5X4=20**

a.

b.

c.

d.

e.

f.

**3. Answer any four questions.**

**5X4=20**

a.

b.

c.

d.

e.

f.

# Question Paper Pattern(CBCS )

## Mathematics

Time: 3 Hours

Max. Marks: 70

### Section – A

**I. Answer any five questions.**

**5 x 2 = 10**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

### Section – B

**II. Answer any three questions.**

**3 x 5 = 15**

- 1.
- 2.
- 3.
- 4.
- 5.

**III. Answer any three questions.**

**3 x 5 = 15**

- 1.
- 2.
- 3.
- 4.
- 5.

**IV. Answer any three questions.**

**3 x 5 = 15**

- 1.
- 2.
- 3.
- 4.
- 5.

**V. Answer any three questions.**

**3 x 5 = 15**

- 1.
- 2.
- 3.
- 4.
- 5.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(An autonomous College of University of Mysuru)  
Re-accredited by NAAC with 'A' grade  
Ooty road, Mysuru-570 025, Karnataka



ESTD-1964

**DEPARTMENT OF MICROBIOLOGY**  
**SYLLABUS**

**NATIONAL EDUCATION POLICY**  
**FOR**  
**B.Sc. PROGRAMME**

**Microbiology & Biotechnology**

**Microbiology & Biochemistry**

**(W. E. F. 2022 – 2023)**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25**  
**DEPARTMENT OF MICROBIOLOGY**  
**PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (NEP)**  
**DURATION OF THE COURSE: 4YEARS (8SEMESTER)**  
**PROGRAMME: BSc Mb & Bt, (2022-23)**  
**PROGRAMME CODE: BScMbBt41**  
**BSc Microbiology (Basic / Hons.)**

Year	Semester	Core course	Title of the paper	Lecture + Practicals hours per week	No. of credits			Total credits	Total hours		Maximum Marks in exam/Assessment			
					L	T	P		Th	Pr	IA(Theory)		Total	
											C-1	C-2		
I B.Sc	I	<b>DSC-I :Theory FSA500</b>	General Microbiology	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-I: Pract-I</b>	General Microbiology	04	0	0	2			60	25	10	10+5(record)	50
		<b>OE-I</b>	Microbial Technology for human welfare	03	3	0	0	<b>03</b>	42	-	-	20	20	100
		<b>SEC-1</b>	Microbiological methods and Analytical Techniques	01	1	0	0	<b>01</b>	14					
	II	<b>DSC-II: Theory FSB500</b>	Microbial biochemistry and physiology	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-II: Pract-II</b>	Microbial biochemistry and physiology	04	0	0	2			60	25	10	10+5(record)	50
<b>OE-II</b>		Environmental and sanitary Microbiology	03	3	0	0	<b>03</b>	42			20	20	100	
II B.Sc	III	<b>DSC-III :Theory FSC500</b>	Microbial Diversity	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-III: Pract-III</b>	Microbial Diversity	04	0	0	2			60	25	10	10+5(record)	50
		<b>OE-III</b>	Microbial Entrepreneurship	03	3	0	0	<b>03</b>	42	-	-	20	20	100
	IV	<b>DSC-IV: Theory FSD500</b>	Microbial Enzymology andMetabolism	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-IV: Pract-IV</b>	Microbial Enzymology andMetabolism	04	0	0	2			60	25	10	10+5(record)	50
		<b>OE-IV</b>	Human Microbiome	03	3	0	0	<b>03</b>	42			20	20	100

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25**  
**DEPARTMENT OF MICROBIOLOGY**  
**PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (NEP)**  
**DURATION OF THE COURSE: 4YEARS (8 SEMESTER)**  
**PROGRAMME: BSc MB & BC**  
**PROGRAMME CODE: BScMbBc42**  
**BSc Microbiology (Basic / Hons.)**

Year	Semester	Core course	Title of the paper	Lecture + Practicals hours per week	No. of credits			Total credits	Total hours		Maximum Marks in exam/Assessment			
					L	T	P		Th	Pr	IA(Theory)		Total	
											C-1	C-2		
I B.Sc	I	<b>DSC-I :Theory FSA500</b>	General Microbiology	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-I: Pract-I</b>	General Microbiology	04	0	0	2			60	25	10	10+5(record)	50
		<b>OE-I</b>	Microbial Technology for human welfare	03	3	0	0	<b>03</b>	42	-	-	20	20	100
		<b>SEC-1</b>	Microbiological methods and Analytical Techniques	01	1	0	0	<b>01</b>	14					
	II	<b>DSC-II: Theory FSB500</b>	Microbial biochemistry and physiology	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-II: Pract-II</b>	Microbial biochemistry and physiology	04	0	0	2			60	25	10	10+5(record)	50
<b>OE-II</b>		Environmental and sanitary Microbiology	03	3	0	0	<b>03</b>		42			20	20	100
II B.Sc	III	<b>DSC-III :Theory FSC500</b>	Microbial Diversity	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-III: Pract-III</b>	Microbial Diversity	04	0	0	2			60	25	10	10+5(record)	50
		<b>OE-III</b>	Microbial Entrepreneurship	03	3	0	0	<b>03</b>	42	-	-	20	20	100
	IV	<b>DSC-IV: Theory FSD500</b>	Microbial Enzymology and Metabolism	04	4	0	0	<b>06</b>	56		60	20	20	100
		<b>DSC-IV: Pract-IV</b>	Microbial Enzymology and Metabolism	04	0	0	2			60	25	10	10+5(record)	50
		<b>OE-IV</b>	Human Microbiome	03	3	0	0		<b>03</b>	42			20	20



**DEPARTMENT OF MICROBIOLOGY**  
**PROGRAMME: BSc MBt (NEP)**  
**PROGRAMME OUTCOMES: B.Sc., Mb-Bt & Mb-Bc**

**Program Outcomes:**

Competencies need to be acquired by the candidate securing B.Sc (Basic) or B.Sc (Hons)

**By the end of the program the students will be able to:**

<b>PO1</b>	Knowledge and understanding of concepts of microbiology and its application in pharma, food, agriculture, beverages, nutraceutical industries.
<b>PO2</b>	Understand the distribution, morphology and physiology of microorganisms and demonstrate the skills in aseptic handling of microbes including isolation, identification and maintenance.
<b>PO3</b>	Competent to apply the knowledge gained for conserving the environment and resolving the environmental related issues.
<b>PO4</b>	Learning and practicing professional skills in handling microbes and contaminants in laboratories and production sectors.
<b>PO5</b>	Exploring the microbial world and analyzing the specific benefits and challenges.
<b>PO6</b>	Applying the knowledge acquired to undertake studies and identify specific remedial measures for the challenges in health, agriculture, and food sectors.
<b>PO7</b>	Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.
<b>PO8</b>	Understanding biochemical and physiological aspects of microbes and developing broader perspective to identify innovative solutions for present and future challenges posed by microbes
<b>PO9</b>	Understanding and application of microbial principles in forensic and working knowledge about clinical microbiology.
<b>PO10</b>	Demonstrate the ability to identify ethical issues related to recombinant DNA technology, GMOs, intellectual property rights, biosafety and biohazards.
<b>PO11</b>	Demonstrate the ability to identify key questions in microbiological research, optimize research methods, and analyze outcomes by adopting scientific methods, thereby improving the employability.
<b>PO12</b>	Enhance and demonstrate analytical skills and apply basic computational and statistical techniques in the field of microbiology.

**PROGRAMME SPECIFIC OUTCOME**

**After completing the graduation in the Bachelor of Science the students are able to:**

<b>PSO 1</b>	Demonstrate effectively the applications of biochemical and biological sciences
<b>PSO2</b>	Inculcating proficiency in all experimental techniques and methods of analysis
<b>PSO3</b>	Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis
<b>PSO4</b>	Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues
<b>PSO5</b>	Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals
<b>PSO6</b>	Gain and understanding of biochemical and molecular processes that occur in and between cells to expand understanding of biology

**Assessment:****Weight age for assessments (in percentage)**

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40%	60%
Practical	50%	50%
Projects	40%	60%
Experiential Learning (Internships/MOO C/ Swayam etc.)	40%	60%

Formative Assessment : 40%	
Assessment Occasion/ type	Weightage in Marks
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
<b>Total</b>	40% : 40 Marks

**Total Marks for each course = 100%**  
**Formative Assesment (C1+C2) = 40%**  
**Semester end examination (C3) = 60%**

## **PREAMBLE**

The role of education is paramount in nation building. One of the major objectives of UGC is maintenance of standards of higher education. Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. Such changes have gained momentum with the introduction of Choice Based Credit System (CBCS) which further expects Learning Outcome-Based curriculum to maximize the benefits of the newly designed curriculum. The Learning Outcome- Based Curriculum in Microbiology will help the teachers of the discipline to visualize the curriculum more specifically in terms of the learning outcomes expected from the students at the end of the instructional process. The commission strives to promote the link of students with the society/industry such that majority of the students engage in socially productive activities during their period of study in the institutions and at least half of the graduate students will secure access to employment/self-employment or engage themselves in pursuit of higher education. The model curriculum envisages to cater to the developmental trends in higher education, incorporating multi- disciplinary skills, professional and soft skills such as teamwork, communication skills, leadership skills, time management skills and inculcate human values, professional ethics, and the spirit of Innovation /entrepreneurship and critical thinking among students and promote avenues for display of these talents, linking general studies with professional courses. Besides imparting disciplinary knowledge to the learners, curriculum should aim to equip the students with competencies like problem solving, analytical reasoning and moral and ethical awareness. Introduction of internship and appropriate fieldwork/case studies are embedded in the curriculum for providing wider exposure to the students and enhancing their employability.

Learning outcomes specify what exactly the graduates are expected to know after completing a Programme of study. The expected learning outcomes are used as reference points to help formulate graduate attributes, qualification descriptors, Programme learning outcomes and course learning outcomes. Keeping the above objectives of higher education in mind the Learning Outcome-Based Curriculum Framework (LOCF) for the discipline of Microbiology has been prepared and presented here.

**BSc Microbiology (Basic / Hons.)  
Semester 1**

<b>Course Title: DSC-1T, General Microbiology</b>	
<b>Course code: FSA500</b>	
Total Contact Hours: <b>56</b>	Course Credits: <b>4+2</b>
Formative Assessment Marks: <b>40%</b>	Duration of ESA/Exam: <b>3 Hrs</b>
Model Syllabus Authors: <b>Curriculum Committee</b>	Summative Assessment Marks: <b>60%</b>

**Course Outcomes (COs):**

At the end of the course the student should be able to:

- 1. Thorough knowledge and understanding of concepts of microbiology.**
- 2. Learning and practicing professional skills in handling microbes.**
- 3. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.**

**Course Articulation Matrix:** Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Thorough knowledge and understanding of concepts of microbiology	✓	✓		✓								
2. Learning and practicing professional skills in handling microbes		✓		✓			✓					
3. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.		✓		✓			✓					

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

## BSc Microbiology (Basic / Hons.)

### Semester 1

**Title of the Courses:**

**Course 1 : DSC-1T: General Microbiology**

**Course 2 : OE 1T: Microbial Technology for Human Welfare**

**Course 3 : SEC 1T: Microbiological Methods and Analytical Techniques**

Course 1 : DSC-1T General Microbiology		Course 2 : OE 1T Microbial Technology for Human Welfare		Course 3 : SEC 1T Microbiological Methods and Analytical Techniques	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
<b>4</b>	<b>56</b>	<b>3</b>	<b>42</b>	<b>1</b>	<b>14</b>

<b>Content of Course 1: Theory: DSC-1T, MBL 101, General Microbiology</b>	<b>56 Hrs</b>
<b>Unit – 1: Historical development, major contributions, origin of microorganisms and microscopy</b>	<b>14Hrs</b>
<p><b>Historical development of microbiology</b> -Theory of spontaneous generation, Biogenesis and Abiogenesis. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner, Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky, Elie Metchnikoff. Contributions of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Microcopy- working principle, construction and operation of simple and compound microscopes.</p>	
<b>Unit – 2: Staining, sterilization and preservation of microorganisms</b>	<b>14Hrs</b>
<p><b>Staining:</b> Nature of strains, principles, mechanism, methods and types of staining- Simple, Differential-Gram staining, Acid fast staining, staining of capsule, cell wall, endospore, inclusion bodies.  <b>Sterilization:</b> Principles, types and techniques, Physical and chemical methods.            Culture media – Types, Cultivation of aerobic and anaerobic bacteria. Pure culture techniques and Cultural characteristics.            Preservation of microorganisms: Methods of preservation of microorganisms; slant culture, stab culture, soil culture, mineral oil overlaying, glycerol preservation.</p>	
<b>Unit – 3: Types, structure, organisation and reproduction of prokaryotic microorganism</b>	<b>14Hrs</b>
<p><b>Overview of Prokaryotic Cell Structure:</b> Size, shape, arrangement. Diagram of Prokaryotic cell organisation, cell wall structure of Gram positive and negative bacteria, cell membrane; Bacterial and Archaeal, Cytoplasmic matrix- Cytoskeleton, ribosome, inclusion granules: Composition and function. Nuclear Materials – Bacterial chromosomes structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials. Components external to cell wall- capsule, slime, s- layer, pili, fimbriae, flagella; structure, motility, chemotaxis. Bacterial Endospore - Examples of spore forming organisms, habitats, function, formation and germination.Reproduction in bacteria and bacterial cell cycle.</p>	

<b>Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms</b>	<b>14Hrs</b>
<p>Over view of eukaryotic cell structure: General structure and types of cells; External cell coverings and cell membrane. Structure and function of Cytoplasmic matrix- cytoskeleton: Structure and function; single Membrane organelles- Endoplasmic reticulum, Golgi complex, Lysosomes, Vesicles and Ribosomes; Double Membrane organelles- Nucleus, Mitochondrion and Chloroplast: Structure and Functions; Peroxisomes; Organelles of motility- Structure and movement of flagella and cilia.</p>	

### **Course 1: Practical: DSC-1P : General Microbiology**

1. Microbiological laboratory standards and safety protocols
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. A. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, Vortex, Magnetic stirrer).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
7. Demonstration of bacterial motility by hanging drop method.
8. Simple staining & Negative staining
9. Differential staining - Gram staining
10. Acid fast staining
11. Structural staining - Flagella and Capsule
12. Bacterial endospore staining
13. Staining of fungi by Lactophenol cotton blue.
14. Staining of reserved food materials.
15. A. Preparation of Physiological saline and Serial dilution  
B. Method of obtaining pure cultures of Microorganisms

### **Text Books / References**

1. General Microbiology 1<sup>st</sup> Edition, 2020 , Linda Bruslind, Oregon State University
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
7. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudbury, 835 pp.
13. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
14. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9<sup>th</sup> ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

## Course 2 : Theory: OE 1T: Microbial Technology for Human Welfare

<b>Course 2 : OE 1T: Microbial Technology for Human Welfare</b>	<b>42Hrs</b>
Unit – 1: Food and Fermentation Microbial Technology	14Hrs
Fermented Foods – Types, Nutritional Values, Advantages and Health Benefits Prebiotics, Probiotics, Synbiotics and Nutraceutical Foods Fermented Products – Alcoholic and nonalcoholic beverages, fermented dairy products, Fruit fermented drinks,	
Unit – 2: Agricultural Microbial Technology	14Hrs
Microbial Fertilizers, Microbial Pesticides, Mushroom Cultivation, Biogas Production	
Unit – 3: Pharmaceutical Microbial Technology	14Hrs
Microbial Drugs – Types and Development of Drug resistance Antibiotics – Types, Functions and Antibiotic Therapy Vaccines – Types, Properties, Functions and Schedules	

## Course 3 : Theory: SEC 1T

### Title: Microbiological Methods and Analytical Techniques

#### LEARNING OUTCOMES

- Demonstrate skills as per National Occupational Standards (NOS) of “Lab Technician/ Assistant” Qualification Pack issued by Life Sciences Sector Skill Development Council - LFS/Q0509, Level 3.
  - Perform microbiology and analytical techniques. Knowledge about environment, health, and safety (EHS), good laboratory practices (GLP), good manufacturing practices (GMP) and standard operating procedures (SOP)
  - Demonstrate professional skills at work, such as decision making, planning, and organizing, Problem solving, analytical thinking, critical thinking, and documentation.
1. Principles which underlies sterilization of culture media, glassware and plastic ware to be used for microbiological work.
  2. Principles of a number of analytical instruments which the students have to use during the study and also later as microbiologists for performing various laboratory manipulations.
  3. Handling and use of microscopes for the study of microorganisms which are among the basic skills expected from a practicing microbiologist. They also get introduced a variety of modifications in the microscopes for specialized viewing.
  4. Several separation techniques which may be required to be handled later as microbiologists.



### Course 3 :Theory: SEC 1T

<b>SEC 1T : Microbiological Methods and Analytical Techniques</b>	<b>14Hrs</b>
<b>DIGITAL SKILLS:</b> <b>The components of digital skills provided by KSHEC, will be followed accordingly.</b> <b>Microbiological Skills</b> Microbiological culture media: Types, Composition, Preparation, Application and storage; Ingredients of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media. Isolation and cultivation of microorganisms: Collection of samples, processing of samples, serial dilution, technique, inoculation of samples, incubation and observations of microbial colonies. Morphological characterization of microorganisms - Colony characteristics, Microscopic characters, biochemical/physiological tests or properties and identification. Subculturing of microorganisms and pure culture techniques. Preservation of microorganisms. Advanced Microscopic Skills: Different types of microscopes - Phase contrast, Bright Field, Dark Field, Fluorescent, Confocal, Scanning and Transmission Electron Microscopy. <b>Analytical Skills</b> Centrifugation, Chromatography and Spectroscopy: Principles, Types, Instrumentation, Operation and applications.	

### Course 3 : Practicals: SEC 1P: Microbiological Methods and Analytical Techniques

1. Preparation of different microbiological culture media
2. Isolation and cultivation of bacteria, actinobacteria, fungi and algae
3. Characterization and identification of bacteria, actinobacteria, fungi and algae – colony characters and microscopic characters
4. Biochemical and physiological tests for identification of bacteria
5. Methods and practices in microbiology lab: MSDS (Material Safety Data Sheet), Good clinical Practices (GCP), Standard Operating Procedure (SOP), Good Laboratory Practices (GLP), Good Manufacturing Practices.
6. Usage and maintenance of basic equipment of microbiology lab: Principles, calibrations, and SOPs of balances (Types), pH meter (Types), Autoclaves (Types), Laminar flows and biosafety cabinets, basic Microscopes, homogenizers, stirrers.
7. Procedures for documentation, lab maintenance, repair reporting
8. Separation of mixtures of biomolecules by paper / thin layer chromatography.
9. Demonstration of column packing in column chromatography.

**Pedagogy :**

The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level 3. Case studies about application of microbial biomolecules in various industries. Seminar on topics of microbial biochemistry

<b>Formative Assessment : 40%</b>	
<b>Assessment Occasion/ type</b>	<b>Weightage in Marks</b>
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
<b>Total</b>	40% : 40 Marks

**BSc Microbiology (Basic / Hons.)**  
**Semester II**

**Title of the Courses:**

**Course 1: DSC-2T: Microbial Biochemistry and Physiology Course**

**2 : OE- 2T: Environmental and Sanitary Microbiology**

**Course code:FSB500**

<b>Course 1: DSC-2T, MBL 102, Microbial Biochemistry and Physiology</b>		<b>Course 2: OE- 2T, MBL 302, Environmental and Sanitary Microbiology</b>	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
<b>4</b>	<b>56</b>	<b>3</b>	<b>42</b>

<b>Content of Course: DSC-2T: Microbial Biochemistry and Physiology</b>	<b>56 Hrs</b>
<b>Unit – 1 Biochemical Concepts</b>	<b>14Hrs</b>
<p>Basic Biochemical Concepts: Major elements of life and their primary characteristics, atomic bonds and molecules – bonding properties of carbon, chemical bonds- covalent and non covalent, Hydrogen bonds and Vander Waal Forces.</p> <p>Biological Solvents: Structure and properties of water molecule, Water as an universal solvent, polarity, hydrophilic and hydrophobic interactions, properties of water, Acids, bases, electrolytes, hydrogen ion concentration, pH, buffers and physiological buffer system, Handerson – Hasselbatch equation.</p>	
<b>Unit – 2 Macromolecules – Types, Structure and Properties</b>	<b>14Hrs</b>
<p>Carbohydrates: Definition, classification, structure and properties.</p> <p>Amino acids and proteins: Definition, structure, classification and properties of amino acids, Structure and classification of proteins.</p> <p>Lipids and Fats: Definition, classification, structure, properties and importance of lipids. Porphyrins and Vitamins: Definition, structure, properties and importance of chlorophyll, cytochrome and hemoglobin.</p>	
<b>Unit – 3 Microbial Physiology</b>	<b>14Hrs</b>
<p><b>Microbial Growth:</b> Definition of growth, Mathematical expression, Growth curve, phases of growth, calculation of generation time and specific growth rate. Synchronous growth, Continuous growth (chemostat and turbidostat), Diauxic growth. Measurement of Growth: Direct Microscopic count – Haemocytometer; Viable count, Membrane filtration; Electronic Counting; Measurement of cell mass; Turbidity measurements-Nephelometer and spectrophotometer techniques;Measurements of cell constituents. Growth Yield (definition of terms). Influence of environmental factors on growth. Microbial growth in natural environments. Viable non-culturable organisms. Quorum sensing.</p> <p><b>Microbial Nutrition:</b> Microbial nutrients, Classification of organisms based on carbon source, energy source and electron source, Macro and micronutrients.</p> <p><b>Membrane Transport:</b> Structure and organization of biological membranes, Types of Cellular transport, Passive, Facilitated, Active, Group Translocation, Membrane bound and binding protein transport system, Carrier models, Liposomes, Ion transduction Na K<sup>+</sup>, ATPase.</p>	
<b>Unit – 4: Microbial Physiology- Bioenergetics, Microbial Respiration, Microbial Photosynthesis</b>	<b>14Hrs</b>

<p>Bioenergetics: Free energy, Enthalpy, Entropy, Classification of high energy compounds, Oxidation reduction reactions, equilibrium constant, Redox potential, Law of thermodynamics.</p> <p>Microbial Respiration: Respiratory electron transport chain in bacteria, oxidation – reduction reactions, protein translocation, oxidative and substrate level phosphorylation – inhibitors and mechanism, chemiosmotic coupling. Fermentation reactions ( homo and hetero)</p> <p>Microbial Photosynthesis: Light reaction: Light harvesting pigments Photophosphorylation, CO<sub>2</sub> fixation pathways: Calvin cycle, CODH pathway, Reductive TCA pathway.</p>	
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### **Course 1: Practicals: DSC-2P: Microbial Biochemistry and Physiology**

1. Preparation of Solution: Normal and Molar solutions
2. Calibration of pH meter and determination of pH of natural samples
3. Preparation of Buffer Solutions
4. Qualitative determination and identification of Carbohydrates
5. Qualitative determination and identification of Proteins & Amino Acids
6. Qualitative determination and identification of Fatty Acids
7. Quantitative estimation of Reducing Sugar by DNS method
8. Quantitative estimation of Proteins by Biuret and Lowry's method
9. Determination of lipid saponification values of fats and iodine number of fatty acids
10. Determination of bacterial growth by spectrophotometric method & calculation of generation time
11. Measurement of cell number by Haemocytometer
12. Effect of pH on bacterial growth
13. Effect of Salt concentration on bacterial growth
14. Effect of Temperature on bacterial growth
15. Demonstration of aerobic and anaerobic respiration in microbes

### **Text Books / References**

1. Cohen, Georges N, 2014, Microbial Biochemistry, Springer Netherlands.
2. Felix Franks, 1993; Protein Biotechnology, Humana Press, New Jersey.
3. Stryer L, 1995; Biochemistry, Freeman and Company, New York.
4. Voet & Voet, 1995; Biochemistry, John Wiley and Sons, New York.
5. Nelson and Cox, 2000; Lehninger Principles of Biochemistry, Elsevier Publ.
6. Harper, 1999; Biochemistry, McGraw Hill, New York.
7. Palmer T. (2001), Biochemistry, Biotechnology and Clinical Chemistry, Harwood Publication, Chichester.
8. Boyer R. (2002), Concepts in Biochemistry 2<sup>nd</sup> Edition, Brook/ Cole, Australia.
9. Moat A. G., Foster J.W. Spector. (2004), Microbial Physiology 4<sup>th</sup> Edition Panama Book Distributors.
10. Caldwell, D. R. (1995) – Microbial Physiology and Metabolism. Brown Publishers.
11. Lodish H, T. Baltimore, A. Berck B.L. Zipursky, P. Mastsydaire and J. Darnell. (2004) – Molecular Cell Biology, Scientific American Books, Inc. Newyork.

## Course 2 :Theory: OE- 2T: Environmental and Sanitary Microbiology

<b>Course 2 :Theory: OE- 2T:Environmental and Sanitary Microbiology</b>	<b>42 Hrs</b>
<b>Unit – 1: Soil and Air Microbiology</b>	<b>14 Hrs</b>
Soil and Air as a major component of environment. Types, properties and uses of soil and air. Distribution of microorganisms in soil and air. Major types of beneficial microorganisms in soil. Major types of harmful microorganisms in soil	
<b>Unit – 2: Water Microbiology</b>	<b>14 Hrs</b>
Water as a major component of environment. Types, properties and uses of water. Microorganisms of different water bodies. Standard qualities of drinking water	
<b>Unit – 3: Sanitary Microbiology</b>	<b>14 Hrs</b>
Public health hygiene and communicable diseases. Survey and surveillance of microbial infections. Airborne microbial infections, waterborne microbial infections, Food borne microbial infections. Epidemiology of microbial infections, their detection and control.	

### Text Books / References

1. Diana Marco, 2019, Microbial Ecology: Current advances from Genomics, Metagenomics and other omics, Caister Academic Press.
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7<sup>th</sup> International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7<sup>th</sup> International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1<sup>st</sup> edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12<sup>th</sup> edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10<sup>th</sup> ed. 2008,Pearson Education.
7. General Microbiology, Stanier, Ingraham et al, 4<sup>th</sup> and 5<sup>th</sup> edition 1987, Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudbury, 835 pp.
13. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
14. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9<sup>th</sup> ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

### Pedagogy :

The general pedagogy to be followed for theory and practicals are as under.

Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential

documentation and Innovative methods.

<b>Formative Assessment : 40%</b>	
<b>Assessment Occasion/ type</b>	<b>Weightage in Marks</b>
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Seminars / Group Discussion	10% + 10 = 20% : 20 Marks
<b>Total</b>	40% : 40 Marks

## BSc Microbiology (Basic / Hons.)

### Semester III

#### Title of the Courses:

**Course 1 : DSC-1T: Microbial Diversity**

**Course 2 : OE 1T: Microbial Entrepreneurship**

Program Name	<b>B. Sc Microbiology</b>		Semester	<b>Third Semester</b>
Course Title	<b>Microbial Diversity</b>			
Course code	<b>FSC500</b>			
Course No.	<b>MBL-103</b>	<b>DCS -3T</b>	No. of Theory Credits	<b>4</b>
Contact hours	<b>56hrs</b>		Duration of ESA/Exam	<b>Hours</b>
Formative Assessment Marks			Summative Assessment Marks	

#### Course Pre-requisite (s):

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Knowledge about microbes and their diversity
2. Study, characters, classification and economic importance of Pro-eukaryotic and Eukaryotic microbes.
3. Knowledge about viruses and their diversity

Content	56Hrs
<b>Unit-I</b>	<b>14 Hrs</b>
<p><b>Biodiversity and Microbial Diversity</b>                      Concept, definition, and levels of biodiversity; Biosystematics – Major classification systems- Numerical and Chemotaxonomy. Study and measures of microbial diversity; Conservation and Economic values of microbial diversity.</p>	
<b>Unit -II</b>	<b>14 Hrs</b>
<p><b>Diversity of Prokaryotic Microorganisms</b>                      General characters; Classification; Economic importance; Distribution and factors regulating distribution.  <b>Bacteria and Archaea-</b> An overview of Bergey's Manual of Systematic Bacteriology.  <b>Bacteria-</b> <i>Escherichia coli</i>, <i>Bacillus subtilis</i>, <i>Staphylococcus aureus</i>  <b>Cyanobacteria-</b> <i>Nostoc</i>, <i>Microcystis</i>, <i>Spirulina</i>  <b>Archea-</b> <i>Thermus aquaticus</i>, Methanogens  <b>Actinomycetes:</b> <i>Streptomyces</i>, <i>Nocardia</i>, <i>Frankia</i>  <b>Rickettsiae-</b> <i>Rickettsia rickettsi</i>  <b>Chlamydiae</b> – <i>Chlamydia trachomatis</i>  <b>Spirochaetes-</b> <i>Trepanema pallidum</i></p>	
<b>Unit -III</b>	<b>14 Hrs</b>

<p><b>Diversity of Eukaryotic Microorganisms</b></p> <p><b>Diversity of Eukaryotic Microorganisms:</b> General characters; Classification- Economic importance</p> <p><b>Fungi:</b> Ainsworth classification- detailed study up to the level of classes, Salient features and Reproduction -Type study: <i>Rhizopus, Aspergillus, Agaricus, Fusarium, Saccharomyces</i>.</p>	
<p><b>Algae:</b> Occurrence, distribution, and symbiotic association- Lichen; thallus organization and types. Type study: <i>Chlorella, Cosmarium, Diatoms, Gracilaria</i>,</p> <p><b>Protozoa:</b> Classification up to the level of classes. Type study: <i>Amoeba, Euglena, Trichomonas, Paramoecium, Trypanosoma</i></p>	
<p><b>Unit -IV</b></p>	<p><b>14 Hrs</b></p>
<p><b>Diversity of Virus</b></p> <p>General properties and structure, Isolation and purification and assay of virus. Principles of Viral Taxonomy- Baltimore and ICTV and the recent trends.</p> <p>Capsid symmetry- Icosahedral, helical, complex</p> <p>Structure, Replication and Significance of the following:</p> <p><b>Human &amp; Animal viruses:</b> HIV, Corona, Ortho and paramyxovirus, Oncogenic virus, H1N1</p> <p><b>Plants viruses:</b> TMV, Ring spot virus</p> <p><b>Microbial viruses:</b> T4/T7/lambda/cyano/mycophages.</p> <p>Sub viral particles, Viroids, Virusoids, satellite virus and Prions.</p>	

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Knowledge about microbes and their diversity		✓			✓			✓				
Study, characters, classification and economic importance of Pro-eukaryotic and Eukaryotic microbes		✓	✓		✓							
Knowledge about viruses and their diversity		✓				✓				✓		

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments



<b>Summative Assessment = 60 Marks</b>	
<b>Formative Assessment : 40%</b>	<b>Weightage in Marks</b>
C1 = IA -1 + Assignments / Visits	10% + 10% = 20% : 20 Marks
C2 = IA -2 + Assignments / Group Discussion	10% + 10 = 20% : 20 Marks
<b>Total</b>	40% : 40 Marks
<b>Total</b>	<b>60 marks + 40 marks = 100 marks</b>

Course Title	<b>Microbial Diversity</b>	Practical Credits	<b>2</b>
Course No.	<b>MBL-103</b>	DSC-3P	Contact hours
<b>Content</b>			
<ol style="list-style-type: none"> <li>1. Study of morphology of bacteria</li> <li>2. Isolation of bacteria from soil</li> <li>3. Isolation of bacteria from air and water</li> <li>4. Isolation of fungi from soil</li> <li>5. Isolation of fungi from air</li> <li>6. Cultivation of cyanobacteria</li> <li>7. Cultivation of Actinomycetes</li> <li>8. Measurement of microbial cell size by Micrometry</li> <li>9. Study of cyanobacteria -<i>Nostoc, Microcystis, Spirulina</i></li> <li>10. Study of Algae –<i>Chlorella, Diatoms, Gracilaria</i></li> <li>11. Study of Fungi – <i>Rhizopus, Aspergillus, Saccharomyces, Agaricus</i></li> <li>12. Study of Protozoa – <i>Amoeba, Paramoecium, Euglena</i></li> <li>13. Study of HIV, TMV, Corona virus, T4Phage</li> <li>14. Study of Paramyxovirus, Oncogenic viruses</li> </ol>			

### Practical assessment

<b>Assessment</b>			
<b>Formative assessment</b>		<b>Summative Assessment</b>	<b>Total Marks</b>
<b>Assessment Occasion / type</b>	<b>Weightage in Marks</b>	<b>Practical Exam</b>	
C1- Assessment	10		
C2- Test+Record	10+5		
<b>Total</b>	<b>25</b>	<b>25</b>	

### References

1	Black, J.G. 2002. Microbiology-Principles and Explorations. John Wiley and Sons, Inc. New York
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2	Brock, T.D. and Madigan, M.T. 1988. Biology of Microorganisms, V Edition. Prentice Hall. New Jersey
3	Dimmock, N. J., Easton, A. J., and Leppard, K. N. 2001. Introduction to Modern Virology. 5 <sup>th</sup> edn. Blackwell publishing, USA
4	Flint, S.J., Enquist, L.W., Drug, R.M., Racaniello, V.R. and Skalka, A.M. 2000. Principles of Virology- Molecular Biology, Pathogenesis and Control. ASM Press, Washington,D.C
5	Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill
6	Vashishta B.R, Sinha A.K and Singh V. P. Botany – Fungi 2005, S. Chand and Company Limited, New Delhi
7	Kotpal R.L Protozoa 5 <sup>th</sup> Edition 2008, Rastogi Publications, Meerut, New Delhi.
8	Brock Biology of Microorganisms, M.T. Madigan, J.M. Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings
9	Microbiology – An Introduction, G. J. Tortora, B. R. Funke, C. L. Case, 10th ed. 2008, Pearson Education
10	General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited
11	Microbiology- Concepts and Applications, Pelczar Jr. Chan, Krieg, International ed, McGraw Hill
12	Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869pp
13	Vashishta, B.R Sinha A.K and Singh V. P. Botany - Algae 2005 S. Chand and Company Limited, New Delhi
14	A Textbook of Microbiology, R. C. Dubey, and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd, New Delhi
15	Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill

**Course 2 : Theory: OE 1T: Microbial Entrepreneurship**

Program Name	<b>B. Sc Microbiology</b>		Semester	<b>Third Semester</b>
Course Title	<b>Microbial Entrepreneurship</b>			
Course Code		<b>OE-3</b>	No. of Theory Credits	<b>3</b>
Contact hours	<b>Lecture</b>		Duration of ESA/Exam	<b>Hours</b>
	<b>Practical</b>			
Formative Assessment Marks	<b>40</b>		Summative Assessment Marks	<b>60</b>

<b>Course Pre-requisite(s):</b>	
<b>Course Outcomes (COs):</b> At the end of the course the student should be able to:	
<ol style="list-style-type: none"> <li>1. Demonstrate Entrepreneurial skills</li> <li>2. Acquire knowledge industrial Entrepreneurship</li> <li>3. Acquire knowledge about Healthcare Entrepreneurship</li> </ol>	
<b>CONTENT</b>	
<b>Unit-I</b>	
<b>General Entrepreneurship</b>	
Entrepreneurship and microbial entrepreneurship - Introduction and scope, Business development, product marketing, HRD, Bio-safety and Bioethics, IPR and patenting, Government organization/ institutions/ schemes, Opportunities and challenges.	
<b>UNIT -II</b>	
<b>Industrial Entrepreneurship</b>	
Microbiological industries – Types, processes and products, Dairy products, Fermented foods, Bakery and Confectionery, Alcoholic products and Beverages, Enzymes – Industrial production and applications. Biofertilizers and Biopesticides, SCP (Mushroom and Spirulina) etc.	
<b>Unit -III -</b>	
<b>Healthcare Entrepreneurship</b>	
Production and applications: Sanitizers, Antiseptic solutions, Polyphenols (Flavonoids), Alkaloids, Cosmetics, Biopigments and Bioplastics, vaccines, Diagnostic tools and kits.	
<b>42 HRS</b>	
<b>14 Hrs</b>	
<b>14 Hrs</b>	
<b>14 Hrs</b>	

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

<b>Summative Assessment = 60 Marks</b>	
<b>Formative Assessment Occasion / type</b>	<b>Weightage in Marks</b>
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
<b>Total</b>	<b>60 marks + 40 marks = 100 marks</b>

<b>Summative Assessment = 60 Marks</b>	
<b>Formative Assessment Occasion / type</b>	<b>Weightage in Marks</b>
C-1 Test + Assignment	20
C-2 Test + Assignment	20
<b>Total</b>	<b>60 marks + 40 marks = 100 marks</b>

<b>References</b>	
1	Srilakshmi B, (2007), Dietetics. New Age International publishers. New Delhi
2	Srilakshmi B, (2002), Nutrition Science. New Age International publishers. New Delhi
3	Swaminathan M. (2002), Advanced text book on food and Nutrition. Volume I. Bappco
4	Gopalan.C.,RamaSastry B.V., and S.C.Balasubramanian (2009), Nutritive value of Indian Foods.NIN.ICMR.Hyderabad.
5	Mudambi S R and Rajagopal M V, (2008), Fundamentals of Foods, Nutrition & diet therapy by New Age International Publishers, New Delhi

## BSc Microbiology (Basic / Hons.) Semester IV

### Title of the Courses:

**Course 1: DSC-2T: Microbial Enzymology and Metabolism**  
**2 : OE- 2T: Human Microbiome**

Program Name	<b>B. Sc Microbiology</b>		Semester	<b>Fourth Semester</b>
Course Title	<b>Microbial Enzymology and Metabolism</b>			
Course code	<b>FSD500</b>			
Course No.	<b>MBL:104</b>	<b>DCS -4T</b>	No. of Theory Credits	<b>4</b>
Contact hours	<b>56 hrs</b>		Duration of ESA/Exam	<b>2 ½ Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks		<b>60</b>

### Course Pre-requisite (s):

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Differentiating concepts of chemo heterotrophic metabolism and chemo lithotrophic metabolism.
2. Describing the enzyme kinetics, enzyme activity and regulation.
3. Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms

### Content

**56 Hrs**

### Unit-I

**14 Hrs**

### Basics of Enzymes

**Definitions of terms** – enzyme unit, specific activity and turnover number, *exo/* endoenzymes, constitutive/ induced enzymes, isozymes. Monomeric, Oligomeric and Multimeric enzymes.

Multienzyme complex: pyruvate dehydrogenase; isozyme: lactate dehydrogenase. Ribozymes, abzymes

**Structure of enzyme:** Apoenzyme and cofactors, prosthetic group-TPP, coenzyme, NAD, metalcofactors.

Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis and Induced Fit hypothesis. Multi substrate reactions.

**Enzyme catalysis:** Types & examples, catalytic mechanisms and testing Lysozyme

<b>Unit -II</b>	<b>14 Hrs</b>
<p><b>Enzyme Kinetics and Regulation</b></p> <p>Enzyme Kinetics: Kinetics of one substrate reactions. i. Equilibrium assumptions ii. Steady state assumptions iii. Lineweaver-Burk plot, Kinetics of enzyme inhibition. Competitive, non-competitive and uncompetitive inhibition. Effect of changes in pH and temperature on enzyme catalyzed reaction. Kinetics of two substrate reactions. Kinetics of immobilized enzymes</p> <p>Enzyme regulation: Allosteric enzyme - general properties, Hill equation, Koshland-Nemethy-Filmer model Covalent modification by various mechanisms. Regulation of multi- enzyme complex- Pyruvate dehydrogenase. Feedback inhibition. HIV enzyme inhibitors and drug design.</p> <p><b>Microbial Enzymes: sources-</b> Bacterial, Fungal, Yeast and their applications.</p>	
<b>Unit -III</b>	<b>14 Hrs</b>
<p><b>Metabolism of Carbohydrates</b></p> <p>Chemoheterotrophic Metabolism- Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway, Phosphoketolase pathway. TCA cycle.</p> <p>Utilization of Lactose, Maltose, Galactose, Cellulose and Pectin.</p> <p>Fermentation – Fermentation balance, concept of linear and branched fermentation pathways. Alcohol fermentation and Pasteur effect; Butyric acid and Butanol- Acetone Fermentation, Mixed acid and 2,3-butanediol fermentation, Propionic acid Fermentation (Succinate pathway and Acrylate pathway), acetate Fermentation</p> <p>Chemolithotrophic Metabolism: Chemolithotrophy – Hydrogen oxidation, Sulphur oxidation, Iron oxidation, Nitrogen oxidation.</p> <p>Anaerobic respiration with special reference to assimilatory nitrate reduction and sulphate reduction.</p>	
<b>Unit –IV</b>	<b>14 Hrs</b>
<p><b>Metabolism of amino acids, nucleotides and lipids</b></p> <p><b>1.Nitrogen Metabolism</b></p> <p>Introduction to biological nitrogen fixation Ammonia assimilation. Assimilatory nitrate reduction, dissimilatory nitrate reduction, denitrification</p> <p><b>2. Biosynthesis of ribonucleotides and deoxyribonucleotides</b></p> <p>The de novo pathway. Regulation by feedback mechanisms. Recycling via the salvage pathway</p>	

<p><b>Metabolism of aminoacids, nucleotides and lipids</b></p> <p><b>3.Nitrogen Metabolism</b> Introduction to biological nitrogen fixation Ammonia assimilation. Assimilatory nitrate reduction, dissimilatory nitrate reduction, denitrification</p> <p><b>4. Biosynthesis of ribonucleotides and deoxyribonucleotides</b> The de novo pathway. Regulation by feedback mechanisms. Recycling via the salvage pathway</p> <p><b>5. Amino acid degradation and biosynthesis</b></p> <p><b>6. Lipid degradation and biosynthesis</b></p> <p><b>7.Metabolism of one carbon compounds:</b> Methylotrophs: i. Oxidation of methane, methanol, methylamines; ii. Carbon assimilation in methylotrophic bacteria and yeasts Methanogens: i. Methanogenesis from H<sub>2</sub>, CO<sub>2</sub>, CHOH, HCOOH, methylamines; ii. Energy coupling and biosynthesis in methanogenicbacteria,Acetogens - Autotrophic pathway of acetate synthesis.</p> <p><b>Metabolism of two-carbon compounds: Acetate-</b> Glyoxylate cycle. <b>Acetic acid bacteria:</b> Ethanol oxidation, sugar alcohol oxidation. <b>Glyoxylate and glycolate metabolism</b> – i. Dicarboxylic acid cycle, ii. Glycerate pathway iii. Beta hydroxyaspartate pathway, <b>Oxalate</b> as carbon and energy source</p>	
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**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)												
	1	2	3	4	5	6	7	8	9	10	11	12	
Differentiating concepts of chemoheterotrophic metabolism and chemolithotrophic metabolism		✓						✓				✓	
Describing the enzyme kinetics, enzyme activity and regulation.		✓						✓				✓	
Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms		✓						✓				✓	

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

<b>Summative Assessment = 60 Marks</b>	
<b>Formative Assessment Occasion / type</b>	<b>Weightage in Marks</b>
C-1 Test + Assignment	20
C-2 Test + Assignment	20
<b>Total</b>	<b>60 marks + 40 marks = 100 marks</b>

Course Title	<b>Microbial Enzymology and Metabolism</b>	Practical Credits	<b>2</b>
Course No.	<b>MBL:104</b>	<b>DSC-4P</b>	Contact hours
<b>Content</b>			
<ol style="list-style-type: none"> <li>1. Identification of fatty acids and other lipids by TLC</li> <li>2. Chemotaxis of <i>Pseudomonas</i></li> <li>3. Effect of variables on enzyme activity (amylase): a. Temperature b. pH c. substrate concentration d. Enzyme concentration</li> <li>4. Sugar fermentation tests for bacteria</li> <li>5. Separation of amino acids by paper chromatography</li> <li>6. Screening of fungi for cellulose and pectin degradation</li> <li>7. Screening of fungi for invertase</li> <li>8. Enzyme immobilization by Alginate method</li> <li>9. Gelatin hydrolysis</li> <li>10. Microscopic examination of root nodules</li> <li>11. Demonstration of Ammonification</li> <li>12. Demonstration of Nitrification – Nitrite and Nitrate</li> <li>13. Demonstration of Denitrification</li> <li>14. Demonstration of lipolytic activity</li> <li>15. Demonstration of citric acid production</li> <li>16. Effect of variables on enzyme activity (amylase): A. temperature B. pH C. substrate concentration D. enzyme concentration</li> <li>17. Study of photographs/models: Chemolithotrophy- Hydrogen oxidation, Sulphur oxidation, Iron oxidation, Nitrogen oxidation, biological Nitrogen fixation, ammonia assimilation, ribozymes, abzymes, lock and key hypothesis, enzyme inhibition – competitive, non competitive and un competitive. Enzyme regulation- allosteric enzymes. Feedback inhibition.</li> </ol>			



## Practical assessment

<b>Assessment</b>			
<b>Formative assessment</b>		<b>Summative Assessment</b>	<b>Total Marks</b>
<b>Assessment Occasion / type</b>	<b>Weightage in Marks</b>	<b>Practical Exam</b>	
<b>C1- Assessment</b>	10	<b>25</b>	<b>50</b>
C2- Test+Record	10+5		
<b>Total</b>	<b>25</b>		
Total	25	25	

<b>References</b>	
1	Philipp. G. Mannual of Methods for General Bacteriology.
2	David T. Plummer. An Introduction to Practical Biochemistry
3	Biochemistry- A Problem Approach, Wood W. B. Wilson J.H., Benbow R.M. and Hood L.E.2nd ed., 1981, The Benjamin/ Cummings Pub.co
4	Biochemical calculations, Segel I.R., 2nd ed., 2004, John Wiley and Sons
5	Biochemical Calculations, Irwin H. Segel, 2nd Edition John Wiley & Sons

**Course 2 : Theory: OE 1T: Human Microbiome**

Program Name	<b>B. Sc Microbiology</b>		Semester	<b>Fourth Semester</b>
Course Title	<b>Human Microbiome</b>			
Course Code		<b>OE-4T</b>	No. of Theory Credits	<b>3</b>
Contact hours	<b>Lecture</b>		Duration of ESA/Exam	<b>Hours</b>
	<b>Practical</b>			
Formative Assessment Marks	<b>40</b>		Summative Assessment Marks	<b>60</b>

**Course Pre-requisite(s):**

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Articulate a deeper understanding on biological complexities of human microbiome.
2. Understand broader goals of biological anthropology.
3. Compare and contrast the microbiome of different human body sites and impact human health promotion

**Content****42 Hrs****Unit-I****14 Hrs****INTRODUCTION TO MICROBIOME**

Evolution of microbial life on Earth, Symbiosis host-bacteria. Microbial association with plants and animals, Symbiotic and parasitic, Normal human microbiota and their role in health. Microbiomes other than digestive system.

**Unit -II****14 Hrs****MICROBIOMES AND HUMAN HEALTH**

Microbiome in early life, Nutritional modulation of the gut microbiome for metabolic health- role of gut microbiomes in human obesity, human type 2 diabetes and longevity.

Probiotics- Criteria for probiotics, Development of Probiotics for animal and human use; Pre and synbiotics. Functional foods-health claims and benefits, Development of functional foods.

<b>Unit -III</b>	<b>14 Hrs</b>
<b>CULTURING OF MICROBES FROM MICROBIOMES</b>	
Culturing organisms of interest from the microbiome: bacterial, archaeal, fungal, and yeast, viral. Extracting whole genomes from the microbiome to study microbiome diversity	
<b>Microbiomes and diseases:</b> Microbiome and disease risks: The gut microbiome and host immunity, bacteriocins and other antibacterials. Human microbiome research in nutrition	

### Pedagogy

<b>Summative assessment = 40 marks theory paper, End semester Exam duration of exam 2 hours</b>	
<b>Formative Assessment Occasion / type</b>	<b>Weightage in Marks</b>
Assignment	10
Seminar	10
Case studies	10
Test	10
<b>Total</b>	<b>40 marks</b>

<b>References</b>	
1	Angela E Douglas, (2018), Fundamentals of Microbiome Science: How Microbes Shape Animal Biology. Princeton University Press. 248pp.
2	Giulia Enders and Jill Enders, (2018), Gut: The Inside Story of Our Body's Most Underrated Organ (Revised Edition). Greystone Books, 304pp.
3	Emeran Mayer, (2018), The Mind-Gut Connection: How the Hidden Conversation within our bodies impacts our mood, our choices, and our overall Health. Harper Wave, 336pp.
4	Edward Ishiguro, Natasha Haskey and Kristina Campbell, (2018), Gut Microbiota. 1 <sup>st</sup> edition. 2008pp.
5	Natalia V Beloborodova, (2021), Human Microbiome. IntechOpen, 166pp.

**GENERAL PATTERN OF THEORY EXAMINATION**

**B.Sc MICROBIOLOGY( I –IV Semester)**

**Duration:2 Hours**

**Maximum: 60 Marks**

*Note: All questions are compulsory*

*Draw neat labeled diagrams wherever necessary*

**QNo. I Answer any EIGHT of the following:**

**2X8=16**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

**QNo. II Answer any SIX of the following:**

**4X6=24**

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

**QNo. III Answer any TWO of the following :**

**10X2=20**

- 19.
- 20.
- 21.
- 22.

## **PATTERN OF PRACTICAL EXAMINATION**

### **Practical examination – B. Sc MICROBIOLOGY**

**Duration: 3 hours**

**Max. Marks: 25**

Q. 1	Major question	08 Marks
Q. 2	Minor question	05 Marks
Q. 3	Identify and comment	2X4 = 08Marks
Q. 4	Viva-voce	04 Marks

### **PATTERN OF FORMATIVE ASSESMENT - PRACTICALS**

**Max. Marks: 25**

1	IA 1(Assesment)	10 Marks
2	IA 2(Test +Record)	15 Marks

## SCHEME OF THEORY EXAMINATION

I B.Sc., I SEMESTER

DSC-I: GENERAL MICROBIOLOGY

Times: 2hrs

Max Marks: 60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
<b>Unit – 1: Historical development, major contributions, origin of microorganisms and microscopy</b>	2	2	1	22
<b>Unit – 2: Staining, sterilization and preservation of microorganisms</b>	2	2	1	22
<b>Unit – 3: Types, structure, organisation and reproduction of prokaryotic microorganism</b>	3	2	1	24
<b>Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms</b>	3	2	1	24

**I Main: 2x10=20Marks**

**II Main: 4x8= 32Marks**

**III Main: 4x10=40Marks**

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## SCHEME OF PRACTICAL EXAMINATION

I B.Sc., I SEMESTER

PRACTICAL-I: GENERAL MICROBIOLOGY

Time: 3hours

Max marks: 25

- I.** Perform/ Stain the given material **A** by.....method. Write the principle, procedure and leave the preparation for evaluation  
(Simple staining/Negative staining/Gram-staining/Cell wall/ Endospore/Pure culture techniques/Serial dilution)  
(Preparation-4 marks; Principle-2 ,Procedure-1& result-1 marks) 08
- II.** Prepare a temporary slide **B** by ..... method. Write the principle, procedure and leave the preparation for evaluation  
(Wet mounting of Fungi/Hanging drop/Microbes from natural sources)  
(Preparation-2 marks; Principle-1 ,Procedure- 1& result-1 marks) 05
- III.** Identify the materials **C, D, E** and **F** with labelled diagrams and reasons 2X4=08  
(Microscopes/ Basic equipments / Basic Microbiological tools as per syllabus)  
(Identification -1mark; diagram and reasons-1mark)
- IV.** Viva-voce 05

**SCHEME OF THEORY EXAMINATION**  
**I B.Sc., II SEMESTER**  
**DSC-I: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY**

Times:3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
<b>Unit – 1 : Biochemical concepts</b>	2	2	1	22
<b>Unit – 2: Macromolecules-Types,Structurand properties</b>	2	2	1	22
<b>Unit – 3: Microbial physiology</b>	3	2	1	24
<b>Unit – 4: Microbial physiology- Bioenergetics, Microbialrespiration Microbial photosynthesis</b>	3	2	1	24

**I Main: 2x10=20Marks**

**II Main: 4x8= 32Marks**

**III Main: 4x10=40Marks**

**SCHEME OF PRACTICAL EXAMINATION**  
**I B.Sc., I SEMESTER**  
**PRACTICAL-I: GENERAL MICROBIOLOGY**

Time: 3hours

Max marks: 25

- I. Demonstrate the experiment **A**, giving principle and procedure. Record the results.  
 (Effect of temperature on growth of microorganisms/Effect of pH on the growth of microorganisms /Effect of salt concentration on growth of microorganism)  
 (Demonstration-4marks; principle -2mark; procedure -1marks; result-1mark) 08
  
- II. Perform/conduct the experiment **B**, giving principle and procedure. Record the results. 05  
 (Demonstration-2marks; principle -1mark; procedure -1marks; result-1mark)
  
- III. Identify the materials **C, D, E** and **F** with labelled diagrams and reasons 2X4=08  
 (Normal /Molar solutions,pH meter,Spectrophotometer/Demonstration of aerobic and anaerobic Respiration, Effect of temperature on growth of microorganisms/Effect of pH on the growth of microorganisms /Effect of salt concentration on growth of microorganism)  
 (Identification -1mark; diagram and reasons-1mark)
  
- IV. Viva-voce 05

**SCHEME OF THEORY EXAMINATION**  
**I B.Sc., II SEMESTER**  
**OE-I: MICROBIAL TECHNOLOGY FOR HUMAN WELFARE**

Times:3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
<b>Unit – 1 : Food and Fermentation Microbial technology</b>	3	2	2	34
<b>Unit – 2: Agricultural Microbial technology</b>	3	3	1	28
<b>Unit – 3: Pharmaceutical Microbial Technology</b>	4	3	1	30

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

**SCHEME OF THEORY EXAMINATION**  
**I B.Sc., II SEMESTER**  
**OE-II: ENVIRONMENTAL AND SANITARY MICROBIOLOGY**

Times: 3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
<b>Unit – 1 : Soil and Air Microbiology</b>	3	2	2	34
<b>Unit – 2: Water Microbiology</b>	3	3	1	28
<b>Unit – 3: Sanitary Microbiology</b>	4	3	1	30

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks



## SCHEME OF THEORY EXAMINATION

II B.Sc., III SEMESTER  
DSC-III: Microbial diversity

Times:2hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
<b>Unit – 1: Biodiversity and microbial diversity</b>	2	2	1	22
<b>Unit – 2: Diversity of prokaryotic microorganism</b>	2	2	1	22
<b>Unit – 3: Diversity of Eukaryotic microorganism</b>	3	2	1	24
<b>Unit – 4: Diversity of virus</b>	3	2	1	24

**I Main: 2x10=20Marks**

**II Main: 4x8= 32Marks**

**III Main: 4x10=40Marks**

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## SCHEME OF PRACTICAL EXAMINATION III SEM (NEP) PRACTICAL III: Microbial Diversity (DSC IIIP)

Max. Marks: 25

Time: 3 hrs

1. Demonstrate the experiment A by giving principle and procedure. Record the result 08marks.  
(Isolation of bacteria from air by exposure plate method/Isolation of bacteria from soil or water by serial dilution method/Isolation of fungi from air by exposure plate method/Isolation of fungi from soil or water by serial dilution method/Micrometry) Demonstration – 2M, Principle – 2M, Procedure – 2M, Result – 2M
2. Prepare a temporary mount of the given material B and identify the organism with labeled diagram and significance. (Leave the preparation for evaluation) 05 marks  
(Staining of fungi/ algae/ cyanobacteria)  
Preparation – 1 M, Identification – 1M, Diagram & significance – 3M
3. Write critical notes on C, D, E and F 2x4 = 08 marks  
(Permanent slides or photographs of *Amoeba*, *Paramecium*, *Euglena*, TMV, Corona, T4 phage, Paramyxovirus, Oncogenic virus, Actinomycetes, *Aspergillus*, *Rhizopus*, *Sachharomyces*, *Agaricus*, *Chlorella*, *Diatoms*, *Gracilaria*, *Nostoc*, *Microcystis*, *Spirulina*)
4. Viva-voce 04 marks

## SCHEME OF THEORY EXAMINATION

II B.Sc., IV SEMESTER

DSC-IV: Microbial Enzymology and Metabolism

Times: 2hrs

Max Marks: 60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
Unit – 1: Basics of enzymes	2	2	1	22
Unit – 2: Enzyme kinetics and regulation	2	2	1	22
Unit – 3: Metabolism of carbohydrates	3	2	1	24
Unit – 4: Metabolism of amino acids, nucleotides and lipids	3	2	1	24

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

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### SCHEME FOR PRACTICAL EXAMINATION IV SEM (NEP)

#### PRACTICAL IV: Microbial Enzymology and Metabolism (DSC 4P)

Time: 3 hrs.

Max. Marks: 25

1. Demonstrate the experiment A giving principle and procedure. Record the result. 08 marks  
(Separation of amino acids by paper chromatography / Screening of fungi for invertase / Enzyme immobilization by Alginate method / Screening of fungi for cellulose and pectin degradation / Microscopic examination of root nodules / Identification of fatty acids and other lipids by TLC)  
(Demonstration – 2M, Principle – 2M, Procedure – 2M, Result – 2M)
2. Conduct the given biochemical test B giving principle and procedure. Write the significance. 05 marks  
(Gelatin hydrolysis / Sugar fermentation tests/ Demonstration of Ammonification / Nitrification / Denitrification / Lipolytic activity / Demonstration of citric acid production)  
(Demonstration – 2M, Principle and Procedure – 2M, Significance – 1M)
3. Write critical notes on C, D, E and F 2x4 = 08 marks  
(Study of photographs/models: Chemolithotrophy-hydrogen oxidation, sulphur oxidation, iron oxidation, nitrogen oxidation, biological nitrogen fixation, ammonia assimilation, ribozymes, abzymes, lock and key hypothesis, enzyme inhibition- competitive, non- competitive and un competitive. Enzyme regulation-allosteric enzymes. Feedback inhibition, Chemotaxis of *Pseudomonas*)
4. Viva-voce 05 marks

**SCHEME OF THEORY EXAMINATION**  
**II B.Sc., III SEMESTER**  
**OE-III: MICROBIAL ENTREPRENEURSHIP**

Times:3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
<b>Unit – 1 : General entrepreneurship</b>	3	2	2	34
<b>Unit – 2: Industrial entrepreneurship</b>	3	3	1	28
<b>Unit – 3: Healthcare entrepreneurship</b>	4	3	1	30

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

**SCHEME OF THEORY EXAMINATION**  
**II B.Sc., IV SEMESTER**  
**OE-IV: Human Microbiome**

Times: 3hrs

Max Marks:60

Question Paper to be set for total of 92 marks including choices

UNITS	2 mark questions	4mark questions	10 mark questions	Total Marks
<b>Unit – 1 : Introduction to microbiome</b>	3	2	2	34
<b>Unit – 2: Microbiomes and human health</b>	3	3	1	28
<b>Unit – 3: culturing of microbes from microbiomes</b>	4	3	1	30

I Main: 2x10=20Marks

II Main: 4x8= 32Marks

III Main: 4x10=40Marks

**Annexure-2**  
**Approved list of Paper setters and Valuers**

SI No.	Name	College address
1	Dr..M .Seema	Chairperson, Dept. of Microbiology JSS College, Ooty road, Mysore
2	H.P.Spoorthy	Assistant prof. Dept. of Microbiology JSS College, Ooty road, Mysore
3	Dr.S.Mahadevamurthy	Associate Prof & HOD Dept. of Microbiology Yuvaraja's college Mysore.
4	Dr.Syeda Kauser Fathima	Associate Prof. of Microbiology Maharani's Science College for women JLB road Mysore.
5	Dr. H.S. Jayanth.	Asso.Prof.of Microbiology Dept. of Microbiology Yuvaraja's college Mysore.
6	Dr.Uma Maheshwari	Assistant prof. JSS University, JSSAHER, Mysuru
7	Sri. M. Girish	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
8	Dr. P.K.Maheshwar	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore.
9	Smt. M.S.Shobha	Assistant Prof, Dept. of Microbiology Maharani's Science College Mysore
10	Sri. R.A. Manjunath	Assistant Prof. Dept. of Microbiology Saradavilas College,Mysore
11	Dr.M.P. Ragavendra	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
12	Dr.K.Girish	Assistant Prof. Dept. of Microbiology Maharani's Science College, Mysore
13	Sri. G.S. Siddegowda	Assistant Prof. Dept. of Microbiology Maharani's Science College

		Mysore
14	Dr.N.S.Devaki	Assistant Prof. Dept. of Molecular Biology Yuvaraja's College , Mysore
15	Syeda Farahna Parveen	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
16	Smt. Vanitha	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
17	Smt. Revanamba	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
18	Mahadevaprasad	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
19	Dr.Nagalambika	Assistant prof. JSS University, JSSAHER, Mysuru
20	RajaRajeshwari.R	Assistant prof. Dept. of Microbiology SDM College JLB Road,Mysuru
21	Uzma Bathool	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
22	Shruthi Prakash	Assistant Prof. Dept. of Microbiology Mahajana's Science College,Mysuru
23	Athiya sultan	Assistant prof. Dept. of Microbiology SDM College JLB Road,Mysuru
24	C.Poornima Devi	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
25	Dr.Rakshith	Assistant Prof. Dept. of Microbiology Yuvaraja's college,Mysore
26	Vasundara Devi R	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
27	Niveditha Prakash	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
28	Dr.K.Sumana	Assistant prof. JSS University, JSSAHER ,Mysuru

29	Samjna.S.R	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
(An autonomous College of University of Mysuru)  
Re-accredited by NAAC with 'A' grade  
Ooty road, Mysuru-570 025, Karnataka



ESTD-1964

**CHOICE BASED CREDIT SYSTEM  
CONTINUOUS ASSESSMENT GRADING PATTERN  
(CBCS-CGPA)**

**B. Sc., DEGREE SYLLABUS (CBCS)**

**MICROBIOLOGY**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25**  
**DEPARTMENT OF MICROBIOLOGY**  
**PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (CBCS)**  
**DURATION OF THE COURSE: 3YEARS (6SEMESTER)**  
**PROGRAMME:BScBMBt, PROGRAMME CODE:BSc06 (2020-21)**

Year	Semester	Course code & Core course	Title of the paper	Lecture + Practicals hours per week	No. of credits			Total credits	Total hours		Percentage			Maximum Marks in exam/Assessment			Exam Duration	
					L	T	P		Th	Pr	Th	Pr	IA	Th	Pr	IA	Th	Pr
III B.Sc.	V	<b>DME28006 / DME28206</b>	No. of courses:1 DSE- A: Environmental Microbiology DSE-B: Agricultural Microbiology	04	4	-	1	5	60	45	50	20	30	70	70	30	3h	3h
		DSE-V: Theory DSE- V:Pract-V	Based on theory	02														
	VI	<b>DMF28406/ DMF28606 SEC</b>	No. of courses:1 SEC-A : Microbial diagnosis in health clinics SEC-B: Microbial analysis of Air and water	02	2	-	-	02	30	-	70	-	30	50	-	30	2h	--
		<b>DMF28006/ DMF28206</b>	No. of courses:1 DSE-A:Industrial and Food Microbiology DSE -B : Medical Microbiology and immunology	04	4	-	1	5	60	45	50	20	30	70	70	30	3h	3h
		DSE-VI: Theory DSE-VI: Pract-VI	Based on theory	02														
					Total credits			<b>36</b>										



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25**  
**DEPARTMENT OF MICROBIOLOGY**  
**PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN MICROBIOLOGY (CBCS)**  
**DURATION OF THE COURSE: 3YEARS (6SEMESTER)**  
**PROGRAMME:BScBBM, PROGRAMME CODE:BS07 (2020-21)**

Year	Semester	Course code & Core course	Title of the paper	Lecture + Practicals hours per week	No. of credits			Total credits	Total hours		Percentage			Maximum Marks in exam/Assessment			Exam Duration		
					L	T	P		Th	Pr	Th	Pr	IA	Th	Pr	IA	Th	Pr	
III B.Sc.	V	<b>DME28006 / DME28206</b>	No. of courses:1 DSE- A: Environmental Microbiology DSE-B: Agricultural Microbiology	04	4	-	1	5	60	45	50	20	30	70	70	30	3h	3h	
		DSE-V: Theory																	
		DSE- V:Pract-V	Based on theory	02															
	VI	<b>DMF28406/ DMF28606</b> SEC	No. of courses:1 SEC-A : Microbial diagnosis in health clinics SEC-B: Microbial analysis of Air and water	02	2	-	-	02	30	-	70	-	30	50	-	30	2h	--	
		<b>DMF28006/ DMF28206</b>	No. of courses:1 DSE-A:Industrial and Food Microbiology DSE -B : Medical Microbiology and immunology	04	4	-	1	5	60	45	50	20	30	70	70	30	3h	3h	
DSE-VI: Theory																			
	DSE-VI: Pract-VI	Based on theory	02																
				Total credits				<b>36</b>											

**DEPARTMENT OF MICROBIOLOGY**

**PROGRAMME: BSc BMBT**

**PROGRAMME CODE: BSC06**

**PROGRAMME OUTCOMES: B.Sc., BMBT**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1. Demonstrate the ability to justify and explain their thinking and/or approach, both written and oral. Demonstrate the ability to present clear, logical and succinct arguments, including prose and mathematical language. Write and speak using professional norms, and demonstrate an ability to collaborate effectively.
- PO2. Develop state-of-the-art laboratory skills and professional communication skills.
- PO3. Apply the scientific method to design, execute, and analyze an experiment and also to explain their scientific procedures as well as their experimental observations.
- PO4. Demonstrate an understanding of fundamental biochemical principles, structure and biological function of biomolecules, metabolic pathways and their regulation.
- PO5. Work as a laboratory technician, biochemists or medical scientist.
- PO6. Possess knowledge of ethical practices in science.
- PO7. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment and host populations.
- PO8. Explain the theoretical basis of the tools, technologies and methods common to microbiology.
- PO9. Apply the scientific method as a demonstration that they understand its application furthering our knowledge of the microbial world.
- PO10. Design and develop solution to Biotechnology problems by applying appropriate tools while keeping in mind safety factor for environmental & society.
- PO11. Create, select, and apply appropriate techniques, resources, and modern tools including prediction and modelling to different activities with an understanding of the limitations.
- PO12. Support biotechnology research activity with strong technical background knowledge.

**PROGRAMME: BSc BBM**

**PROGRAMME CODE: BSC07**

**PROGRAMME OUTCOMES: B.Sc., BBM**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1. Identify the taxonomic position of plants using principles and methods of nomenclature and classification in Botany.
- PO2. Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO3. Use interdisciplinary approaches with quantitative skills to work on biological problems.
- PO4. Demonstrate the ability to justify and explain their thinking and/or approach, both written and oral. Demonstrate the ability to present clear, logical and succinct arguments, including prose and mathematical language. Write and speak using professional norms, and demonstrate an ability to collaborate effectively.
- PO5. Develop state-of-the-art laboratory skills and professional communication skills.
- PO6. Apply the scientific method to design, execute, and analyze an experiment and also to explain their scientific procedures as well as their experimental observations.
- PO7. Demonstrate an understanding of fundamental biochemical principles, structure and biological function of biomolecules, metabolic pathways and their regulation.
- PO8. Work as a laboratory technician, biochemists or medical scientist.
- PO9. Possess knowledge of ethical practices in science.
- PO10. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations.
- PO11. Explain the theoretical basis of the tools, technologies and methods common to microbiology.
- PO12. Apply the scientific method as a demonstration that they understand its application furthering our knowledge of the microbial world.

**DEPARTMENT OF MICROBIOLOGY**  
**PROGRAMME: BSc BMBt**  
**PROGRAMME CODE: BSC06**  
**PROGRAMME SPECIFIC OUTCOME: B.Sc., BMBt**

After completing the graduation in the Bachelor of Science the students are able to;

**PSO 1:** Gain and understanding of biochemical and molecular processes that occur in and between cells to expand understanding of biology

**PSO2:** Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals.

**PSO3:** Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues.

**PSO4:** Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.

**PSO5:** Demonstrate effectively the applications of biochemical and biological sciences

**PSO6:** Decide and apply appropriate tools and techniques in biotechnological manipulation.

**POS7:** Justify societal, health, safety and legal issues and understand his or her responsibilities in biotechnological practices.

**PROGRAMME: BSc BBM**

**PROGRAMME CODE: BSC07**

**PROGRAMME SPECIFIC OUTCOME: B.Sc., BBM**

After completing the graduation in the Bachelor of Science the students are able to;

**PSO 1:** Demonstrate effectively the applications of biochemical and biological sciences.

**PSO2:** Inculcating proficiency in all experimental techniques and methods of analysis.

**PSO3:** Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.

**PSO4:** Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues.

**PSO5:** Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals.

**PSO6:** Gain and understanding of biochemical and molecular processes that occur in and between cells to expand understanding of biology

**DEPARTMENT OF MICROBIOLOGY**

**DSE- A**

**V SEMESTER**

**TITLE: ENVIRONMENTAL MICROBIOLOGY  
(THEORY)**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 4**

**COURSE CODE-DME28006 / DME28007**

**Course outcome**

Enable the students to have sound knowledge about:

- CO1.** The role of microorganisms in soil, air, water, waste water and bioremediation.
- CO2.** Know about the diversity of microorganism and microbial communities inhabiting a wide range of ecological habitats.
- CO3.** Learn the occurrence, abundance and distribution of microorganisms in the environment and their role in the environment
- CO4.** Understand various biogeochemical cycles – Carbon, Nitrogen, Phosphorus cycles etc. and microbes involved in these cycles.
- CO5.** Understand various plant microbes interactions especially rhizosphere, phyllosphere and mycorrhizae and their applications especially the biofertilizers and their mass production.
- CO6.** Understand the basic principles of bioremediation.
- CO7.** The various methods to determine the Sanitary quality of water and sewage Treatment methods employed in waste water treatment

**UNIT 1**

**No. of Hours: 15**

**SOIL MICROBIOLOGY**

- A.** Introduction: Definition, Soil types, Soil profile and Physical characteristics of soil- Mineral particles, Organic residues, Water and Gases. Soil fertility. Role of microorganisms in soil formation (in brief).
- B.** Microbial flora of Soil: A brief account of Bacteria, Fungi, Algae, Actinomycetes, Protozoa and Viruses.
- C.** Biogeochemical cycles: Carbon cycle: Microbes involved in carbon cycle  
Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction  
Phosphorus cycle: Phosphate immobilization and solubilisation.  
Sulphur cycle: Microbes involved in sulphur cycle
- D.** Associated soil microorganisms with plants- the Rhizosphere and Rhizoplane microflora, Actinorrhizae, and Mycorrhizae (AM), Tripartite and Tetra partite association.
- E.** Interaction among soil microorganisms – Neutralism, Mutualism, Commensalism, Antagonism and Parasitism. (In brief).  
Microbe-Plant interaction: Symbiotic and non symbiotic interactions  
Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria

## UNIT: II

No. of Hours: 15

### AEROBIOLOGY

- A. Introduction: Definition, history and development, aim and scope of aerobiology.
- B. Microbes and atmosphere: Atmospheric layers, sources of microorganisms, Air spora of indoor and outdoor environment. Factors affecting air spora. Significance of air borne microbes. Management of air-borne microbes. Human air borne diseases (Tuberculosis, Rhinitis and Aspergillosis).
- C. Techniques of trapping air-borne microorganisms: Impactors- The slit sampler, Hirst spore trap, Andersen sampler, Rotorod sampler, Vertical cylinder spore trap, Burkard spore traps. Impingers and Filtration. Advantages and disadvantages of the techniques.

## UNIT-III

No. of Hours: 15

### AQUATIC MICROBIOLOGY

- A. Introduction: Natural waters- atmospheric water, surface water and ground water. Distribution of microorganisms in aquatic environment-Neuston, plankton (Phytoplankton, Zooplankton). Aquatic microorganisms-lakes, ponds, streams, rivers estuaries, and marine plankton. Lotic and benthic population.
- B. Water pollution: Sources, water borne diseases- Viral (jaundice), Bacterial (cholera) and Protozoan (amoebic dysentery). Biological indicator of water pollution.
- C. Determination of sanitary quality of water: SPC, Tests for coliforms, MPN, IMViC reactions and membrane filter.
- D. Water purification in Municipal water supply, Parameters of potable water (According to WHO).

### SEWAGE MICROBIOLOGY

- A. Introduction: Sources of waste water- Domestic, Agricultural and Industrial. Physical, chemical and microbiological characteristics of waste water
- B. Waste water treatment: Single dwelling unit-Septic tank. Municipal waste treatment – Primary (screening, coagulation and sedimentation), Secondary (trickling filter, activated sludge process, oxidation pond), Tertiary (reverse osmosis, ion exchange method and electro-dialysis in brief).
- C. Solid waste recycling- Anaerobic digestion process, Biogas and Composting.

### MICROBIAL BIOREMEDIATION

*In situ* –Intrinsic, engineered and *Ex situ* bioremediation- Solid phase system (composting, composting process), Slurry phase system (aerated lagoons, low shear air lift reactor). Bioremediation of hydrocarbons- use of genetically engineered bacterial strains. Bioremediation of xenobiotics, Microbial leaching.

**UNIT: IV**

**No. of Hours: 15**

**AGRICULTURAL MICROBIOLOGY**

- A.** Introduction – Classification of plant diseases on the basis of spread and severity of infection
- B.** Microbes and Plant diseases - Entry of pathogens into host-prepenetration, penetration, post penetration.
- C.** Microbes in Agriculture: Biofertilizers: Definition and Types. Mass production of Bacterial inoculants (*Rhizobium*, *Azospirillum* & *Cyanobacteria*). Biopesticides: Definition, Types – Bacterial, Viral, Fungal and Protozoan, Mode of action, Microbial herbicides.
- D.** Plant diseases: Study of Symptoms, Etiology, Epidemiology, Management of the following diseases – Bean Mosaic, Sandal spike, Citrus canker, Downy mildew of Bajra, Powdery mildew of mulberry, Rust of sorghum, Blast of paddy, Red rot of sugarcane, Tikka disease of groundnut.

**DSE(A)**  
**V SEMESTER**  
**TITLE: ENVIRONMENTAL MICROBIOLOGY**  
**PRATICALS**

**TOTAL HOURS: 45hrs (3hrs/week)**

**CREDITS: 1**

1. a. Isolation and identification of fungi from soil by serial dilution method.  
b. Isolation and enumeration of bacteria from soil by serial dilution method.
2. Study of AM fungi
3. Isolation of Nitrogen fixing bacteria- *Rhizobium*
4. Study of antagonism between microorganisms
- 5a. Gram's staining of citrus canker specimen  
b. Observation of specimens - Bean mosaic, Sandal spike, Citrus canker, Downy mildew of Bajra, Powdery mildew of mulberry, Rust of sorghum, Blast of paddy, Red rot of Sugarcane, Tikka disease of groundnut.
6. Isolation of airborne microorganisms (Bacteria and Fungi) by Petriplate exposure method.
7. Demonstration of air samplers: equipments / photographs of vertical cylindrical spore trap, Rotorod sampler, Hirst's spore trap, Andersen's sampler, Liquid impingement method (bead bubbler device) and Membrane filter.
8. Microscopic observation of different water samples for biological indicators of water pollution.
9. a. Standard analysis of water sample  
b. Determination of MPN.
10. IMViC reactions.
11. Water quality test by Hydrogen sulphide strip test.
12. Display of photographs of water purification process (Baffles, Flocculator, Clarifier, Sand filter, Back wash, Chlorinometer and Chloroscope).
13. Determination of biological oxygen demand (BOD) of water.
14. a. Estimation of total solids in sewage.  
b. Display of photographs - Septic tank, Trickling filter, Activated sludge process, Oxidation ponds, Sedimentation tank, and anaerobic digester.
15. a. Demonstration of composting  
b. Display of photographs: composting, composting process, aerated lagoons, low shear air lift reactor and microbial leaching.

**NOTE:** Visit to water treatment plant/ sewage treatment plant/ industrial effluent treatment plant/Agricultural research institute. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.



**DME28006/DME28007**

**V SEMESTER**

**DSE-B: AGRICULTURAL MICROBIOLOGY**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 4**

**COURSE OUTCOME:**

After successful completion of the course students are able to:

**CO1.** Know microorganisms in agriculture, plant pathology and control of plant diseases and their significance

**CO2.** Understand the land mark in the field of Agricultural microbiology

**CO3.** Gain knowledge about biofertilizers and biopesticide in agriculture

**CO4.** Know the stages in disease development, epidemiology and host pathogen interaction

**CO5.** Know about principles and practices involved in the management of plant diseases

**UNIT I**

**No. of Hours: 15**

**INTRODUCTION AND HISTORY OF PLANT PATHOLOGY**

**A.** Concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases, types of plant pathogens, Koch's postulates, economic losses and social impact of plant diseases.

**B.** Significant landmarks in the field of plant pathology- Contributions of Anton DeBary, Millardet, T J Burrill, E. Smith, Adolph Mayer, Dmitri Ivanowski, Diener, Stakman, H.H. Flor, Van Der Plank. Contributions of eminent Indian plant pathologists- E J Butler, B B Mundkar, K V Subbarao and M J Thirumalachar.

**MICROORGANISMS IN AGRICULTURE**

**A.** Biofertilizers: Definition, Types- Nitrogen fixing, Phosphate solubilizing and cellulolytic microbes. Mass production of Bacterial inoculants (*Rhizobium*, *Azospirillum*, *Azotobacter*, *Cyanobacteria*). Mode of application, Advantages and limitations.

**B.** Biopesticides: Definition, Types – Bacterial, Viral, Fungal and Protozoan, Mode of action, Microbial herbicides.

**UNIT:II**

**No. of Hours: 15**

**PHYTOPATHOLOGY**

**A. Stages in development of a disease :** Introduction – Classification of plant diseases on the basis of spread and severity of infection.

Microbes and Plant diseases: Entry of pathogens into host- prepenetration (Infection) penetration, post penetration (invasion, colonization, dissemination of pathogens and perennation).

**B. Plant disease epidemiology:** Concepts of monocyclic, polycyclic and polyetic diseases, disease triangle & disease pyramid, forecasting of plant diseases.

**C. Host Pathogen Interaction**

**a.** Microbial Pathogenicity

Virulence factors of pathogen: Role of Enzymes-pectic enzymes, Toxins: Host specific

(Tabtoxin) and host non-specific (Victorin and T toxin) and growth regulating substance in disease development- Auxins and Gibberellins.

**b. Defense Mechanisms in Plants**

Defence mechanism in plants: Preexisting (fungitoxic exudates and phenolic compounds) Structural (formation of cork layers, abscission layer and tyloses) and Biochemical defense mechanism (simple phenolic compounds), Hypersensitivity (in brief).

**UNIT: III**

**No. of Hours: 15**

**CONTROL OF PLANT DISEASES**

- A.** Principles & practices involved in the management of plant diseases by different methods, viz. regulatory - quarantine, crop certification, avoidance of pathogen, use of pathogen free propagative material : a. Cultural-Host eradication, crop rotation, sanitization, polythene traps and mulches(in brief).
- B.** Chemical- Inorganic chemicals: Copper compounds-Bordeaux mixture and Bordeaux paste, Organic chemicals- Organic sulfur compounds (Dithiocarbamates), Systemic fungicide, Heterocyclic compounds (Benomyl), antibiotics (Agrimycin).
- C.** Physical method-Soil sterilization by heat, soil solarization, hot water treatment of propagative organs and hot air treatment of storage organs (in brief)
- D.** Biological methods- suppressive soils, antagonism, antagonistic plants and trap plants (in brief).
- E.** IDM-Perennial Crop and annual crop (in brief).

**UNIT:IV**

**No. of Hours: 15**

**SPECIFIC PLANT DISEASES**

**Study of some important plant diseases giving emphasis on its etiological agent, symptoms, epidemiology and control**

- A.** Important diseases caused by fungi
  - Late blight of potato - *Phytophthora infestans*
  - Powdery mildew of wheat - *Erysiphe graminis*
  - Ergot of rye - *Claviceps purpurea*
  - Loose smut of wheat - *Ustilago nuda*
  - Wilt of tomato - *Fusarium oxysporum* f.sp. *lycopersici*
  - Red rot of sugarcane - *Colletotrichum falcatum*
  - Blast of rice-*Magnaporthe grisea*
- B.** Important diseases caused by phytopathogenic bacteria: Bacterial leaf blight of rice, Bacterial cankers of citrus
- C.** Important diseases caused by phytoplasmas: Sandal spike
- D.** Important diseases caused by viruses: Papaya ring spot, Bunchy top of banana, Bean mosaic.
- E.** Important diseases caused by viroids: Potato spindle tuber.

**Total marks100: 70(Theory) +30(C1+C2)**

**DME28106/DME28107**

**V SEMESTER**

**DSE-B: AGRICULTURAL MICROBIOLOGY  
PRACTICAL**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 02**

1. Demonstration of Koch's postulates in fungal disease.
- 2-5. Study of important diseases of crop plants by cutting sections of infected plant material -  
Late blight of potato, Powdery mildew of wheat, Ergot of rye, Loose smut of wheat, Wilt of tomato, Red rot of sugarcane, Blast of rice
6. Gram's staining of citrus canker specimen
- 7-8. Mounting of fungal pathogen- *Phytophthora infestans*, *Fusarium*, *Colletotrichum* and *Magnaporthe grisea*.
9. Observation of specimens-Bean mosaic and sandal spike
10. Observation of root nodule formation in plants ( *Trigonella/Crotolaria*)
11. Demonstration of Indole acetic acid (IAA) production by soil fungi
12. Plant disease control by fungicides
13. Chemical determination of IAA produced by soil fungi *in vitro*
14. Isolation of fungal pathogens from soil
15. Isolation of fungal pathogens from diseased parts of plant

**NOTE:** Visit to Agricultural research station. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

**REFERENCES:**

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4. Subha Rao.N.S., 1988. Biofertilizers in Agricultural 2nd ed.Oxford and IBH Pub.Co., New Delhi.
5. Agrios.2009. Agricultural Microbiology
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**DMF28006/DMF28007**

**VI SEMESTER**

**DSE-A: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 4**

**COURSE OUTCOME:**

After successful completion of the course students are able to:

- CO1.** Understand food related microorganisms, their contamination, spoilage and preservation
- CO2.** Understand the beneficial role of microorganisms in fermented dairy products
- CO3.** Understand how microbiology is applied in manufacture of industrial products
- CO4.** The underlying principles in downstream processing
- CO5.** Know the human immune response towards microbes, Know the relationship between microorganism and human disease, pathogenicity, Laboratory diagnosis, treatment and prophylaxis
- CO6.** Demonstrate an understanding of key concepts in immunology

**UNIT: I**

**No of Hours: 15**

**INDUSTRIAL MICROBIOLOGY**

- A.** Introduction, Definition and scope
- B.** Microorganisms of industrial importance; Isolation, Screening and Preservation of Industrially important microbes.
- C.** Strain improvement of Microorganisms for industrial purposes.
- D.** A brief account of production medium, inoculum medium, raw materials-Molasses, corn steep liquor, sulphite waste liquor, yeast extract and whey. Buffers, Precursors, Inhibitors and Antifoam agents.
- E.** Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation (in brief). Fermentation process – Surface, Submerged and Solid state fermentation. Types- Batch and Continuous fermentation. Downstream processing: Steps in recovery and purification of products – Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, Chromatography, Drying and Crystallization (in brief).

**INDUSTRIAL PRODUCTION**

- A. a.** Organic acids – Citric acid.
- b.** Antibiotics – Penicillin.

- c. Enzymes –Pectinase
  - d. Alcohol – Ethanol.
  - e. Amino acid –Glutamic acid.
- B.** Mushroom cultivation – Oyster mushroom (bag method). Nutritional value.
- C.** Role of microorganisms in the production and recovery of minerals and petroleum.
- D.** Single cell protein: *Spirulina*.

## UNIT: II

**No of Hours: 15**

### FOOD MICROBIOLOGY

- A.** Introduction to Food Microbiology: Definition, Concept and Scope. Food as a substrate for microorganisms, Factors influencing microbial growth in foods (intrinsic and extrinsic factors).
- B.** Sources of contamination, Microbial spoilage of foods – fruits, vegetables, meat, poultry, canned foods, cereals and cereal products.
- C.** Methods of food preservation: Physical method – high temperature, low temperature, canning. Drying – solar drying, drum drying, spray drying and Radiation. Chemical methods – chemical preservatives – (propionates, benzoate, sorbates, nitrates and nitrites, sugar and salt)
- D.** Food borne intoxication and infection:  
 Bacterial intoxication - Staphylococcal intoxication and Botulism.  
 Bacterial infection - Salmonellosis.  
 Mycotoxin –Types and importance of toxins with special reference to Aflatoxins.
- E.** Food safety and quality control. –A brief account on HACCP, FSSAI and Food safety and standard act 2006

### DAIRY MICROBIOLOGY

- A.** Introduction to Dairy Microbiology: Source of milk contamination. Types of microorganisms in milk.
- B.** Methods to detect microbial spoilage by SPC, Reductase test.
- C.** Biochemical changes of milk - Souring, Gassy fermentation, Proteolysis, Lipolysis, and Ropiness.
- D.** Fermented dairy products (a brief account of characteristic and therapeutic value). Acidophilus milk, Yoghurt, Butter milk, Srikhand. Types of cheese. Probiotics and their benefits.
- E.** Preservation of milk and milk products – Pasteurization and Sterilization.

## UNIT:III

**No of Hours: 15**

### MEDICAL MICROBIOLOGY

- A.** Introduction – History and development of medical microbiology. Normal microflora of the human body: normal microflora of skin, throat, gastrointestinal tract, urogenital tract
- B.** Infection and disease transmission – Signs, symptoms, syndrome. Types of Infection: opportunistic infection and Nosocomial infection, mode of transmission.

- C. Host pathogen interaction –Pathogenicity, microbial virulence, microbial toxins, Opportunistic and true pathogens.
- D. Antimicrobial chemotherapy – General characteristics and types of antibiotics. Mode of action of -Penicillin, Aminoglycosides, Erythromycin and Chloramphenicol, Antifungal drugs- Griseofulvin and Nystatin. Antiviral drugs-Acyclovir. Multiple Drug Resistance (in brief).

### **HUMAN DISEASES**

- A. Pathogen –Morphology, Cultural and Biochemical characteristics,clinical symptoms, laboratory diagnosis, prophylaxis and treatment of the following diseases:
  - a. Air borne: Influenza, Diphtheria, Blastomycosis
  - b. Direct contact: Warts, Syphilis, Sporotrichosis
  - c. Vector borne: Dengue, Malaria
  - d. Water borne: Typhoid, Amoebic dysentery

### **UNIT IV**

**No. of Hours: 15**

#### **IMMUNOLOGY: IMMUNE CELLS AND ORGANS**

- A. Historical account and introduction to immune system – Blood and Plasma system.
- B. Types of immunity – Innate (non specific) and Adaptive immunity (specific). Humoral and cell mediated immunity.
- C. Structure, Functions and Properties of: Immune Cells –T cell, B cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell, Phagocytes and NK cells. Cells and tissues of immune systems-Structure and role of primary lymphoid organs (bone marrow,thymus),secondary lymphoid organs (spleen, lymph nodes and tonsils).

#### **IMMUNOLOGY: ANTIGENS AND ANTIBODIES**

- A. Antigens –Nature and types
- B. Antibodies – Basic structure of immunoglobulin (Ig G). Biological properties of Immunoglobulin classes, monoclonal antibodies, antigen antibody reactions – salient features. Precipitation reaction, neutralization test, opsonisation, agglutination reaction, compliment fixation. Immunotechniques – RIA, ELISA and ELISPOT.
- C. Hypersensitivity (Type I to V - in brief).
- D. Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each. National Immunization program (Tabular form).

**Total marks100: 70(Theory) +30(C1+C2)**

**DMF28106/DMF28107**

**VI SEMESTER**

**DSE-A: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY  
PRACTICAL**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 02**

**COURSE CODE: DMF28106/28107**

- 1a. Isolation and enumeration of bacteria from utensils
- b. Isolation and identification of fungi from food utensils
- 2a. Isolation and enumeration of bacteria from spoiled vegetables
- b. Isolation and identification fungi from spoiled vegetables.
- 3a. Isolation and enumeration of bacteria from spoiled fruits.
- b. Isolation and identification of fungi from spoiled fruits.
4. Isolation and identification of *Aspergillus* on groundnut by standard blotters Method (ISTA,1982).
5. Estimation of lactic acid in milk.
- 6a. Turbidity test to detect boiled and unboiled milk.
- b. Methylene blue reductase test to determine the quality of milk.
- 7a. Preparation of wine from grapes.
- b. Preparation of alcohol using jaggery or molasses.
- 8a. Estimation of percentage alcohol in a given sample by specific gravity method
- b. Production of citric acid using *Aspergillus niger*
9. Determination of blood group and Rh factor.
- 10a. Enumerate RBC in given blood sample
- b. Enumerate WBC in given blood sample
11. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).
12. Antibiotic sensitivity test.
- 13a. Determination of susceptibility to dental caries-Snydal test
- b. Identification of dermatophytes from human skin.
- 14a. Detection of typhoid by Widal test
- b. Rapid plasma reagin (RPR) card test for syphilis
15. Material/ microscopic observation/ display of photographs of human pathogens as per theory syllabus: Influenza virus, *Corynebacterium diphtheriae*, *Blastomyces dermatitidis*, Human papilloma virus, *Trypanosoma pallidum*, *Sporothrix schenckii*,

*Plasmodium*, Dengue viruses (DENV), *Salmonella typhi* and *Entamoeba histolytica*

**NOTE:** Visit to food industries or food research laboratories, dairy industries, distilleries, pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

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25. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication
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**DMF28006/DMF28007**

**VI SEMESTER**

**DSE-B: MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 4**

**COURSE OUTCOME:**

After successful completion of the course students are able to:

**CO1.** Understand microbial biotechnology and its applications

**CO2.** Understand the microbial products and their recovery

**CO3.** Know about the applications of bioinformatics

**CO4.** The underlying principles of bioinformatics and biological databases

**UNIT I**

**MICROBIAL BIOTECHNOLOGY AND ITS APPLICATIONS**

**15 hrs**

**Microbial biotechnology:** Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology. Use of prokaryotic and eukaryotic microorganisms in biotechnological applications. Genetically engineered microbes for industrial application: Bacteria and yeast.

**Recombinant microbial production processes in pharmaceutical industries** - Streptokinase, recombinant vaccines (Hepatitis B vaccine). Microbial polysaccharides and polyesters, Microbial production of bio-pesticides, bioplastics Microbial biosensors.

**UNIT II**

**MICROBIAL PRODUCTS AND THEIR RECOVERY**

**15hrs**

**Microbial product purification:** filtration, ion exchange & affinity chromatography techniques Immobilization methods and their application: Whole cell immobilization.

**Microbes for Bio-energy and Environment:** Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass, Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents.

**UNIT III**

**INTRODUCTION TO BIOINFORMATICS**

**15hrs**

**Introduction to Computer Fundamentals:** RDBMS - Definition of relational database Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer.

**Introduction to Bioinformatics and Biological Databases:** Biological databases - nucleic acid, genome, protein sequence and structure, gene expression databases, Database of

metabolic pathways, Mode of data storage - File formats - FASTA, Genbank and Uniprot, Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB.

#### **UNIT IV**

#### **APPLICATIONS OF BIOINFORMATICS**

**15 hrs**

**Sequence Alignments, Phylogeny and Phylogenetic trees:** Local and Global Sequence alignment, pairwise and multiple sequence alignment. Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA, Neighbour joining, Maximum Parsimony, Maximum likelihood. Genome organization and analysis. Diversity of Genomes: prokaryotic & eukaryotic genomes Genome, transcriptome and proteome.

**Protein Structure Predictions:** Hierarchy of protein structure - primary, secondary and tertiary structures, modeling Structural Classes, Motifs, Folds and Domains. Protein structure prediction in presence and absence of structure template.

**Total marks 100: 70(Theory) +30(C1+C2)**

**DMF28106/DMF28107**

**SEMESTER-VI**

#### **MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 02**

1. Study yeast cell immobilization in calcium alginate gels
2. Study enzyme immobilization by sodium alginate method
3. Pigment production from fungi (Trichoderma / Aspergillus / Penicillium)
4. Isolation of xylanase or lipase producing bacteria
5. Study of algal Single Cell Proteins
6. Introduction to different operating systems - UNIX, LINUX and Windows
7. Introduction to bioinformatics databases (any three): NCBI/PDB/DDBJ, Uniprot, PDB
8. Sequence retrieval using BLAST
9. Sequence alignment & phylogenetic analysis using clustalW & phylip
10. Picking out a given gene from genomes using Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool
11. Protein structure prediction: primary structure analysis, secondary structure prediction using psipred, homology modeling using Swissmodel. Molecular visualization using jmol, Protein structure model evaluation (PROCHECK)
12. Prediction of different features of a functional gene

## **REFERENCES:**

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2. Glick BR, Pasternak JJ, and Patten CL (2010) *Molecular Biotechnology* 4th edition, ASM Press,
3. Gupta PK (2009) *Elements of Biotechnology* 2nd edition, Rastogi Publications,
4. Lesk M.A.(2008) *Introduction to Bioinformatics* . Oxford Publication, 3rd International Student Edition
5. Pradeep and Sinha Preeti (2007). *Foundations of Computing*, 4th ed., BPB Publications
6. Prescott, Harley and Klein's *Microbiology* by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.
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9. Ratledge, C and Kristiansen, B. (2001). *Basic Biotechnology*, 2nd Edition, Cambridge University Press.
10. Saxena Sanjay (2003) *A First Course in Computers*, Vikas Publishing House
11. Swartz, J. R. (2001). *Advances in Escherichia coli production of therapeutic proteins*. *Current Opinion in Biotechnology*, 12, 195–201.

**DMF28206/DMF28207**

**SEMESTER – VI**

**SEC-A: MICROBIAL DIAGNOSIS IN HEALTH CLINICS**

**TOTAL HOURS: 30hrs (2hrs/week)**

**CREDITS: 2**

**COURSE OUTCOME**

After successful completion of the course students are able to:

**CO1.** Gain experience in health clinics such as examination, collection of clinical samples and diagnosis

**CO2.** Demonstrate scientific quantitative skills, the ability to evaluate experimental design, read graphs

**CO3.** Understand and use information from scientific papers/Journals

**UNIT: I**

**No of Hours: 5**

**IMPORTANCE OF DIAGNOSIS OF DISEASES**

Bacterial, viral, fungal and protozoan diseases of various human body systems. Disease associated clinical samples for diagnosis.

**UNIT: II**

**No of Hours: 5**

**COLLECTION OF CLINICAL SAMPLES**

Collection of clinical samples (oral cavity/sputum, throat, skin, blood, CSF, urine and faeces) and handling clinical specimens. Method of transport of clinical samples to laboratory and storage.

**UNIT: III**

**No of Hours: 15**

**DIRECT MICROSCOPIC EXAMINATION AND CULTURE**

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained, Thin blood film for malaria, Preparation and use of culture media – Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

**Serological and Molecular Methods**

Serological Methods – Agglutination, Precipitation, ELISA and PCR.

Test for Typhoid, Dengue, HIV and Swine flu

Laboratory exposure to students: demonstration of staining.

**UNIT: IV**

**No of Hours: 5**

**TESTING FOR ANTIBIOTIC SENSITIVITY IN BACTERIA**

Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial dilution method

**Total marks 50: 35(Theory) +15(C1+C2)**

**REFERENCES:**

1. Jagdish Chandra (1996). Text Book of Medical Mycology. Oreint Longman
2. Jawetz, Melnick, Adelberg, Medical Microbiolgy, Prentice Hall Inc, London.
3. Mackie and Mc catney, Medical Microbiology I and II. Charchill Livingston , 14th ed.
4. Nandhini Shetty 1993. Immunology: Inductory Text Book . New Age International Ltd.
5. R.P.Singh, Immunology and Medical Microbiology
6. Rajan. S. Medical Microbiology. MJP Publishers, Chennai.
7. Roitt I.M., Essentials of Immunology, ELBS, Blackwell Scientific Publishers, London.

**DMF28206/28207**

**SEMESTER – VI**

**SEC-II: MICROBIOLOGICAL ANALYSIS OF AIR AND WATER**

**TOTAL HOURS: 30hrs (2hrs/week)**

**CREDITS: 2**

**COURSE OUTCOME:**

After successful completion of the course students are able to:

**CO1.** Know about bioaerosols, airsamle collection and analysis

**CO2.**Control measures of air microbes

**CO3.** Know about the water borne diseases and their management

**CO4.**To identify water borne pathogens

**UNIT: I**

**No of Hours: 10**

**AIR MICROBIOLOGY**

Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens

**Air Sample Collection and Analysis**

Bioaerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and fungi.

**Control Measures**

Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation and Incineration

**UNIT: II**

**No of Hours: 5**

**WATER MICROBIOLOGY**

Water borne diseases and their management: Cholera, Typhoid, Gastroenteritis and Traveller's diarrhoea.

**UNIT: III**

**No of Hours: 5**

**MICROBIOLOGICAL ANALYSIS OF WATER**

Sample Collection, Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive/MPN tests, confirmed and completed tests for faecal coliforms (b) Membrane filter technique.

**UNIT: IV**

**No of Hours: 5**

**LABORATORY SAFETY MEASURES**

Precipitation, chemical disinfection, filtration, high temperature, UV light

Laboratory exposure to students: demonstration of air borne and water borne microbes.

**Total marks 50: 35(Theory) +15(C1+C2)**

REFERENCES:

1. da Silva N, Taniwaki MH, Junqueira VC, Silveira N, Nascimento MS, Gomes RAR (2012) Microbiological Examination Methods of Food and Water A Laboratory Manual, CRC Press
2. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
4. Hurst CJ, Crawford RL, Garland JL, Lipson DA (2007) Manual of Environmental Microbiology, 3rd edition, ASM press

**PATTERN OF QUESTION PAPER (CBCS)**  
**SUBJECT: MICROBIOLOGY**  
**[THEORY: V SEMESTER (DSE (A/B)) TO VI SEMESTER (DSE(A/B))]**

Time: 3hours

Max marks: 70

I. Answer the following

1X5=05Marks

- 1
- 2
- 3
- 4
- 5

II Answer any five of the following:

3X5=15 Marks

(Seven questions to be given and five to be answered)-short answer type

- 6
- 7
- 8
- 9
- 10
- 11
- 12

III Answer any four of the following:

5X4=20Marks

(Six questions to be given and four to be answered)-short answer type

- 13
- 14
- 15
- 16
- 17
- 18

III Answer any three of the following

10X3=30Marks

(Five questions to be given and three to be answered- essay type questions)

- 19
- 20

21  
22  
23

C1+C2=30(15+15) Continuous assessment

**PATTERN OF QUESTION PAPER (CBCS)**  
**SUBJECT: MICROBIOLOGY (SEI-SEII)**  
**SEC (A) – SEC (B)**  
**(THEORY: VI SEMESTER)**

Time: 2 hours

Max marks: 35

I. Answer the following

1X3=03

1  
2  
3

II Answer any four of the following:

3X4=12

(Six questions to be given and four to be answered)-short answer type

6  
7  
8  
9  
10  
11

III Answer any two of the following:

10X2=20

(Four questions to be given and two to be answered)-short answer type

12  
13  
14  
15

C1+C2=15 Continuous assessment



**SCHEME OF THEORY EXAMINATION**  
**III B.Sc.,V SEMESTER**  
**DSE-A: ENVIRONMENTAL MICROBIOLOGY**

**Times: 3hrs**

**Max Marks:70**

**Question Paper to be set for total of 106marks including choices**

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: 1 Soil Microbiology	2	-	1	2	27
UNIT:2 Aerobiology	1	2	2	1	27
UNIT:3 Aquatic, sewage & bioremediation	2	3	1	1	26
UNIT:4 Microbes in Agriculture	-	2	2	1	26

I Main: 1x5=05Marks

II Main: 3x7=21Marks

III Main: 5x6=30Marks

IVMain: 10x5=50Marks

**SCHEME OF THEORY EXAMINATION**  
**III B.Sc.,V SEMESTER**  
**DSE-B: AGRICULTURAL MICROBIOLOGY**

**Times: 3hrs**

**Max Marks:70**

**Question Paper to be set for total of 106marks including choices**

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: 1 Introduction & History of Plant pathology & Microorganism in Agriculture	-	2	2	1	26
UNIT:2 Phytopathology	1	2	2	1	27
UNIT:3 Control of Plant diseases	2	3	1	1	26
UNIT:4 Specific Plant disease	2	-	1	2	27

I Main: 1x5=05Marks

II Main: 3x7=21Marks

III Main: 5x6=30Marks  
IVMain: 10x5=50Marks

**DSE-A**  
**III B.Sc.-VSEMESTER**  
**SCHEME OF PRACTICAL EXAMINATION**  
**PRACTICAL V: ENVIRONMENTAL MICROBIOLOGY**

**Time: 3hours**

**Max. marks :35**

- I.** Demonstrate /perform the experiment **A**, giving principle and procedure. Record and interpret the result. 08  
(Demonstration-4marks; principle-2marks; procedure-1marks; results-1marks)  
(Petriplate exposure method/standard analysis of water/ determination of MPN/ Isolation of Bacteria /Fungi from soil by serial dilution method/Antagonism between microorganisms).
- II.** Demonstrate /perform the experiment **B**, giving principle and procedure. Record and interpret the result. (Demonstration-2marks; principle-1mark; procedure & results-2marks) 05  
(Demonstration of BOD of sewage/Estimation of total solids in sewage/IMViC/Hydrogen sulphide strip test).
- III.** Record the source and importance of microorganisms in the material **C** with Identification and label the diagrams. 06  
(Source of the microorganisms and identification-3marks; labelled diagram- 1marks; importance- 2marks).  
(Pond water, agar plates exposed to air, biological indicators of water pollution/*Anabena* in *Azolla* ).
- IV.** Write critical notes on **D, E** and **F** 2x3=06  
(Identification -1mark; critical comments-4marks)  
(Air samplers, Results of standard analysis of water, MPN, IMViC reactions, Hydrogen sulphide strip test, photographs of baffles, flocculator, clarifier, sand filter, back wash, chlorinometer, chloroscope, septic tank, Trickling filter, activated sludge process, oxidation pond, sedimentation tank, anaerobic digester, biogas plant, composting, composting process, aerated lagoons, low shear air lift reactor and microbial leaching/ *Azolla*/ VAM/Rhizosphere microflora/Plant diseases as per theory syllabus).
- VI.** Record+Report  
05+05=10
- 

**DSE-B**  
**III B.Sc.-V SEMESTER**  
**SCHEME OF PRACTICAL EXAMINATION**  
**PRACTICAL V: AGRICULTURAL MICROBIOLOGY**

**Time:3hours**

**Max. marks :35**

- I.** Demonstrate /perform the experiment **A**, giving principle and procedure. Record and Interpret the result. 10  
(Demonstration-5marks; principle-2marks; procedure-2marks; results-1marks). (Isolation of Fungi from soil by serial dilution method/ from diseased parts of plants, chemical determination of IAA/plant disease control by fungicide).
- II.** Prepare a temporary stained slide of **B**. Identify with labeled sketch and reasons. Leave the preparation for evaluation. 09  
(Identification -2mark; preparation-3marks; labeled diagram-2 and reasons-2marks).  
( Plant diseases as per theory syllabus)
- III.** Identify the slides/materials **C, D, E** and **F** with labelled diagrams and reasons 2X3=06

(Identification-1mark; reasons & labeled sketch-1mark).

( Plant diseases as per theory syllabus/ Koch postulates)

IV. Record +Report

05+05=10

**Total marks: 35: [25 (Practical Exam) + 10 (5 -record+ 5- viva)]**

### **SCHEME OF THEORY EXAMINATION**

**III B.Sc., VI SEMESTER**

**DSE-A: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY**

**Times: 3hrs**

**Max Marks: 70**

**Question Paper to be set for total of 106marks including choices**

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: 1 Industrial microbiology & Industrial production	2	-	1	2	27
UNIT:2 Food & Dairy Microbiology	2	3	1	1	26
UNIT:3 Medical Microbiology	1	2	2	1	27
UNIT:4 Immunology	-	2	2	1	26

I Main: 1x5=05Marks

II Main: 3x7=21Marks

III Main: 5x6=30Marks

IVMain: 10x5=50Marks

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### **SCHEME OF THEORY EXAMINATION**

**III B.Sc., VI SEMESTER**

**DSE-B: MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS**

**Times: 3hrs**

**Max Marks:70**

**Question Paper to be set for total of 106marks including choices**

UNITS	1 mark questions	3 mark questions	5 mark questions	10 mark questions	Total Marks
UNITS: 1 Microbial Biotechnology and its Applications	2	-	1	2	27
UNIT:2 Microbial Products and their Recovery	1	2	2	1	27
UNIT:3 Introduction to Bioinformatics	2	3	1	1	26
UNIT:4 Applications of bioinformatics	-	2	2	1	26

I Main: 1x5=05Marks

II Main: 3x7=21Marks

III Main: 5x6=30Marks  
IVMain: 10x5=50Marks

**DSE-A**  
**SCHEME OF PRACTICAL EXAMINATION**  
**III B.Sc. – VI SEMESTER**  
**TITLE: INDUSTRIAL, FOOD AND MEDICAL MICROBIOLOGY**

- Time: 3hours.** **Max.marks:35**
- I. Demonstrate / Perform the experiment A, giving principle and procedure. Record and interpret the result.** 10  
(Demonstration -5marks; principle-2marks; procedure-2marks; results and interpretation-1marks).  
(Isolation of microorganisms from utensils/spoiled vegetables/spoiled fruits. Antibiotic sensitivity test/Determination of blood group and Rh factor/Demonstration of precipitation reaction-ODD ).
- II. Conduct the test for B. Write the principle and procedure. Record and interpret the results.** 05  
(Demonstration -2 marks; principle-1 marks; procedure-1 marks; results and interpretation- 1marks).  
(Turbidity test, Phosphatase test, MBRT test, Estimation of % of alcohol in a given sample by specific gravity bottle method RPR/Urine bacteria by calibrated loop /Enumerate RBC in given blood sample/ Enumerate WBC in given blood sample/ Snyder test.).
- III. Write critical notes on C, D and E. (Identification -1mark; critical comments-1marks).** 2X3=06  
(Cheese, Yoghurt, Srikhand, Bread, Molasses, Wine, Alcohol, *Aspergillus* on groundnut, Citric acid production/alcohol from jiggery. Antibiotic sensitivity test, Estimation of urine bacteria by calibrated loop/IMViC/TSI/Nitrate reduction/urease production/catalase/ Ouchterlony procedure, RPR, Widal test, Slides/Photographs of human pathogens as per theory syllabus ).
- IV .Prepare temporary stained slide of F. Identify with labelled sketch and reasons.** 04  
Leave the preparation for evaluation.  
(Identification -1mark; preparation-2marks; reasons- 1marks).  
(*Spirullina*, *Chlorella*, *Aspergillus niger* and Yeast/ Petri plates with Fungal colonies/Bacterial colonies.)
- V. Record +Report** 10
- 

**DSE-B**  
**SCHEME OF PRACTICAL EXAMINATION**  
**III B.Sc. – VI SEMESTER**  
**TITLE: MICROBIAL BIOTECHNOLOGY AND BIOINFORMATICS**

- Time:3 hours** **Max.marks:35**
- I. Demonstrate / Perform the experiment A, giving principle and procedure. Record and interpret the result.** 10  
(Demonstration -5marks; principle-4marks; procedure-4marks;results and interpretation- 2).  
(Study yeast cell immobilization in calcium alginate gels/Study enzyme immobilization by sodium alginate method)
- II. Write critical notes on B, C & D** 4x3=12  
(Identification -1mark; critical comments-1marks)  
(Single Cell Proteins/ BLAST / Protein structure prediction as per theory syllabus)
- III. .Identify the given photographs E,F,G &H** 2x4=08  
(Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool )

IV. Record  
05

**Total marks: 35: [30 (Practical Exam) + 05 – (record)]**

**SCHEME OF THEORY EXAMINATION**  
**III B.Sc.,V SEMESTER**  
**SEC-A: MICROBIAL DIAGNOSIS IN HEALTH CLINICS**

**Times: 3hrs**

**Max Marks: 35**

**Question Paper to be set for total of 59 marks including choices**

UNITS	1 mark questions	3 mark questions	10 mark questions	Total Marks
UNITS: 1 Importance of diagnosis of diseases	1	1	1	14
UNIT:2 Collection of clinical samples	1	2	1	16
UNIT:3 Deirect microscopic examination and culture	--	1	1	13
UNIT:4 Testing for antibiotic sensitivity in bacteria	1	2	1	16

I Main: 1x3= 03Marks

II Main: 3x4= 12Marks

III Main: 10x2=20Marks

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**SCHEME OF THEORY EXAMINATION**  
**III B.Sc.,V SEMESTER**  
**SEC-B: MICROBIOLOGICAL ANALYSIS OF AIR AND WATER**

**Times: 3hrs**

**Max Marks: 35**

**Question Paper to be set for total of 59marks including choices**

UNITS	1 mark questions	3 mark questions	10 mark questions	Total Marks
UNITS: 1 Air microbiology	1	1	1	14
UNIT:2 Water microbiology	1	2	1	16
UNIT:3 Microbial analysis of water	--	1	1	13
UNIT:4 Control Measures	1	2	1	16

I Main: 1x3=03Marks

II Main: 3x6=18Marks

III Main: 10x2=20Marks

### Approved list of Paper setters and Valuers

Sl No.	Name	College address
1	Dr..M .Seema	Chairperson, Dept. of Microbiology JSS College, Ooty road, Mysuru
2	H.P.Spoorthy	Assistant professor,Dept. of Microbiology JSS College, Ooty road, Mysuru
3	Dr.S.Mahadevamurthy	Associate Professor, Dept. of Microbiology Yuvaraja's college,Mysore.
4	Dr.Syeda Kauser Fathima	Associate Professor, Dept. of Microbiology Maharani's Science College for women, JLB road, Mysuru
5	Dr. H.S. Jayanth.	Associate Professor, Dept. of Microbiology Yuvaraja's college, Mysuru
6	Dr.Nagarathnamma	Associate Professor, Dept. of Microbiology Government women college,Mandya
7	Sri. M. Girish	Assistant Professor,Dept. of Microbiology JSS College for Women,Saraswathipuram, Mysuru
8	Dr. P.K.Maheshwar	Assistant Professor Dept. of Microbiology Yuvaraja's college, Mysuru.
9	Smt. M.S.Shobha	Assistant Professor, Dept. of Microbiology Maharani's Science College, Mysuru
10	Sri. R.A. Manjunath	Assistant Professor, Dept. of Microbiology Saradavilas College, Mysuru
11	Dr.M.P. Ragavendra	Assistant Professor,Dept. of Microbiology Maharani's Science College, Mysuru
12	Dr.K.Girish	Assistant Professor,Dept. of Microbiology Maharani's Science College, Mysuru
13	Sri. G.S. Siddegowda	Assistant Professor,Dept. of Microbiology Maharani's Science College , Mysuru
14	Dr.N.S.Devaki	Assistant Professor,Dept. of Molecular Biology Yuvaraja's College , Mysuru
15	Syeda Farahna Parveen	Assistant Professor,Dept. of Microbiology St.Philomina's College, Mysuru
16	Smt. Vanitha	Assistant Professor,Dept. of Microbiology Maharani's Science College, Mysuru
17	Smt. Revanamba	Assistant Professor,Dept. of Microbiology Maharani's Science College, Mysuru

18	Mahadevaprasad	Assistant Professor,Dept. of Microbiology JSS College for WomenSaraswathipuram, Mysuru
19	Dr.Nagalambika	JSS University,Mysuru
20	RajaRajeshwari.R	Assistant Professor ,Dept. of Microbiology SDM College,JLB Road,Mysuru
21	Uzma Bathool	Assistant Professor Dept. of Microbiology St.Philomina's College, Mysuru
22	Shruthi Prakash	Assistant Professor,Dept. of Microbiology Mahajana's Science College,Mysuru
23	Athiya sultan	Assistant Professor,Dept. of Microbiology SDM College,JLB Road,Mysuru
24	C.Poornima Devi	Assistant Professor,Dept. of Microbiology Yuvaraja's college, Mysuru
25	Dr.Rakshith	Assistant Professor,Dept. of Microbiology Yuvaraja's college, Mysuru
26	Vasundara Devi R	Assistant Professor,Dept. of Microbiology Maharani's Science College, Mysuru
27	Niveditha Prakash	Assistant Professor,Dept. of Microbiology JSS College for Women Saraswathipuram, Mysuru
28	Dr.K.Sumana	Assistant Professor, JSS University,Mysuru
29	Samjna.S.R	Assistant Professor, Dept. of Microbiology Maharani's Science College,Mysuru







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**Wef**

**2021-22**

Sem	Course No	Course Code	Combination	Title of the course	Course type	Credit pattern L:T:P	Total credit	Teaching/week	Evaluation pattern			
									C1	C2	C3	Total Marks
I	C1/C2	FSA41031	PC	Mechanics & Properties of Matter	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSA41032	PM									
		FSA41033	PE									
		FSA41035	PCs	Practical - I		0:0:2	2	4hrs/week	10	15	25	50
II	C1/C2	FSB41031	PC	Electricity and Magnetism	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSB41032	<b>PM</b>									
		FSB41033	PE									
		FSB41035	PCs	Practical - II		0:0:2	2	4hrs/week	10	15	25	50
III	C1/C2	FSC41031	PC	Wave motion and optics	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSC41032	PM									
		FSC41033	PE									
		FSC41035	PCs	Practical-III		0:0:2	2	4hrs/week	10	15	25	50
IV	C1/C2	FSD41031	PC	Thermal Physics & Electronics	DSC	4:0:0	4	4hrs/week	20	20	60	100
		FSD41032	PM									
		FSD41033	PE									
		FSD41035	PCs	Practical-IV		0:0:2	2	4hrs/week	10	15	25	50

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**Scheme of Evaluation for OE (Open Elective papers)**  
**(Open elective paper will be given to students in first four semesters)**

Sem	Course No	Course Code	Combinations	Title of the course	Course type	Credit pattern L:T:P	Total credit	Teaching/week	Evaluation pattern			
									C1	C2	C3	Total Marks
I	C1/C2	FSA800	KG, HP, EG	Energy Sources	OE	2:1:0	3	3hrs/week	20	20	60	100
II	C1/C2	FSB800	KG, HP, EG	Astronomy	OE	2:1:0	3	3hrs/week	20	20	60	100
III	C1/C2	FSC800	KG, HP, EG	Sports science	OE	2:1:0	3	3hrs/week	20	20	60	100

## Scheme of Evaluation for DSC papers

Course type	L:T:P	Total credits	Maximum Marks in the Examination/Assessment						Examination Duration				
			SEE		IA				Theory	Practical			
			Theory	Practical	Theory		Practical						
DSC	4:0:2	4+2=6	60	25	40 (C1+C2)		25(C1+C2)			3h	3h		
					C1		C2		C1			C2	
					IA	Assignment	IA	Seminar/ Assignment	IA			IA	Record
					10	10	10	10	10			10	05

## Scheme of Evaluation for OE (Open Elective) papers

(Open elective paper will be given to students in first four semesters)

Course type	L:T:P	Total credits	Maximum Marks in the exam/Assessment						Exam Duration		
			SEE		IA				Theory	Practical	
			Theory	Practical	Theory		Practical				
OE	3:0:0	3	60	-	40 (C1+C2)				-	3h	-
					C1		C2				
					IA	Assignment	IA	Seminar/ Assignment			
					10	10	10	10			

## Scheme of Evaluation for DSC papers

Course type	L:T:P	Total credits	Maximum Marks in the Examination/Assessment						Examination Duration				
			SEE		IA				Theory	Practical			
			Theory	Practical	Theory		Practical						
DSC	4:0:2	4+2=6	60	25	40 (C1+C2)		25(C1+C2)			3h	4h		
					C1		C2		C1			C2	
					IA	Assignment/ Field work	IA	Seminar/ Assignment/ Activity	IA			IA	Record
					10	10	10	10	10			10	05

## Scheme of Evaluation for OE (Open Elective) papers

(Open elective paper will be given to students in first four semesters)

Course type	L:T:P	Total credits	Maximum Marks in the exam/Assessment						Exam Duration		
			SEE		IA				Theory	Practical	
			Theory	Practical	Theory		Practical				
OE	3:0:0	3	60	-	40 (C1+C2)				-	3h	-
					C1		C2				
					IA	Assignment /Field work	IA	Seminar/ Assignment/ Activity			
					10	10	10	10			

### Programme Educational Objectives:

1. Graduates will demonstrate competence in respective domain as they apply skills to conduct scientific research and contribute to quality education.
2. Graduates will be recognized as experts in educational and research institutes as well as industries in identifying and solving global challenges.
3. Graduates will become leading researchers and professors who create and disseminate new knowledge in scientific and allied fields.

### Graduate Attributes and Programme Outcomes:

Exit with:	Credits Required
<b>Certificate</b> upon the Successful Completion of the First Year (Two Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	44 - 48

1. **Discipline Knowledge:** Knowledge of science and ability to apply to relevant areas.
2. **Problem solving:** Execute a solution process using first principles of science to solve problems related to respective discipline.
3. **Modern tool usage:** Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. **Ethics:** Apply the professional ethics and norms in respective discipline.
5. **Individual and teamwork:** Work effectively as an individual as a team member in a multidisciplinary team.
6. **Communication:** Communicate effectively with the stake holders, and give and receive clear instructions.

Exit with:	Credits Required
<b>A Diploma</b> upon the Successful Completion of the Second Year (Four Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	88 - 96

**Discipline Knowledge:** Knowledge of science and ability to apply to relevant areas.

1. **Conduct investigations:** Conduct investigations of technical issues as per their level of understanding and knowledge.
2. **Problem solving:** Formulate and implement a solution process using first principles of science to solve problems related to respective discipline.
3. **Modern tool usage:** Apply a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. **Ethics:** Apply and commit to the professional ethics and norms in respective profession.
5. **Individual and teamwork:** Work effectively as an individual in a multidisciplinary team.
6. **Communication:** Communicate effectively with the stake holders, and give and receive clear instructions.



Exit with:	Credits Required
<b>Basic Bachelor Degree</b> at the Successful Completion of the Third Year (Six Semesters) of the multidisciplinary Four- year Undergraduate Programme/Five-year Integrated Master's Degree Programme	132 - 144

1. **Discipline Knowledge:** Knowledge of basics of science and ability to apply the understanding of fundamentals of major discipline in solving complex problems.
2. **Conduct investigations:** Conduct investigations of issues in their respective disciplines and arrive at valid conclusions.
3. **Problem solving:** Implement a solution process using first principles of science to solve problems related to respective discipline.
4. **Modern tool usage:** Select and use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
5. **Environment and Society:** Evaluate the impact of scientific solutions on society and environment and the need for sustainable solutions.
6. **Ethics:** Demonstrate professional ethics, responsibilities and norms in respective profession.
7. **Individual and teamwork:** Work effectively as an individual as a team member and as a leader in a multidisciplinary team.
8. **Communication:** Communicate effectively with the stake holders, write and comprehend project reports and documentation, deliver effective presentations, and give and receive clear instructions.
9. **Project Management and Finance:** Apply the knowledge of scientific and technological principles to one's own work to manage projects in multidisciplinary settings.
10. **Lifelong Learning:** Engage in lifelong learning in the context of changing trends in respective discipline.

Exit with:	Credits Required
<b>Bachelor Degree with Honours</b> in a Discipline at the Successful Completion of the Fourth Years (Eight Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	176 - 192

1. **Discipline Knowledge:** Knowledge of basics of science and research, and ability to apply the understanding of fundamentals of specialized discipline in solving complex scientific problems.
2. **Conduct investigations:** Conduct investigations of issues using research methods and research-based discipline knowledge including design of experiments, data collection, interpretation and analysis to arrive at valid conclusions.
3. **Problem analysis:** Identify, formulate and analyse complex scientific problems using first principles of respective discipline.
4. **Design and Development of solutions:** Design solutions for complex scientific problems and execute them by considering the environmental, societal and public safety aspects appropriately.

5. **Modern tool usage:** Identify, select and use a modern scientific, engineering and IT tool or technique for modelling, prediction, data analysis and solving problems in the areas of their discipline.
6. **Environment and Society:** Evaluate the impact of scientific solutions on society and environment and design sustainable solutions.
7. **Ethics:** Demonstrate professional ethics, responsibilities and norms in respective profession.
8. **Individual and teamwork:** Work effectively as an individual as a team member and as a leader in a multidisciplinary team.
9. **Communication:** Communicate effectively with the stakeholders with emphasis on communicating with scientific community, comprehend scientific reports, write research papers and projects proposals and reports, deliver effective presentations, and give and receive clear instructions.
10. **Project Management and Finance:** Apply the knowledge of scientific and technological principles to one's own work to manage projects in multidisciplinary settings.
11. **Lifelong Learning:** Identify knowledge gaps and engage in lifelong learning in the context of changing trends in respective discipline.

## Options for Study

- The programmes are flexible enough to allow liberty to students in designing them according to their requirements. Students may choose a single Major, one Major with a Minor, and one Major with two Minors. Teacher Education or Vocational courses may be chosen in place of Minor/s. Below listed are the various options students may choose from.
- One Major subject/discipline, Two Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities.
- One Major and one Minor subject/discipline along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities
- Two Major subject/disciplines along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses, including Extracurricular Activities (subject to fulfilling the requirements as stated in 3.i and 3.ii)
- One Major subject/discipline and one Vocational course along with Languages, Generic Electives, Ability Enhancement and Skill Development and courses including Extracurricular Activities.
- One Major Discipline and One Education Discipline along with Languages, Generic Electives, Ability Enhancement and Skill Development Courses including Extracurricular Activities.

**Proposed Curriculum Framework for Multidisciplinary Four- year  
Undergraduate Programme**

Year	Objective	Nature of Courses	Outcome	No. of courses
<b>1<sup>st</sup> year – (1 &amp; 2 Semesters)</b>	Understanding and Exploration	1. Major Core Courses	Understanding of Disciplines	1+1
		2. Minor/Related Discipline	Language Competency	1+1
		3. Languages,	Gaining perspective of context/Generic skills	2+2
		4. Ability Enhancement Compulsory Courses	Basic skills sets to pursue any vocation	1+1
		5. Skill Enhancement/ Development Courses		1+1
<b>Exit option with Certification</b>				
<b>2<sup>nd</sup> Year - (3 &amp; 4 Semesters)</b>	Focus and Immersion	1. Major Core Courses	Understanding of disciplines	2+2
		2. Minor/ Related Discipline	Gaining perspective of context	1+1
		3. Ability Enhancement	Skill sets to pursue vocation	1+1
		4. Skill based Vocational	Development of various Domains of mind & Personality	1+1
		5. Extra-Curricular Activities		1+1
<b>Exit Option with Diploma</b>				
<b>3<sup>rd</sup> Year - (5 &amp; 6 Semesters )</b>	Real time Learning	1. Major Discipline Core and Elective Courses	In depth learning of major and minor disciplines, Skill sets for employability.	2+2
		2. Minor Discipline/ Generic or Vocational Electives /Field based Learning/ Res. Project	Exposure to discipline beyond the chosen Subject	1+1
			Experiential learning/ Res.	1+1
<b>Exit option with Bachelor Degree</b>				
<b>4<sup>th</sup> Year - (7 &amp; 8 Semesters)</b>	Deeper Concentration	Major Discipline Core and Elective courses	Deeper and Advanced Learning of Major Discipline Foundation to pursue Doctoral Studies & Developing Research competencies	4+4
		Research/Project Work with Dissertation		
<b>Bachelor Degree with Honours</b>				
5 <sup>th</sup> Year - (9 <sup>th</sup> & 10 <sup>th</sup> Semesters)	Master of the subject	Major Discipline Core and Elective courses/Research/Project Work with Dissertation	Deeper and Advanced Learning of the Major Discipline towards gaining proficiency over the subject	4+4/6+6
Master's Degree				

## MODEL FOUND APPROPRIATE AND ADOPTED

### IIA. Model Program Structures for the Under-Graduate Programs

Bachelor of Science (Basic/Hons.) in subjects with practical, with one major and one minor Sem.		Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective(DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), Languages (Credits) (L+T+P)	Skill Enhancement Courses (SEC)		Total Credits
<b>Skill based (Credits) (L+T+P)</b>				<b>Value based (Credits) (L+T+P)</b>			
I	Discipline A1(4+2) Discipline B1(4+2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs each)	SEC-1: Digital Fluency (2) (1+0+2)	Physical Education for fitness(1)(0+0+2)	Health & Wellness (1) (0+0+2)	25
II	Discipline A2(4+2) Discipline B2(4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs each)	Environmental Studies (2)	Physical Education - Yoga(1) (0+0+2)	NCC/NSS/R&R(S&G)/Cultural (1) (0+0+2)	25
<b>Exit option with Certificate (50 credits)</b>							
III	Discipline A3(4+2) Discipline B3(4+2)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs each)	SEC-2: Artificial Intelligence (2)(1+0+2)	Physical Education- Sports skills(1)(0+0+2)	NCC/NSS/R&R(S&G)/Cultural (1) (0+0+2)	25
IV	Discipline A4(4+2) Discipline B4(4+2)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs each)	Constitution of India (2)	Physical Education -Games (1) (0+0+2)	NCC/NSS/R&R(S&G)/Cultural (1) (0+0+2)	25
<b>Exit option with Diploma (100 credits) OR Choose any one of the core subjects as Major and the other as Minor</b>							
V	Discipline A5(3+2) Discipline A6(3+2) Discipline B5(3+2)		Vocational-1 (3)		SEC-3: SEC such as Cyber Security (2) (1+0+2)		20
VI	Discipline A7(3+2) Discipline A8(3+2) Discipline B6(3+2)		Vocational-2 (3) Internship (2)		SEC-4: Professional Communication (2)		22
<b>Exit option with Bachelor of Arts, B.A./ Bachelor of Science, B.Sc. Basic Degree (142 credits) or continue studies with the Major</b>							
VII	Discipline A9(3+2) Discipline A10(3+2) Discipline A11(3)	Discipline A, E-1 (3) Discipline A, E-2 (3) Res.Methodology (3)					22
VIII	Discipline A12(3+2) Discipline A13(3) Discipline A14(3)	Discipline A, E-3(3) Research Project (6)*					20
<b>Award of Bachelor of Arts Honours, B.A. (Hons.)/ Bachelor of Science Honours, B.Sc. (Hons) degree in a discipline (184 credits)</b>							



## Curriculum Structure-Physics(Core and Electives)

### Semesters- I to X

SEM	DSC	Core Papers
<b>Sem-1 :</b>	A1	Mechanics & Properties of Matter
<b>Sem -2 :</b>	A2	Electricity and Magnetism
<b>Sem-3 :</b>	A3	Wave motion and optics
<b>Sem-4:</b>	A4	Thermal Physics & Electronics
<b>Sem-5 :</b>	A5 A6	1. Classical Mechanics and Quantum Mechanics- I 2. Elements of Atomic, Molecular Physics
<b>Sem -6 :</b>	A7 A8	1. Elements of Nuclear Physics and Nuclear Instruments 2. Elements of Condensed Matter Physics
<b>Sem-7</b>	A9 A10 A11	1. Mathematical Methods of Physics – I 2. Classical Electrodynamics. 3. Experimental methods of Physics 4. Research Methodology <i>(Select Two DSE subjects from the Pool B-I shown below)</i>
<b>Sem-8</b>	A12 A13 A14	1. Classical Mechanics and Quantum Mechanics-II 2. Statistical Mechanics 3. Astrophysics & Astronomy 4. Research Project* <i>(Select Two DSE subjects from the Pool B-II shown below)</i> *In lieu of the research Project, two additional elective papers/ Internship may be offered.
<b>Sem-9</b>	A15	1. Mathematical Methods of Physics – II <i>(Select One DSE subjects from the Pool B-III shown below)</i> 2. Research Project
<b>Sem-10</b>	A17	1. Quantum Mechanics – III <i>(Select One DSE subjects from the Pool B-IV shown below)</i> 2. Research Project

\* The Topics of 5<sup>th</sup> Sem and above need to be revisited

### Open Electives for 1<sup>st</sup> to 4<sup>th</sup> Semesters

Sl.No.	1 to 4 Semester
1.	Energy Sources
2.	Climate Science
3.	Astronomy
4.	Medical Physics
5.	Optical Instruments
6.	Sports Science
7.	Nanotechnology
8.	Electrical Instruments
9.	Electronic Instruments
10.	Physics for all
11.	Space Missions

### Discipline Specific Electives for 7<sup>th</sup> to 10<sup>th</sup> Semesters

7 <sup>th</sup> Sem Electives Pool B-I (Select any two)		8 <sup>th</sup> Sem Electives Pool B-II (Select any two)	
A.	Condensed Matter Physics-1	A.	Atomic & Molecular Physics-1
B.	Nuclear and Particle Physics	B.	Materials Physics & Nano materials
C.	Theoretical and Computational Physics-I	C.	Lasers and non-linear optics
D.	Biophysics	D.	Plasma Physics
E.	Astronomy and Astrophysics	E.	Physics of Semiconductor devices

9 <sup>th</sup> Sem Electives (Specialization papers) Pool B-III		10 <sup>th</sup> Sem Electives (Specialization papers) Pool B-IV	
A.	Condensed Matter Physics-2	A.	Condensed Matter Physics-3
B.	Nuclear and Particle Physics-2	B.	Nuclear and Particle Physics-3
C.	Atomic & Molecular spectroscopy-1	C.	Atomic & Molecular spectroscopy-2
D.	Materials Physics & Nanophysics –1	D.	Materials Physics & Nanophysics -2
E.	Theoretical and Computational Physics-I	E.	Theoretical and Computational Physics-2
F.	Astronomy and Astrophysics-1	F.	Astronomy and Astrophysics-2

## Detailed Syllabus for Semesters I & II B.Sc., Physics

### Detailed Syllabus for Semesters I & II

Semester	SEM I (2024)		SEM II (2024)	
	1001	1002	1003	1004
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>1. Introductory Physics (1001)</li> <li>2. Introductory Chemistry (1002)</li> <li>3. Introductory Mathematics (1003)</li> </ul>			
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>1. Understand the fundamental concepts of physics and their applications.</li> <li>2. Develop problem-solving skills in physics.</li> <li>3. Gain a deep understanding of the physical world and its laws.</li> </ul>			
<b>Course Content</b>	<ul style="list-style-type: none"> <li>1. Kinematics: Displacement, Velocity, Acceleration, Equations of Motion.</li> <li>2. Dynamics: Newton's Laws of Motion, Free Body Diagrams, Friction, Work, Energy, Power.</li> <li>3. Rotational Motion: Angular Displacement, Angular Velocity, Angular Acceleration, Torque, Angular Momentum.</li> <li>4. Gravitation: Universal Gravitation, Gravitational Field, Gravitational Potential, Escape Velocity, Satellites.</li> <li>5. Oscillations: Simple Harmonic Motion, Pendulum, Spring-Mass System, Damped Oscillations, Resonance.</li> <li>6. Waves: Transverse and Longitudinal Waves, Wave Equation, Interference, Diffraction, Polarization.</li> <li>7. Optics: Ray Optics, Reflection, Refraction, Total Internal Reflection, Dispersion, Lenses, Mirrors, Optical Instruments.</li> <li>8. Modern Physics: Photoelectric Effect, Compton Effect, Matter Waves, De Broglie Wavelength, Bohr's Model of the Atom, Atomic Spectra, Radioactivity, Nuclear Energy.</li> </ul>			
<b>Assessment</b>	<ul style="list-style-type: none"> <li>1. Mid-Semester Examinations (20%)</li> <li>2. End-Semester Examination (80%)</li> </ul>			



# I Semester

## Detailed Syllabus of I Semester Physics

### Mechanics and Properties of Matter

Course Title: Mechanics and Properties of Matter	Course Credits:4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	

### Programme Outcomes (POs)

**PO-1:** Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.

**PO-2:** Problem solving: Execute a solution process using first principles of science to solve problems related to respective discipline.

**PO-3:** Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.

**PO-4:** Ethics: Apply the professional ethics and norms in respective discipline.

**PO-5:** Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.

**PO-6:** Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

### Course Articulation Matrix:

#### Mapping of Course Outcomes (COs) with Program Outcomes (POs)

#### Program Outcomes (POs)

Course Outcomes (COs) (UGC guidelines)	1	2	3	4	5	6
CO-1: Will learn fixing units, tabulation of observations, analysis of data (graphical/analytical)	x	x				x
CO-2: Will learn about accuracy of measurement and sources of errors, importance of significant figures.	x	x				
CO-3: Will know how g can be determined experimentally and derive satisfaction.	x					

CO-4: Will see the difference between simple and torsional pendulum and their use in the determination of various physical parameters.	X			X	X	X
CO-5: Will come to know how various elastic moduli can be determined.	X				X	X
CO-6: Will measure surface tension and viscosity and appreciate the methods adopted.	X	X				
CO-7: Will get hands on experience of different equipment.	X	X	X		X	X

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course are Marked 'X' in the intersection cell if a course outcome addresses a particular program outcome.

<b>Mechanics &amp; Properties of Matter</b>		Hrs
<b>Credit : 4+2</b>		<b>Unit – 1</b>
<b>Theory : 4 hours /Week</b>		
<b>Chapter No. 1</b>	<b>Topics</b> to be covered/taught/learnt: <b>Units and measurements:</b> System of units (CGS and SI), measurement of length, mass and time, dimensions of physical quantities, dimensional formulae. Minimum deviation, errors.	(13)
<b>Chapter No. 2</b>	<b>Momentum and Energy:</b> Work and energy, Conservation of momentum (linear). Conservation of energy with examples. Motion of rockets.	
<b>Chapter No. 3</b>	<b>Special Theory of Relativity:</b> Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.	
<b>Topics for self study( If any)</b>	<b>Self Study</b> Chapter.4 Laws of Motion: Newton’s Laws of motion. Dynamics of single and a system of particles. Centre of mass. Ref: 1-4,9,10	
<b>Suggested Activities</b>		
<b>Activity No. 1</b>	1. i). Students can measure diameters of small balls of different size and estimate their volumes. 2. ii). Students can measure lengths of nails of different size. iii). Students can measure volume of a liquid iv). Students can measure distances and put the result both in CGS and SI units in 2, 3 and 4 significant figures. Ask them to mention the precession of the measurement. v). students can estimate standard deviations wherever possible.	
<b>Activity No. 2</b>	Students can try and understand conservation of energy in every day examples. For example: i) What happens in solar conservation panels ii) Pushing an object on the table it moves iii) Moving car hits a parked car causes parked car to move. In these cases, energy is conserved. How? Understand and verify if possible.	
<b>Unit – 2</b>		
<b>Chapter No. 4.</b>	<b>Laws of Motion:</b> Newton’s Laws of motion. Dynamics of single and a system of particles. Centre of mass.	(13)
<b>Chapter No. 5.</b>	<b>Dynamics of Rigid bodies:</b> Rotational motion about an axis, Relation between torque and angular momentum, Rotational energy. moment of inertia: M I of a rectangular Lamina and solid cylinders. Flywheel, Theory of compound pendulum and determination of g.	
<b>Chapter No. 6.</b>	<b>Gravitation:</b> Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler’s laws (statements). Satellite in a circular orbit.	

<b>Topics for self study( If any)</b>	<b>Chapter 7:</b> Geosynchronous orbits. Basic idea of global positioning system (GPS). Ref: 1-4,9,10	
	<b>Suggested Activities</b>	
<b>Activity No. 3</b>	<p>Activity: Moment of inertia is an abstract concept. It simply gives a measure of rotational inertia of a rigid body and it is proportional to the product of the square of radius, r of the body and its mass, m. Students by referring to websites, can construct and perform simple experiments to verify that <math>MI \propto mr^2</math>.</p> <p>Reference : <a href="http://www.khanacademy.org">www.khanacademy.org</a>, <a href="http://www.pinterest.com">www.pinterest.com</a>, <a href="http://www.serc.cerleton.edu">www.serc.cerleton.edu</a></p>	
<b>Activity No. 4</b>	<p>Activity: Prepare suitable charts and give seminar talks in the class.</p>	

### Unit - 3

<b>Chapter No. 8</b>	<p><b>Elasticity:</b> Hooke's law - Stress-strain diagram, elastic moduli-relation between elastic constants, Poisson's Ratio-expression for Poisson's ratio in terms of elastic constants. Work done in stretching and work done in twisting a wire-Twisting couple on a cylinder. Torsional pendulum-Determination of rigidity modulus and moment of inertia - <math>q</math>, <math>\eta</math> and <math>\sigma</math> by Searle's method</p>	(13)
	<b>Suggested Activities</b>	
<b>Activity No. 5</b>	<p><b>Activity:</b> Arrange a steel spring with its top fixed with a rigid support on a wall and a meter scale along side. Add 100 g load at a time on the bottom of the hanger in steps. This means that while putting each 100g load, we are increasing the stretching force by 1N. Measure the extension for loads up to 500g. Plot a graph of extension versus load. Shape of the graph should be a straight line indicating that the ratio of load to extension is constant. Go for higher loads and find out elastic limit of the material.</p>	
<b>Activity No.6</b>	<p><b>Activity:</b> Repeat the above experiment with rubber and other materials and find out what happens after exceeding elastic limit. Plot and interpret.</p>	

<b>Unit - 4</b>		
<b>Chapter No. 9</b>	<b>Surface tension:</b> Definition of surface tension. Surface energy, relation between surface tension and surface energy, pressure difference across curved surface example, excess pressure inside spherical liquid drop, angle of contact.	(13)
<b>Chapter No. 11</b>	<b>Viscosity:</b> Streamline flow, turbulent flow, equation of continuity, determination of coefficient of viscosity by Poissulle’s method, Stoke’s method. Problems.	
<b>Topics for self study( If any)</b>	Capillarity determination of surface tension by drop weight method. Ref: 6,7,9,10	
<b>Suggested Activities</b>		
<b>Activity No.7</b>	<p>1. Measure surface tension of water and other common liquids and compare and learn</p> <p>i) Why water has high ST? think of reasons.</p> <p>ii) Check whether ST is a function of temperature? You can do it by heating the water to different temperatures and measure ST.</p> <p>iii) Plot ST versus T and learn how it behaves.</p> <p>Mix some quantity of kerosene or any oil to water and measure ST. Check whether ST for the mixture is more or less than pure water. List the reasons.</p>	
<b>Activity No. 8</b>	<p>Activity:</p> <p>2. Collect a set of different liquids and measure their viscosity.</p> <p>i) Find out whether sticky or non-sticky liquids are most viscous. List the reasons.</p> <p>ii) Mix non sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out viscosity is increasing or decreasing with increase of non-sticky liquid concentration.</p> <p>iii) Do the above experiment by mixing sticky liquid to the non sticky liquid. Find out change in viscosity with increase of concentration of sticky liquid.</p> <p>List the applications where concept of Viscosity plays a dominant role</p>	

#### Text Books:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Mechanics by, New Eition	D. S. Mathur	S.Chand & Co.	2000
2	Mechancis and Relativity by 3 <sup>rd</sup> Edition,	Vidwan Singh Soni,	PHI Learning Pvt. Ltd.	
3	Mechanics Berkeley Physics Course, Vol.1:	Charles Kittel, <i>et.al.</i>	Tata McGraw-Hill	2007
4	Properties of Matter	Brijlal & Subramanyam.		

## References Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics. 9 <sup>th</sup> Edn,	Resnick, Halliday & Walter,	Wiley	2010
2	Physics Vol-I	Halliday and Resnick,		

### List of Experiments to be performed in the Laboratory:

1.	Determination of g using bar pendulum (L versus T and L versus $LT^2$ graphs).
2.	Determination of moment of inertia of a Fly Wheel.
3.	Determination of rigidity modulus using torsional pendulum.
4.	Modulus of rigidity of a rod – Static torsion method.
5.	Determination of elastic constants of a wire by Searle's method.
6.	Young's modulus by Koenig's method.
7.	Viscosity by Stoke's method.
8.	Verification of Hook's law.
9.	Determination of surface tension of a liquid and the interfacial tension between two liquids using drop weight method.
10.	Study of motion of a spring and to calculate Spring constant, g and unknown mass.
11.	Determination of Young's modulus of a bar by the single cantilever method.
12.	Determination of Young's modulus of a bar by uniform bending method.
13.	Radius of capillary tube by mercury pellet method.
14	Verification of parallel and perpendicular axis theorems.

(Minimum EIGHT experiments have to be carried out)

### Reference Book for Laboratory Experiments

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics through experiments	B.Saraf	Vikas Publications	2013
2	A lab manual of Physics for undergraduate classes, 1 <sup>st</sup> Edition,		Vikas Publications.	
3	BSc Practical Physics Revised Ed	CL Arora	S.Chand & Co.	2007
4	An advanced course in practical physics.	D. Chatopadhyay, PC Rakshit, B.Saha	New Central Book Agency Pvt Ltd.	2002

## Semester – II

# Detailed Syllabus of II Semester Physics

## Electricity & Magnetism

Course Title: Electricity and Magnetism	Course Credits: 4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors:	Physics Expert Committee

### Programme Outcomes

1. Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
2. Problem solving: Execute a solution process using first principles of science to solve problems related to respective discipline.
3. Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. Ethics: Apply the professional ethics and norms in respective discipline.
5. Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.
6. Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

#### Program Outcomes (POs)

Course Outcomes (COs)	1	2	3	4	5	6
i. Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.	x	x				
ii. Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.	x					
iii. Apply Gauss's law of electrostatics to solve a variety of problems.	x	x			x	
iv. Describe the magnetic field produced by magnetic dipoles and electric currents.	x					

v. Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.	x					
vi. Describe how magnetism is produced and list examples where its effects are observed.	x				x	x
vii. Apply Kirchhoff's rules to analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.	x	x			x	x
viii. Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, • Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.	x	x			x	x

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

<b>Electricity &amp; Magnetism</b>		<b>Hrs</b>
<b>Unit – 1</b>		
<b>Chapter No. 1</b>	<b>Topics to be covered/taught/learnt:</b> Electric charge and field Coulomb's law, electric field strength, electric field lines, point charge in an electric field and electric dipole, work done by a charge (derivation of the expression for potential energy)	3
<b>Chapter No. 2</b>	<b>Topics to be Covered</b> Gauss's law and its applications (electric fields of a (i) spherical charge distribution, (ii) line charge and (iii) an infinite flat sheet of charge).	3
<b>Chapter No. 3</b>	<b>Topics to be Covered</b> Electric potential, line integral, gradient of a scalar function, relation between field and potential. Potential due to point charge and distribution of charges (Examples: potential associated with a spherical charge distribution, infinite line charge distribution, infinite plane sheet of charges). Constant potential surfaces, Potential due to a dipole and electric quadrupole.	7
<b>Topics for self study( If any)</b>	<i>Constant potential surfaces - for self learning</i> <i>Work out problems listed in the reference</i>	
<b>Suggested Activities</b>		



<b>Activity No. 1</b>	<ol style="list-style-type: none"> <li>Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries.</li> <li>A small project report on production of electricity as a source of energy: Different methods</li> </ol>	
<b>Activity No. 2</b>	<ol style="list-style-type: none"> <li>Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire.</li> <li>Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures</li> </ol>	
<b>Unit – 2</b>		
<b>Chapter No. 4.</b>	<b>Topics to be covered</b> Conductors in electrostatic field Conductors and insulators, conductors in electric field. Capacitance and capacitors, calculating capacitance in a parallel plate capacitor, parallel plate capacitor with dielectric, dielectrics: an atomic view. Energy stored in a capacitor, Dielectric and Gauss's law.	6
<b>Chapter No. 5.</b>	<b>Topics to be covered</b> Electric currents and current density. Electrical conductivity and Ohm's law. Physics of electrical conduction, conduction in metals and semiconductors, circuits and circuit elements: Variable currents in capacitor circuits, Resistor, inductor and capacitor and their combination. force on a moving charge.	7
<b>Topics for self study( If any)</b>	<i>Currents and voltage in combination of R, L and C circuits</i>	
<b>Suggested Activities</b>		
<b>Activity No. 3</b>	<ol style="list-style-type: none"> <li>Learn about electrical appliances which work with AC and DC electricity</li> <li>Learn about types of resistors and their colour codes and types of capacitors(electrolytic and non-electrolytic)</li> </ol>	
<b>Activity No. 4</b>	<ol style="list-style-type: none"> <li>Learn about power transmission: 3-phase electricity, voltage and phase</li> <li>Visit a nearby electrical power station. Interact with line men, Electrical engineers and managers. Discuss about power loss in transmission. How to reduce it?</li> <li>Prepare a small project report on street lighting and types of electrical bulbs.</li> </ol>	

### Unit – 3

<b>Chapter No.6</b>	<b>Topics to be covered</b> Magnetism Definition of magnetic field, Ampere’s law and Biot-Savart law (magnetic force and magnetic flux), Magnetic force on a current carrying conductor, Hall effect. Electromagnetic induction, conducting rod moving in a magnetic field, law of induction and mutual inductance, self inductance and energy stored in a magnetic field.	7
<b>Chapter No. 7</b>	<b>Topics to be covered</b> Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.	6
<b>Topics for self study( If any)</b>	Hall Effect	
<b>Suggested Activities</b>		
<b>Activity No. 5</b>	<b>Activity:</b> 1. Prepare a small project report on street lighting and types of electrical bulbs. 2. Learn the measurement of electric current using tangent galvanometer.	
<b>Activity No.6</b>	<b>Activity:</b> Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.	
<b>Unit - 4</b>		
<b>Chapter No. 8</b>	Electromagnetic waves: Equation of continuity, Maxwell’s equations, displacement current, electromagnetic wave, energy transported by electromagnetic waves. Electromagnetic waves in different frames of reference, Field of a current loop, magnetic moment, Electric current in atoms, electron spin and magnetic moment, magnetization and magnetic susceptibility.	8
<b>Chapter No. 9</b>	<b>Topics to be covered:</b> Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.	5
<b>Topics for self study( If any)</b>	<i>B-H curves and its characteristics</i> <i>Ferrites</i>	

	<b>Suggested Activities</b>	
<b>Activity No.7</b>	<b>Activity:</b> <ol style="list-style-type: none"> <li>1. Prepare a small project report on production of magnetic field: Permanent magnets, electromagnets and superconducting magnets.</li> <li>2. Learn the principle of working of a Gauss meter to measure magnetic field</li> </ol>	
<b>Activity No. 8</b>	<b>Activity:</b> <ol style="list-style-type: none"> <li>1. Model the earth's magnetic field with a diagram. Explain the effect of tilt of the earth's axis and reasons for the change in the tilt of the earth's axis over thousands of years.</li> </ol>	

### References Books:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics-Part-II,	David Halliday and Robert Resnick	Wiley Eastern Limited	2001
2	Berkeley Physics Course, Vol-2, Electricity and Magnetism, Special Edition	Edward M Purcell	Tata Mc Graw-Hill Publishing Company Ltd, New Delhi	2008

### List of Experiments to be performed in the Laboratory

1.	Experiments on tracing of electric and magnetic flux lines for standard configuration.
2.	Determination of components of earth's magnetic field using a Ballistic galvanometer.
3.	Determination of capacitance of a condenser using B.G.
4.	Determination of high resistance by leakage using B.G.
5.	Determination of mutual inductance using BG.
6.	Charging and discharging of a capacitor (energy dissipated during charging and time constant measurements).
7.	Series and parallel resonance circuits (LCR circuits).
8.	Impedance of series RC circuits- determination of frequency of AC.
9.	Study the characteristics of a series RC and RL Circuit.
10.	Determination of self-inductance of a coil.
11.	Verification of laws of combination of capacitances and determination of unknown capacitance using de - Sauty bridge.
12.	Determination of $B_H$ using Helmholtz double coil galvanometer and potentiometer.

(Minimum EIGHT experiments have to be carried out)

## Semester – III

# Detailed Syllabus of III Semester Physics

<b>Program Outcomes:</b>	
1.	Disciplinary knowledge
2.	Communication Skills
3.	Critical thinking, Reflective thinking, Analytical reasoning, Scientific reasoning
4.	Problem-solving
5.	Research-related skills
6.	Cooperation/ Teamwork/ Leadership readiness/Qualities
7.	Information/ Digital literacy/Modern Tool Usage
8.	Environment and Sustainability
9.	Multicultural competence
10.	Multi-Disciplinary
11.	Moral and ethical awareness/Reasoning
12.	Lifelong learning / Self Directed Learning

<b>Course Content Semester -III</b> <b>Wave Motion and Optics</b>	
Course Title: Wave Motion and Optics	Course Credits:4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	

<b>Prerequisites</b>	
<b>i.</b>	Fundamentals of waves

## Course Learning Outcomes

**At the end of the course students will be able to:**

<b>i.</b>	Identify different types of waves by looking into their characteristics.
<b>ii.</b>	Formulate a wave equation and obtain the expression for different parameters associated with waves.
<b>iii.</b>	Explain and give a mathematical treatment of the superposition of waves under different conditions, such as, when they overlap linearly and perpendicularly with equal or different frequencies and equal or different phases.
<b>iv.</b>	Describe the formation of standing waves and how the energy is transferred along the standing wave in different applications, and mathematically model in the case of stretched string and vibration of a rod.
<b>v.</b>	Give an analytical treatment of resonance in the case of open and closed pipes in general and Helmholtz resonators in particular.
<b>vi.</b>	Describe the different parameters that affect the acoustics in a building, measure it and control it.
<b>vii.</b>	Give the different models of light propagation and phenomenon associated and measure the parameters like the wavelength of light using experiments like Michelson interferometer, interference and thin films.
<b>viii.</b>	Explain diffraction due to different objects like singles slit, two slits, diffraction of grating, oblique incidence, circular aperture and give the theory and experimental setup for the same.
<b>ix.</b>	Explain the polarization of light and obtain how the polarization occurs due to quarter wave plates, half wave plates, and through the optical activity of a medium.

## Course Articulation Matrix

### Mapping of Course Outcomes (CO) Program Outcomes

Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
<b>i.</b> Identify different types of waves by looking into their characteristics.	X	X	X	X	X	X					X	X
<b>ii.</b> Formulate a wave equation and obtain the expression for different parameters associated with waves.	X	X	X	X	X	X					X	X

<b>iii.</b>	Explain and give a mathematical treatment of the superposition of waves under different conditions such as when they overlap linearly and perpendicularly	X	X	X	X	X	X						X	X
	with equal or different frequencies and equal or different phases.													
<b>iv.</b>	Describe the formation of standing waves and how the energy is transferred along the standing wave in different applications, and mathematically model in the case of stretched string and vibration of a rod.	X	X	X	X	X	X						X	X
<b>v.</b>	Give an analytical treatment of resonance in the case of open and closed pipes in general and Helmholtz resonators in particular.	X	X	X	X	X	X						X	X
<b>vi.</b>	Describe the different parameters that affect the acoustics in a building, measure it and control it.	X	X	X	X	X	X						X	X
<b>vii.</b>	Give the different models of light propagation and phenomenon associated and measure the parameters like the wavelength of light using experiments like Michelson interferometer, interference and thin films.	X	X	X	X	X	X						X	X
<b>viii.</b>	Explain diffraction due to different objects like singles slit, two slits, diffraction grating, oblique incidence, circular aperture and give the theory and experimental setup for the same.	X	X	X	X	X	X						X	X
<b>ix.</b>	Explain the polarization of light and obtain how the polarization occurs due to quarter wave plates, half wave plates, and through the optical activity of a medium.	X	X	X	X	X	X						X	X

## Wave Motion and Optics

### Unit – 1 - Waves and Superposition of Harmonic Waves

#### The Portion to be Covered

**Waves:** Plane and Spherical Waves. Longitudinal and Transverse Waves. Characteristics of wave motion, Plane Progressive (Travelling) Wave and its equation, Wave Equation – Differential form (derivation). Particle and Wave Velocities: Relation between them, Energy Transport – Expression for intensity of progressive wave, Newton’s Formula for Velocity of Sound. Laplace’s Correction (Derivation). Brief account of Ripple and Gravity Waves. **(Text Book : 1-4) (5 Hours)**

**Superposition of Harmonic Waves :** Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats) – Analytical treatment. Superposition of two perpendicular Harmonic Oscillations: Lissajous Figures with equal and unequal frequency- Analytical treatment. Uses of Lissajous’ figures. **(Text Book : 1-4) (6 Hours)**

#### Topic Learning Outcomes

At the end of the topic, students should be able to:

SL No	TLO's	B L	CO	PO
i.	Explain the difference between plane and spherical waves, longitudinal and transverse waves and give their characteristics.	L2	1	1-6, 11-12
ii.	Write down an equation for the progressive wave in its differential form.	L2	1	1-6, 11-12
iii.	Obtain the relation between particle and wave velocity.	L2	1	1-6, 11-12
iv.	Obtain an expression for intensity of progressive waves.	L2	1	1-6, 11-12
v.	Obtain Newton's formula for the velocity of sound and discuss the factors for which sound velocity is dependent.	L2	2	1-6, 11-12
vi.	Apply the Laplace’s correction to the equation of motion of a progressive wave.	L2	2	1-6, 11-12
vii.	With examples explain ripple and gravity waves.	L1	2	1-6, 11-12
viii.	Give the theory of superposition of two linear waves having equal frequencies and different frequencies.	L2	3	1-6, 11-12
ix.	Discuss the formation of different Lissajous figures under different conditions of amplitude and frequency when they superimpose perpendicularly.	L2	3	1-6, 11-12
x.	Give some applications of an Lissajous figures.	L1	3	1-6, 11-12
xi.	Higher order problems.	L3	1,2,3	1-6, 11-12

#### Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

### Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

### Suggested Activities (2 Hours)

<b>Activity No. 1</b>	<p>We know that sound is produced because of vibration. Look into at least 10 musical instruments and identify the regions of vibrations that produces the sound and those parts which enhances the sound because of reverberation.</p> <ol style="list-style-type: none"> <li>1. Identify one common element in all of these.</li> <li>2. Identify equipment which creates beats and try to explain the underlying basic principles. Demonstrate the examples of beats using two tuning forks.</li> <li>3. Identify what will happen when you drop a stone in a standing water, and when your drop two stones side by side.</li> <li>4. Make your observations sketch them and comment on it in a report.</li> </ol>
<b>Activity No. 2</b>	<p>Draw two sine waves (Amplitude vs time) one shifted with other in phase. Identity where the resonance occurs for each phase shift. Plot phase vs time taken for resonance.</p>
<b>Activity No. 3</b>	<p>Take smooth sand, place a pointed edged pen vertically on the sand. To the mid of the pen, connect two perpendicular threads. Pull these perpendicular threads by varying the forces and timings. Note down the different shapes produced on the sand. Try to interpret the shapes. Make a report of it</p>
<b>Activity No. 4</b>	<p>Hang a pot with sand, which has a hole in the bottom. Gently pull the pot on one side and observe the pattern formed by the sand on the floor. Report the observations.</p>
<b>Activity No. 5</b>	<p>Design a coupled pendulum. Study the impact of the motion of one pendulum over the other pendulum by varying the length, direction of the motion of one pendulum and mass of pendulum and observe the resultant changes. Trace the path of the bobs and make a report.</p>
<b>Activity No. 6</b>	<p><b>Note for the teachers for the activity:</b> Make 3 groups among students and assign each group the activity of drawing one of the 3 graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation,</p>



	<p>teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <ol style="list-style-type: none"> <li>1. The first slide will explain the process of doing the experiment.</li> <li>2. In the second slide. Students will show the graph of measurement.</li> <li>3. In the third slide, they will list three observations from that study.</li> </ol> <p><b>Activity:</b> Take a stretched spring. Stretch it across two edges. Put a weight on the string, pluck it and measure the amplitude of the vibration. All group will measure the total damping time of oscillating spring. (Using mobile or scale) And plot a graph of the-</p> <ol style="list-style-type: none"> <li>1. Varying load on the spring and amplitude at the centre.</li> <li>2. Take another weight and put that in another place and measure the amplitude of vibration at the centre.</li> <li>3. Vary the load in the centre of the spring and measure the amplitude at the centre.</li> </ol>
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<b>Wave Motion and Optics</b>				
<b>Unit – 2 - Standing Waves and Acoustics</b>				
<b>The Portion to be Covered</b>				
<p><b>Standing Waves :</b> Velocity of transverse waves along a stretched string (derivation), Standing (Stationary) Waves in a String - Fixed and Free Ends (qualitative). Theory of Normal modes of vibration in a stretched string, Energy density and energy transport of a transverse wave along a stretched string. Vibrations in rods – longitudinal and transverse modes (qualitative). Velocity of Longitudinal Waves in gases (derivation). Normal Modes of vibrations in Open and Closed Pipes – Analytical treatment. Concept of Resonance, Theory of Helmholtz resonator. <b>(Text Book : 1-4) (8 Hours)</b></p> <p><b>Acoustics:</b> Absorption coefficient, Reverberation and Reverberation time, Sabine’s Reverberation formula (derivation), Factors affecting acoustics in buildings, Requisites for good acoustics. Acoustic measurements – intensity and pressure levels. <b>(Text Book : 1-4) (3 Hours)</b></p>				
<b>Topic Learning Outcomes</b>				
<b>At the end of the topic, students should be able to:</b>				
SL No	TLO's	B L	CO	PO
i.	Discuss the Transverse waves produced in stretched string and obtain the expression for the same.	L2	3	1-6, 11-12

ii.	Give a qualitative treatment of vibration of a string when it's both ends are fixed and free.	L2	3	1-6, 11-12
iii.	Explain normal modes of a stretched string. Obtain an expression for the energy density and discuss how this energy is transported along a stretched string.	L2	3	1-6, 11-12
iv.	Quantitatively bring about the mode of vibrations created in a rod.	L2	4	1-6, 11-12
v.	Explain types of waves that are produced in gas. Obtain an expression for the same.	L2	4	1-6, 11-12
vi.	With an analytical treatment explain the concept of resonance using the normal modes of vibrations of open and closed pipes.	L2	5	1-6, 11-12
vii.	Give the theory of Helmholtz resonator and explain how it is used to calculate some parameters of the way the standing waves are set in there.	L2	5	1-6, 11-12
viii.	Define Reverberation, Reverberation time and absorption coefficient of a material.	L1	5	1-6, 11-12
ix.	Obtain Sabine's Reverberation formula and discuss what are the factors on which the Reverberation time depends on?	L2	5	1-6, 11-12
x.	List out which are different parameters within a building which effects the acoustics.	L1	6	1-6, 11-12
xi.	Explain what good acoustics of a building are and how acoustics is measured in terms of intensity and pressure inside a building.	L2	6	1-6, 11-12
xii.	Higher order problems.	L3	4,5,6	1-6, 11-12

### **Teaching and Learning Methodology**

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

### **Formative Assessment Techniques**

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc.

**Suggested Activities (2 Hours)**

<b>Activity No. 7</b>	List different phenomenon where standing waves are found in nature. Identify the phenomena and reason for standing waves. Also identify the standing waves in musical instruments. Make a report.
<b>Activity No. 8</b>	<ol style="list-style-type: none"> <li>1. Go to 5 different newly constructed houses when they are not occupied and when they are occupied. Make your observations on sound profile on each room. Give the reasons. Make a report.</li> <li>2. Visit three very good auditoriums, list out different ways in which the acoustic arrangements have been done (as decoration and Civil works). Look for the reasons in Google and identify which is acoustically the best auditorium among the three you visited. Make a report.</li> </ol>
<b>Activity No. 9</b>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. On the specific day, each group has to make a ppt presentation of the following three slides. On the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <ol style="list-style-type: none"> <li>1. The first slide will explain the process of doing the experiment.</li> <li>2. In the second slide. Students will show the graph of measurement.</li> <li>3. In the third slide, they will list three observations from that study.</li> </ol> <p><b>Activity:</b> Take a bowl of different liquids (water, milk, kerosene, salt water, Potassium Permanganate (KMNO<sub>4</sub>) solution. Place a small non oily floating material (ex: thin plastic) on the surface of the liquid. Drop a marble on the liquid at the centre of the bowl. Repeat the experiment by dropping the marble from the different heights. Plot a graph of-</p> <ol style="list-style-type: none"> <li>1. Height v/s time of oscillation</li> <li>2. Weight of the marble v/s time of oscillation</li> </ol>

<b>Activity No. 10</b>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. On the specific day, each group has to make a ppt presentation of the following three slides. On the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <ol style="list-style-type: none"> <li>1. The first slide will explain the process of doing the experiment.</li> <li>2. In the second slide. Students will show the graph of measurement.</li> <li>3. In the third slide, they will list three observations from that study.</li> </ol>
	<p><b>Activity:</b> Take two marbles of same weight. Drop both the marbles on the surface of the liquid from some height. With the help of the mobile take the picture and measure the position of interface of two wave fronts formed in the liquid. Plot graphs for different activities by doing the following activities.</p> <ol style="list-style-type: none"> <li>1. By dropping two marbles of same weight from different heights.</li> <li>2. By dropping two marbles of different weight from the same height</li> </ol>

## Wave Motion and Optics

### Unit – 3 - Nature of light and Interference

#### The Portion to be Covered

**Nature of light :** To Determine wavelength of light, distances and shapes using Michelson interferometer. The corpuscular model of light-The wave model - Maxwells electromagnetic waves-Wave Particle Duality (**Text Book No 5; Sections 2.1 to 2.4 and 2.8) (2 Hours)**

**Interference of light by division of wave front:** Huygen’s theory-Concept of wave-front-Interference pattern produced on the surface of water-Coherence-Interference of light waves by division of wave- front- Young’s double slit experiment- derivation of expression for fringe width-Fresnel Biprism- Interference with white light (Text Book No 5; Sections 12.1 to 12.2, 14.1 to 14.5, 14.7 to 14.9) (**4 Hours)**

**Interference of light by division of amplitude:** Interference by division of amplitude-Interference by a plane parallel film illuminated by a plane wave-Interference by a film with two non-parallel reflecting surfaces- color of thin films—Newton’s rings-(Reflected light)-Michelson Interferometer- Determination of wavelength of light\* (Text Book No 5; Sections 15.1 to 15.2, 15.8 to 15.11) (**5 Hours)**

#### Topic Learning Outcomes

At the end of the topic, students should be able to:

SL No	TLO	BL	CO	PO
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	's			
<b>i.</b>	Explain using Michelson interferometer how to determine the wavelength of light.	L2	7	1-6, 11-12
<b>ii.</b>	Give an account of the different possible shapes that are obtained in Michelson interferometer experiment and their relevance.	L2	7	1-6, 11-12
<b>iii.</b>	Discuss the wave model and the Corpuscular model of light.	L2	7	1-6, 11-12
<b>iv.</b>	Explain Maxwells electromagnetic waves.	L2	7	1-6, 11-12
<b>v.</b>	Give an account of the phenomenon of wave-particle duality.	L1	7	1-6, 11-12
<b>vi.</b>	Give the Huygen theory of wave-front.	L1	7	1-6, 11-12
<b>vii.</b>	Define Interference. Give some examples of Interference.	L1	7	1-6, 11-12
<b>viii.</b>	Give the theory of interference due to two coherent sources of light and obtain an expression for the wavelength of monochromatic source of light (Young's double slit experiment)	L 2	7	1-6, 11-12
<b>ix.</b>	Explain how using personal biprism, a monochromatic coherent source of light are obtained. Using this experimental setup explain how the wavelength of monochromatic sources of light is determined.	L 2	7	1-6, 11-12
<b>x.</b>	Give the theory of interference due to division of amplitude by parallel and non-parallel plates.	L 1	7	1-6, 11-12
<b>xi.</b>	Explain how Newton's rings are obtained and discuss how the wavelength of light is determined using this experiment.	L 2	7	1-6, 11-12
<b>xii.</b>	Higher order problems.	L 3	7	1-6, 11-12

### **Teaching and Learning Methodology**

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

### **Formative Assessment Techniques**

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

<b>Suggested Activities (2 Hours)</b>	
<b>Activity No. 11</b>	In the table given below explore which phenomenon can be explained by what and Make a report.
<b>Activity No. 12</b>	Why colour strips are seen in paddles on roads in rainy seasons try to simulate the same. Give the reasons. Make a report.
<b>Activity No. 13</b>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <ol style="list-style-type: none"> <li>1. The first slide will explain the process of doing the experiment.</li> <li>2. In the second slide. Students will show the graph of measurement.</li> <li>3. In the third slide, they will list three observations from that study.</li> </ol> <p><b>Activity:</b> Take a bowl of different liquids (water, milk, kerosene, salt water, Potassium Permanganate (KMNO<sub>4</sub>) solution. Place a small non oily floating material (ex: thin plastic) on the surface of the liquid. Drop two marbles of same weight (mass) from the same height on to the surface of the water but at the different time intervals. Plot graph for the different observations.</p> <p><b>For teachers:</b> Demonstrate the formation of Lissajous Figure using a CRO. Give different shapes of Lissajous Figure with varying frequency and amplitude. Ask the students to comment on the observations.</p>

## Wave Motion and Optics

### Unit – 4 - Diffraction and Polarisation

#### The Portion to be Covered

**Fraunhofer diffraction** : Introduction- Fraunhofer diffraction- Single slit diffraction pattern-position of Maxima and Minima (Qualitative arguments)- Two slit diffraction pattern-position of Maxima and minima- Theory of plane diffraction Grating-Grating spectrum- normal and oblique incidence-Resolving power and dispersive power of a grating Single slit; Double Slit. Multiple slits & Diffraction grating. (Text Book No 5; Sections 18.1 to 18.2, 18.6,18.8 to 18.9) **(4 Hours)**

**Fresnel Diffraction**- Fresnel half period zones-Diffraction by a circular aperture-diffraction by an opaque disc-The zone plate -comparison between zone plate and convex lens. (Text Book No 5; Sections 20.1 to 20.3) **(3 Hours)**

**Polarisation**: Introduction-Production of polarized light- The wire Grid polarizer and Polaroid-Superposition of two disturbances-Phenomenon of double refraction-Quarter wave plates and half wave plates- Analysis of polarized light-optical activity. (Text Book No 5; Sections 22.1, 22.3,22.4,22.6 to 22.8) **(4 Hours)**

**Topic Learning Outcomes**

**At the end of the topic, students should be able to:**

SL No	TLO 's	BL	CO	PO
i.	Define Fraunhofer diffraction.	L2	8	1-6, 11-12
ii.	Give a qualitative treatment of single slit/diffraction double slit diffraction.	L2	8	1-6, 11-12
iii.	Explain the theory of diffraction due to grating and the normal and oblique incidence.	L2	8	1-6, 11-12
iv.	Explain how the resolving power of a grating depends of the number of slits used.	L2	8	1-6, 11-12
v.	Give the theory of Fersnel half period zones.	L2	8	1-6, 11-12
vi.	Discuss zone plates with respect to convex lenses.	L2	8	1-6, 11-12
vii.	Explain optical polarization and polaroids.	L2	9	1-6, 11-12
viii.	Give different types of polaroids.	L2	9	1-6, 11-12
ix.	Give the theory of phenomenon of double refraction and explain what are ordinary and extraordinary rays.	L2	9	1-6, 11-12
x.	Give the theory of quarter wave plates and half wave plates.	L2	9	1-6, 11-12
xi.	Explain optical activity with theory. Give an experimental method to measure the optical activity of a material.	L2	9	1-6, 11-12
xii.	Higher order problems.	L3	8,9	1-6, 11-12

**Teaching and Learning  
Methodology**

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

### Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

### Suggested Activities (2 Hours)

<b>Activity No. 14</b>	<p>Explain polarization of light through a chart. List out the surfaces that reflect polarized light. Learn how polarization of light can be done by both transmission and reflection. Perform an experiment and make a report.</p> <p>USING CDs AND DVDs AS DIFFRACTION Gratings Ref:<a href="https://www.nmin.org/sites/default/files/files/Karen_Rama_USING_CDs_AND_DVDs_AS_DIFFRACTION GRATINGS_0.pdf">https://www.nmin.org/sites/default/files/files/Karen_Rama_USING_CDs_AND_DVDs_AS_DIFFRACTION GRATINGS_0.pdf</a></p> <p>Obtain the diffraction spectra using a CD and design an experiment to find the distance between the tracks on it)</p> <p>(Ref: <a href="https://www.brighthubeducation.com/science-lessons-grades-9-12/39347-diffraction-experiment-measuring-groove-spacing-on-cds/">https://www.brighthubeducation.com/science-lessons-grades-9-12/39347-diffraction-experiment-measuring-groove-spacing-on-cds/</a>, <a href="https://silo.tips/download/diffraction-from-a-compact-disk">https://silo.tips/download/diffraction-from-a-compact-disk</a>)</p>
<b>Activity No. 15</b>	<p>What is the physics behind making 3D movies? Group Discussion (<a href="https://www.slideserve.com/rae/physics-behind-3d-movies-powerpoint-ppt-presentation">https://www.slideserve.com/rae/physics-behind-3d-movies-powerpoint-ppt-presentation</a>) Make a report.</p>
<b>Activity No. 16</b>	<p>List out different types of zone plates and look for their applications in day to day life. Make a report.</p>
<b>Activity No. 17</b>	<p>Collect information and study how optically polarizing lenses are made. Visit a nearby lens making facility. Learn the principle behind sunglasses. Make a report.</p>
<b>Activity No. 18</b>	<p><b>Note for the teachers for the activity:</b> Make 3 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <p>1. The first slide will explain the process of doing the experiment.</p>



	<p>2. In the second slide. Students will show the graph of measurement.</p> <p>3. In the third slide, they will list three observations from that study.</p> <p><b>Activity:</b> Identify any 3 sharp edges of varying thickness and assign them to 3 groups. Shine a laser light pointing towards the edge of the needle. Observe the patterns formed on the wall or screen and measure the distance between the bands. Correlate the distance between the bands formed with the thickness of the edge and the distance from the edge to the screen. By this, calculate the wavelength of the laser light used.</p>
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### Textbook S

SI No	Title of the Book	Authors Name	Publisher	Year of Publication
1.	The Physics of Waves and Oscillations,	N K Bajaj	Tata McGraw-Hill Publishing Company Ltd., Second Edition,	1984
2.	Waves and Oscillations	N Subramanyam and Brij Lal	Vikas Publishing House Pvt. Ltd., Second Revised Edition	2010
3.	A Text Book of Sound	D R Khanna and R S Bedi	Atma Ram & Sons, Third Edition	1952
4.	Oscillations and Waves	Satya Prakash	Pragathi Prakashan, Meerut, Second Edition	2003
5.	Optics	Ajoy Ghatak	McGraw Hill Education (India) Pvt Ltd	2017
6.	A text Book of Optics	Brij Lal, M N Avadhanulu & N Subrahmanyam	S. Chand Publishing	2012

### References Books

SI No	Title of the Book	Authors Name	Publisher	Year of Publication
1.	Berkeley Physics Course – Waves,	Frank S Crawford Jr.	Tata Mc Graw-Hill Publishing Company Ltd., Special Indian Edition,.	2011

2.	Optics	Eugene <i>Hecht</i>	Pearson Paperback	2019
3.	Introduction To Optics	Pedrotti and Frank L ,	Pearson India	3rd Edition
4.	Fundamentals of Optics	Francis Jenkins Harvey White	McGraw Hill Education	2017

<b>Formative Assessment</b>	
<b>Assessment</b>	<b>Mark s</b>
Internal Assessment	10
Activity	10
REU based Group Activity (Conduct, Report, Presentation)	10
Science Communication Seminar/Poster etc.)	10
<b>Total</b>	<b>40</b>

<b>List of Experiments to be performed in the Laboratory</b> (Minimum 8 experiments are to be conducted)	
1.	Velocity of sound through a wire using Sonometer.
2.	Frequency of AC using Sonometer.
3.	Study of Lissajous' Figures
4.	To verify the laws of transverse vibration using Melde's apparatus.
5.	Helmholtz resonator using tuning fork.
6.	Helmholtz resonator using electrical signal generator.
7.	To determine refractive index of the Material of a prism using sodium source.
8.	To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
9.	To determine the wavelength of sodium source using Michelson's interferometer.
10.	To determine wavelength of sodium light using Fresnel Biprism.
11.	To determine wavelength of sodium light using Newton's Rings
12.	To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
13.	To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
14.	To determine dispersive power and resolving power of a plane diffraction grating.

<b>Reference Book for Laboratory Experiments</b>				
Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1.	Advanced Practical Physics for students	B.L. Flint and H.T. Worsnop	Asia Publishing House.	1971
2.	A Text Book of Practical Physics	I. Prakash & Ramakrishna	Kitab Mahal, 11 <sup>th</sup> Edition	2011
3.	Advanced level Physics Practicals	Michael Nelson and Jon M. Ogborn	Heinemann Educational Publishers, 4 <sup>th</sup> Edition	1985
4.	A Laboratory Manual of Physics for undergraduate classes	D.P.Khandelwal	Vani Publications.	1985

**Open Elective : OPTICAL INSTRUMENTS (III SEM)**

**Time: 3 hrs./week**

**Max Marks: 60**

Unit 1.	<p><b>Basics of Optics</b> Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin), convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation.</p> <p>Focal and nodal points, focal length, image formation, combination of lenses,</p>	13
	<p>dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation.</p> <p>(Expressions need not be derived, but have to be discussed qualitatively).</p>	
Unit 2.	<p><b>Camera and microscopes</b></p> <p>Human eye (constitution and working), Photographic camera (principle, construction and working), construction, working and utilities of Simple microscopes, Compound microscope, Electron microscopes, Binocular microscopes</p> <p><b>Self study</b></p> <p>Experimental determination of magnifying power of a microscope. (Construction part can be discussed through block diagrams)</p>	14
Unit 3.	<p><b>Telescopes and Spectrometer</b></p> <p>Construction, working and utilities of Astronomical telescopes Terrestrial telescopes Reflecting telescopes, Construction, working and utilities of Eyepieces or Oculars (Huygen, Ramsden's, Gauss)</p> <p>Spectrometer - Construction, working and utilities, measurement of refractive index.</p> <p><b>Self study</b></p> <p>Telescopes used at different observatories in and outside India.</p>	13
	<p><b>Activities:</b> Find position and size of the image in a magnifying glass and magnification. Observe rain bows and understand optics. Create a rainbow. Find out what makes a camera to be of good quality. Observe the dispersion of light through prism. Make a simple telescope using magnifying glass and lenses. Learn principle of refraction using prisms. Check bending of light in different substances and find out what matters here. Learn about different telescopes used to see galaxies and their ranges. Many more activities can be tried to learn optics by going through you tubes and webistes such as <a href="https://spark.iop.org">https://spark.iop.org</a>, <a href="http://www.yenka.com">http://www.yenka.com</a>, <a href="https://publiclab.org">https://publiclab.org</a> etc.</p>	

## Open Elective: Sports Science (III Sem)

Time: 3 hrs./week

Max Marks: 60

Content (Use maths of 10 <sup>th</sup> Std only – Only qualitative discussion)		Hrs
<b>Unit - 1</b>		
<b>Chapter No. 1</b>	<b>Measurement:</b> Physical quantities. Standards and Units. International system of Units. Standards of time, length and mass. Precision and significant figures.	04
<b>Chapter No. 2</b>	<b>Newton's laws of motion:</b> Newton's first law. Force, mass. Newton's second law. Newton's third law. Mass and weight. Applications of Newton's laws.	03
<b>Chapter No. 3</b>	<b>Projectile motion:</b> Shooting a falling target. Physics behind Shooting, Javelin throw and Discus throw.	03
<b>Topics for self study ( If any)</b>	<a href="https://www.real-world-physics-problems.com/physics-of-sports.html">https://www.real-world-physics-problems.com/physics-of-sports.html</a>	
<b>Unit - 2</b>		
<b>Chapter No. 4.</b>	<b>Conservation laws:</b> Conservation of linear momentum, collisions – elastic and inelastic. Angular momentum. (Physics behind Carom, Billiards, Racing)	04
<b>Chapter No. 5.</b>	<b>Centre of mass:</b> Physics behind Cycling, rock climbing, Skating,	02
<b>Chapter No. 6.</b>	<b>Gravitation:</b> Origin, Newton's law of gravitation. Archimedes's principle, Buoyancy (Physics behind swimming)	04
<b>Topics for self study ( If any)</b>	<a href="#">Archimedes' Principle: Made EASY   Physics</a> in You tube	
<b>Unit - 3</b>		
<b>Chapter No.7</b>	<b>Food and Nutrition:</b> Proteins, Vitamins, Fat, Blood pressure. Problems due to the deficiency of vitamins.	04
<b>Chapter No. 8</b>	<b>Energy:</b> Different forms of Energy, Conservation of mass-energy.	03
<b>Chapter No . 9</b>	<b>Physical exercises:</b> Walking, Jogging and Running, Weight management.	03
<b>Topics for self study ( If any)</b>	<a href="#">10 Best Exercises for Everyone – Healthline</a>	
<b>Suggested Activities</b>		
<b>Activity No. 1</b>	Identify the methods of measurement of time, length and mass from ancient time and build models for them.	02
	Reference : <a href="https://en.wikipedia.org/wiki/History_of_measurement">History of measurement - Wikipedia</a> <i>https://en.wikipedia.org › wiki › History_of_measurem</i>	

<b>Activity No. 2</b>	Identify Physics principles behind various Sports activities.	01
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	<a href="https://www.real-world-physics-problems.com/physics-of-sports.html">https://www.real-world-physics-problems.com/physics-of-sports.html</a>	
<b>Activity No. 3</b>	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
<b>Activity No. 4</b>	List the difficulties experienced in swimming.	01
<b>Activity No. 3</b>	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
<b>Activity No. 4</b>	List the difficulties experienced in swimming.	01
<b>Activity No. 5</b>	Learn breathing exercises.	02
	Reference : 1) <a href="#">Simple Breathing Exercise for Beginners   Swami Ramdev</a> 2) <a href="https://www.yogajournal.com">https://www.yogajournal.com</a>	
<b>Activity No.6</b>	Write an essay on Physical health v/s Mental health or conduct a debate on Physical health v/s Mental health.	01

### Text Books

SI No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics for Entertainment	Yakov Perelman	Createspace Independent Pub.	
2	Physics Everywhere	Yakov Perelman	Prodinnova	2014
3	Mechanics for Entertainment	Yakov Perelman	Prodinnova	2014
4	Handbook of Food and Nutrition	M.Swaminathan	Bangalore Press 2012	2012
5	Food Science	B. Srilakshmi	New Age International Pub	2015

### References Books

SI No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics	Resnick, Halliday and Krane, Vol 1	Wiley Student Edition.	
2	For the love of Physics	Walter Lewin	Taxmann Publications Private Limited	2012
3	An Introduction to the Physics of Sports	VassiliosMcInnesS pathopoulos	CreateSpace Independent Publishing Platform	2013

### Internet resources

<https://www.topendsports.com/biomechanics/physics.htm>  
<https://www.real-world-physics-problems.com/physics-of-sports.html>  
<https://www.healthline.com/>  
<https://www.mayoclinic.org/>  
<https://www.who.int/news-room/>

## Semester – IV

# Detailed Syllabus of IV Semester Physics

<b>Program Outcomes:</b>	
1.	Disciplinary knowledge
2.	Communication Skills
3.	Critical thinking, Reflective thinking, Analytical reasoning, Scientific reasoning
4.	Problem-solving
5.	Research-related skills
6.	Cooperation/ Teamwork/ Leadership readiness/Qualities
7.	Information/ Digital literacy/Modern Tool Usage
8.	Environment and Sustainability
9.	Multicultural competence
10.	Multi-Disciplinary
11.	Moral and ethical awareness/Reasoning
12.	Lifelong learning / Self Directed Learning

<b>Course Content Semester – IV Thermal Physics and Electronics</b>	
Course Title: Thermal Physics and Electronics	Course Credits:4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	

<b>Prerequisites</b>	
<b>i.</b>	Study of Pre-University



## Course Learning Outcomes

**At the end of the course students will be able to:**

<b>i.</b>	Apply the laws of thermodynamics and analyze the thermal system.
<b>ii.</b>	Apply the laws of kinetic theory and radiation laws to the ideal and practical thermodynamics systems through derived thermodynamic relations.
<b>iii.</b>	Use the concepts of semiconductors to describe different Semiconductor devices such as diode transistors, BJT, FET etc and explain their functioning.
<b>iv.</b>	Explain the functioning of OP-AMPS and use them as the building blocks of logic gates.
<b>v.</b>	Give the use of logic gates using different theorems of Boolean Algebra followed by logic circuits.

## Course Articulation Matrix

### Mapping of Course Outcomes (CO) Program Outcomes

Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
<b>i.</b> Apply the laws of thermodynamics and analyze the thermal system.	X	X	X	X	X	X					X	X
<b>ii.</b> Apply the laws of kinetic theory and radiation laws to the ideal and practical thermodynamics systems through derived thermodynamic relations.	X	X	X	X	X	X					X	X
<b>iii.</b> Use the concepts of semiconductors to describe different Semiconductor devices like diode transistors, BJT, FET etc and explain their functioning.	X	X	X	X	X	X					X	X
<b>iv.</b> Explain the functioning of OP-AMPS and them as the building blocks of logic gates.	X	X	X	X	X	X					X	X
<b>v.</b> Give the use of logic gates using different theorems of Boolean Algebra followed by logic circuits.	X	X	X	X	X	X					X	X

# Thermal Physics and Electronics

## Unit – 1

### The Portion to be Covered

**Laws of Thermodynamics:**

Review of the concepts of Heat and Temperature. (1 Hour)

**First Law of Thermodynamics:** Differential form, Internal Energy. Equation of state for an adiabatic process, Work Done during Isothermal and Adiabatic Processes. (3 Hours)

**Second Law of Thermodynamics:** Kelvin-Planck and Clausius Statements and their Equivalence. Reversible and Irreversible processes with examples. Heat Engines: Carnot engine & efficiency (no derivation). Refrigeration & coefficient of performance, Applications of Carnot engine in locomotion, Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. Concept of Entropy, Second Law of Thermodynamics in terms of Entropy (5 Hours)

**Third Law of Thermodynamics:** Statement, Significance and Unattainability of Absolute Zero. (2 Hours)

**Topic Learning Outcomes**

**At the end of the topic, students should be able to:**

SL No	TLO's	B L	C O	P O
i.	Explain the first law of thermodynamics.	L1	1	1-6,11-12
ii.	Give the differential form of the first law of thermodynamics and define what the internal energy is.	L2	1	1-6,11-12
iii.	Obtain an expression for work done in isothermal and adiabatic processes.	L2	1	1-6,11-12
iv.	Give two systems of units of temperature measurement and give their equivalence.	L2	1	1-6,11-12
v.	Describe and Discuss heat engine based on Carnot cycle.	L2	1	1-6,11-12
vi.	Explain how the efficiency of refrigeration is measured?	L2	1	1-6,11-12
vii.	Detail out the application of the Carnot engine to a locomotion system.	L1	1	1-6,11-12
viii.	Define entropy and write an expression for entropy using the second law of thermodynamics.	L2	1	1-6,11-12
ix.	State the third law of thermodynamics and give its significance using the third law of thermodynamics describing why absolute zero temperature is not unattainable.	L2	1	1-6,11-12

x.	High Order Problems.	L3	1	1-6,11-12
<b>Teaching and Learning Methodology</b>				
Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.				
<b>Assessment Techniques</b>				
One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc				
<b>Suggested Activities (2 Hours)</b>				
<b>Activity No. 1</b>	<p>I feel cold because coldness enter my body. Discuss the statement in day-to-day life. Approximately give examples of</p> <ul style="list-style-type: none"> <li>(i) open system</li> <li>(ii) closed system and</li> <li>(iii) isolated system</li> </ul> <p>Discuss when the temperature of the body is locked until what time you hold the thermometer in contact with a body. Discuss it in contact with laws of thermodynamics.</p> <p>Discuss why when a person works or does exercise, he sweats. Reason it with the laws of thermodynamics.</p>			

<p><b>Activity No. 2</b></p>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <ul style="list-style-type: none"> <li>(i) The first slide will explain the process of doing the experiment.</li> <li>(ii) In the second slide. Students will show the graph of measurement.</li> <li>(iii) In the third slide, they will list three observations from that study.</li> </ul> <p><b>Activity:</b> Take four different sizes of same metal, preferable of same shape and give one piece to each group. Heat it uniformly on a hot plate. Keep a beaker of water with a thermometer immersed in it. Drop one hot metal into the water and record the temperature with time. Repeat the experiment for the other heated metal pieces of different sizes.</p> <ul style="list-style-type: none"> <li>(i) Plot a graph for the volume of the metal piece used v/s respective temperature change observed.</li> <li>(ii) Determine the heat capacity and specific heat of the metal used.</li> </ul>
	<p>All groups shall also do the following activity:</p>
<p><b>Activity No. 3</b></p>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <ul style="list-style-type: none"> <li>(i) The first slide will explain the process of doing the experiment.</li> <li>(ii) In the second slide. Students will show the graph of measurement.</li> <li>(iii) In the third slide, they will list three observations from that study.</li> </ul> <p><b>Activity:</b> Take ice cubes of different size and immerse in water and measure the temperature change with time and repeat the experiment. Graph the observations.</p>

# Thermal Physics and Electronics

## Unit – 2

### The Portion to be Covered

**Thermodynamic Potentials:** Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Properties and Applications. **(1 Hour)**

**Maxwell's Thermodynamic Relations:** Derivations and applications of Maxwell's Relations (1) First order Phase Transitions with examples, Clausius - Clapeyron Equation (2) Values of  $C_p - C_v$  (3) Joule- Thomson Effect and Joule-Thomson coefficient and Derive an equation for Vander Walls gas. Attainment of low temperature by liquefaction of gases and adiabatic demagnetization. **(3 Hours)**

**Kinetic Theory of Gases:** Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas: Mean, RMS and Most Probable Speeds. Degrees of Freedom, Law of Equipartition of Energy. Specific heats of Gases. **(3 Hours)**

**Radiation:** Blackbody radiation, spectral distribution, the concept of energy density and pressure of radiation, Wien's law, Wien's displacement law, Stefan-Boltzmann law, Rayleigh-Jeans law, Ultraviolet Radiation catastrophe and Planck's law of radiation. **(3 Hours)**

#### Topic Learning Outcomes

**At the end of the topic, students should be able to:**

SL No	TLO's	B L	CO	PO
i.	State Maxwell relations.	L1	2	1-6, 11-12
ii.	Give examples where Maxwells relations are used.	L1	2	1-6, 11-12
iii.	Explain the phase transition. Which is called as first order phase transition? Give Examples	L2	2	1-6, 11-12
iv.	State Clausius - Clapeyron Equation.	L1	2	1-6, 11-12
v.	Obtain an equation for difference in $C_p - C_v$ .	L2	2	1-6, 11-12
vi.	State Joule-Thomson effect and Joule-Thomson coefficient.	L1	2	1-6, 11-12
vii.	Obtain an expression, giving the relation between pressure, volume and temperature for a real gas (Vander Waals gas).	L2	2	1-6, 11-12
viii.	Explain adiabatic demagnetization and how it is used to obtain low temperature by the liquidation of gases?	L2	2	1-6, 11-12

<b>ix.</b>	State Maxwell-Boltzmann Law of Distribution of Velocities in Ideal gases.	<b>L1</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>x.</b>	Explain the mean RMS and most probable speeds in ideal gases.	<b>L1</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>xi.</b>	Explain degrees of freedom associated with particles in an ideal gas?	<b>L2</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>xii.</b>	Define the specific heat of a gas.	<b>L1</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>xiii.</b>	Explain black body radiation and its spectral distribution.	<b>L1</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>xiv.</b>	Explain the different laws used to describe different parts of the curves of a spectral distribution of black body radiation.	<b>L2</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>xv.</b>	Define ultraviolet radiation catastrophe? Discuss its importance in the explanation of black body radiation.	<b>L2</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>xvi.</b>	Define Planck's law of radiation and discuss how it could describe the whole black body radiation curve.	<b>L2</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>xvii.</b>	High Order Problems.	<b>L3</b>	<b>2</b>	<b>1-6, 11-12</b>
<b>Teaching and Learning Methodology</b>				
Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.				
<b>Assessment Techniques</b>				
One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc				
<b>Suggested Activities (2 Hours)</b>				

<p><b>Activity No. 4</b></p>	<p><b>(i) Measuring the Solar Constant</b>  Materials: Simple flat sided Jar and Thermometer.  Activity: Bottle containing water is exposed to solar radiation. The rise in temperature and time taken are noted. Calculate the heat absorbed by water and relate it to the output of the Sun.</p> <p><b>(ii) Thermo emf</b>  Materials: Suitable two dissimilar metal wires, voltage measuring device.  Activity: In this experiment student will assemble the thermocouple and study the three effects namely, Seebeck, Peltier, and Thompson.</p> <p><b>(iii) Inverse square law of radiation</b>  Materials: A cardboard with a grid, cardboard with a hole, supporting clips, a ruler, candle.</p> <p><b>(iv) Activity:</b> Students set the device. They count the lighted squares on the cardboard with the grid by varying the distance. And make necessary measurements and calculations to arrive at the inverse square law of radiation.</p> <p>Ref: Activity Based Physics Thinking Problems in Thermodynamics: Kinetic Theory  <a href="http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm">http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm</a></p>
<p><b>Activity No. 5</b></p>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <p><b>(i)</b> The first slide will explain the process of doing the experiment.  <b>(ii)</b> In the second slide. Students will show the graph of measurement.  <b>(iii)</b> In the third slide, they will list three observations from that study.</p> <p><b>Activity:</b> Take two dissimilar metal wires. Spot weld them forming two junctions. Dip one junction in ice and heat the other junction with a burner. Plot a graph of time of heating v/s Thermo EFM generated in the voltmeter.</p>
<p><b>Activity No. 6</b></p>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <p><b>(i)</b> The first slide will explain the process of doing the experiment.  <b>(ii)</b> In the second slide. Students will show the graph of measurement.  <b>(iii)</b> In the third slide, they will list three observations from that study.</p>

	<p><b>Activity:</b> Make 4 groups and give different-sized balloons to each group. Fit different-sized nozzles into the mouth of the large balloons. Measure the temperature or the EMF generated using a thermocouple placed at the mouth of the nozzle as the pressurised gas is released. Plot a graph of time v/s temperature. Vary the volume of the balloon and repeat the experiment. Plot the graph of volume v/s temperature difference created.</p>
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## Thermal Physics and Electronics

### Unit – 3

#### The Portion to be Covered

**Semiconductor devices:** Review of Intrinsic and Extrinsic semiconductors, p-n junction and its Characteristics and Parameters, Diode approximations, Half-wave rectifier, Full-wave rectifier, Zener diode voltage regulators: Regulator circuit with no load, Loaded Regulator. **(5 hours)**

**Junction Transistors:** Basics of Bipolar Junction Transistors (BJT), BJT operation, Common Base, Common Emitter and Common Collector Characteristics. Field Effect Transistor (FET) and its characteristics. Transistor as an Amplifier and Oscillator. **(6 hours)**

#### Topic Learning Outcomes

**At the end of the topic, students should be able to:**

SL No	TLO's	B L	CO	PO
i.	Define Semiconductors and Band Gap. Explain on what basis they are classified as intrinsic and extrinsic.	L2	3	1-6, 11-12
ii.	Define PN junction. Explain it's functioning in forward and reverse bias.	L1	3	1-6, 11-12
iii.	Explain the approximation used in a real diode with respect to an ideal PN Junction?	L2	3	1-6, 11-12
iv.	With a schematic diagram, explain half wave and full wave rectifiers.	L1	3	1-6, 11-12
v.	Define a Zener diode and explain how it is different from an ordinary diode using V-I curves?	L2	3	1-6, 11-12
vi.	With the schematic diagram, explain the working of voltage regulators of different types using a Zener diode.	L1	3	1-6, 11-12
vii.	Give the basic concepts used in the instruction of bipolar junction transistor and its operation.	L1	3	1-6, 11-12



viii.	Compare the V-I curve of common base common emitter and common collector BJT curves while explaining their working principles.	L2	3	1-6, 11-12
ix.	Define FET? Give its characteristics.	L1	3	1-6, 11-12
x.	Explain how a transistor can be used as an amplifier and an oscillator using a circuit diagram.	L2	3	1-6, 11-12
xi.	High Order Problems.	L3	3	1-6, 11-12

### Teaching and Learning Methodology

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

### Assessment Techniques

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

### Suggested Activities (2 Hours)

<b>Activity No. 7</b>	<p>Wire a regulated DC power supply on a bread board or groove board to give a regulated output voltage of + 5 V; +15 V; Dual power output : <math>\pm 5</math> V; Dual power output : <math>\pm 15</math> V. Use: 3-pin voltage regulators.</p> <p>Components required:</p> <p>1. Step down transformer- 1 No. (5 V tapping, 100 – 500 mA current rating), BY 127 semiconductor diodes – 4 Nos, Inductor -1, Capacitor - 1, 3 pin 5V regulator-1</p> <p>Search for circuit diagram in books/net.</p> <p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <p>(i) The first slide will explain the process of doing the experiment.  (ii) In the second slide. Students will show the graph of measurement.  (iii) In the third slide, they will list three observations from that study.</p>
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	<b>Activity:</b> Form 3 groups and tell them to make a DC supply of low current of different voltages like 5V, 10V, and 15V on a breadboard
<b>Activity No. 8</b>	<ul style="list-style-type: none"> <li>(i) Learn to identify the terminals of different types (packages) of BJTs.</li> <li>(ii) In the case of power transistors, learn how to fix a heat sink for the transistor.</li> <li>(iii) Learn the difference between BJT and FET in its operational characteristics.</li> </ul>
<b>Activity No. 9</b>	<p><b>Note for the teachers for the activity:</b> Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.</p> <ul style="list-style-type: none"> <li>(i) The first slide will explain the process of doing the experiment.</li> <li>(ii) In the second slide. Students will show the graph of measurement.</li> <li>(iii) In the third slide, they will list three observations from that study.</li> </ul> <p><b>Activity:</b> Take any 3 diode and assign one to each group. Measure its resistance when dipped in ice and heating the ice till it boils. Using this data, plot calibration curve of temperature v/s resistance and also the cooling curve of temperature V/s time for the diode by each group.</p>

<b>Thermal Physics and Electronics</b>
<b>Unit – 4</b>
<b>The Portion to be Covered</b>
<p><b>Electronics:</b> Integrated Circuits (Analog and Digital), Operational Amplifier, Ideal characteristics of Op-Amp, Inverting and Non-Inverting Configurations. Applications- Voltage Follower, Addition and Subtraction. <b>(4 hours)</b></p> <p><b>Digital:</b> Switching and Logic Levels, Digital Waveform. Number Systems: Decimal Number System, Binary Number System, Converting Decimal to Binary, Hexadecimal Number System: Converting Binary to Hexadecimal, Hexadecimal to Binary. <b>(3 hours)</b></p> <p><b>Boolean Algebra Theorems:</b> De Morgan’s theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, NAND Gate, NOR Gate, Algebraic Simplification, Implementation of NAND and NOR functions. <b>(4 hours)</b></p>

<b>Topic Learning Outcomes</b>				
<b>At the end of the topic, students should be able to:</b>				
<b>SL No</b>	<b>TLO's</b>	<b>BL</b>	<b>CO</b>	<b>PO</b>
<b>i.</b>	Define op-amps and give the characteristics of an ideal op-amp.	L 1	4	1-6, 11-12
<b>ii.</b>	Explains an inverting and non-inverting configuration of typical op-amps, with a schematic diagram.	L 2	4	1-6, 11-12
<b>iii.</b>	Explain how op-amps can be used as a voltage follower, with a schematic diagram and with relevant expressions.	L 2	4	1-6, 11-12
<b>iv.</b>	Explain how op-amps can be used as a voltage follower, adder and subtractor, with a schematic diagram and with relevant expressions.	L 2	4	1-6, 11-12
<b>v.</b>	Give different digital wave forms and explain how one can visualize the switching and logic levels.	L 1	5	1-6, 11-12
<b>vi.</b>	Write any four-digit numbers other than zero in the decimal number system and convert that into binary and hexadecimal.	L 2	5	1-6, 11-12
<b>vii.</b>	Write any number in a Binary System of 8 digits other than zero and convert it into decimal and hexadecimal.	L 2	5	1-6, 11-12
<b>viii.</b>	Write any number in the hexadecimal system of 4 digits other than zero and converted it into a binary and decimal number.	L 2	5	1-6, 11-12
<b>ix.</b>	Give simplified diagram for a given Boolean circuit diagram of logic gates, and verify using the De-Morgans theorem.	L 2	5	1-6, 11-12
<b>x.</b>	Why are X-NOR gates called Universal Gates?	L 2	5	1-6, 11-12
<b>xi.</b>	High Order Problems.	L 3	4, 5	1-6, 11-12
<b>Teaching and Learning Methodology</b>				
Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.				
<b>Assessment Techniques</b>				

One minute paper/ Predict-Observe-Explain/ Think-Pair-Share/ Class Test/ Quiz/ Crosswords/ Group Assessment/ Assignment/ Peer-to-Peer Evaluation/Seminar etc

### Suggested Activities (2 Hours)

<b>Activity No. 10</b>	Learn how to implement logic functions (AND, OR, NOT) using just diodes and resistors.
	With a circuit diagram show how different types of gates can be built by X-NOR gates.
<b>Activity No. 11</b>	<p><b>Operational Amplifiers</b></p> <p>(i) Understand the concept of virtual ground of an OP-AMP.</p> <p>(ii) Learn the different types of op-amps used for different applications.</p> <p>(iii) What is a buffer? Prepare a report on buffers and its application in instrumentation electronics.</p>
<b>Activity No. 12</b>	<p>(i) A man has to take a wolf, a goat, and some cabbage across a river. His rowboat has enough room for the man plus either the wolf or the goat or the cabbage. If he takes the cabbage with him, the wolf will eat the goat. If he takes the wolf, the goat will eat the cabbage. Only when the man is present are the goat and the cabbage safe from their enemies. All the same, the man carries wolf, goat, and cabbage across the river. How? Write the truth table for the above story and implement using gates.</p> <p>(ii) A locker has been rented in the bank. Express the process of opening the locker in terms of digital operation.</p> <p>(iii) A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by and one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles.</p>

### Textbooks

Sl No	Title of the Book
1.	Electronic Devices and Circuits, David A. Bell, 2004, PHI, New Delhi
2.	Integrated Electronics, Jacob Millman and CC Halkias
3.	Digital Fundamentals, Floyd, 2001, PHI, New Delhi

### References Books

Sl No	Title of the Book
1.	Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2.	Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
3.	A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press

4.	Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5.	Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
6.	An Introduction to Thermal Physics, Daniel V Schroeder, 2020, Oxford University Press

<b>Formative Assessment</b>	
<b>Assessment</b>	<b>Marks</b>
Internal Assessment	10
Activity	10
REU based Group Activity (Conduction, Report, Presentation)	10
Science Communication (Seminar/Poster etc)	10
<b>Total</b>	<b>40</b>

<b>List of Experiments to be performed in the Laboratory</b>	
1.	Mechanical Equivalent of Heat by Callender and Barne's method
2.	Coefficient of thermal conductivity of Copper by Searle's apparatus
3.	Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method
4.	Determination of Stefan's constant/ Verification of Stefan's law
5.	Variation of thermo-emf across two junctions of a thermocouple with temperature
6.	Verification of Clausius –Clapeyron equation and determination of specific enthalpy
7.	V-I Characteristics of Silicon & Germanium PN Junction diodes (FB & RB) OR V-I Characteristics of Zener Diode and voltage regulator
8.	Characteristics of BJT in Common Emitter Configuration OR Frequency response of CE Amplifier
9.	Half Wave and Full Wave Rectifier with and without Filter
10.	Non-inverting and Inverting op-amp circuits OR Voltage follower, Adder and Subtractor circuits
11.	Truth table verification of logic gates using TTL 74 series ICs. OR Logic Gates; Combinational Circuits; Sequential Circuits

**Minimum 8 experiments are to be conducted**

<b>Reference Book for Laboratory Experiments</b>	
Sl No	Title of the Book
1.	Basic Electronics Lab (P242) Manual 2015-16, National Institute of Science Education and Research, Bhubaneswar, 2015.
2.	<b>Suggested Readings:</b> 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e. 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e.

# **SYLLABUS FOR OPEN ELECTIVES**

**(SEM I to IV)**

**3 Credits: 3 Lectures + 1 Tutorial**

## SYLLABUS FOR OPEN ELECTIVE ENERGY SOURCES

Time: 2 hrs./week + 01 Hr tutorial

Max Marks:

		No. of lectures
<b>Unit-I</b>	<b>Non-Renewable energy sources</b>	
	<b>Chapter-1: Introduction</b>	
	Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources.	<b>04</b>
	<b>Chapter-2: Conventional energy sources</b>	
	Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues& challenges. Overview of Indian & world energy scenario with latest statistics- consumption & necessity. Need of eco-friendly & green energy & their related technology.	<b>09</b>
	<b>Total</b>	<b>13</b>
<b>Unit-II</b>	<b>Renewable energy sources</b>	
	<b>Chapter-1: Introduction:</b>	
	Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	<b>05</b>
	<b>Chapter 2 : Solar energy:</b>	
	Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.	<b>08</b>
	<b>Total</b>	<b>13</b>
<b>Unit-III</b>	<b>Chapter-3: Wind and Tidal Energy harvesting:</b>	
	Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.	<b>08</b>
	<b>Chapter-4 : Geothermal and hydro energy</b>	
	Geothermal Resources, Geothermal Technologies.	<b>02</b>
	Hydropower resources, hydropower technologies, environmental impact of hydro power sources.	<b>03</b>
	Carbon captured technologies, cell, batteries, power consumption	<b>01</b>
	<b>Total</b>	<b>13</b>



	<p><b>Activity for tutorial classes 01 lectures/week</b></p> <ol style="list-style-type: none"> <li>1. Demonstration of on Solar energy, wind energy, etc, using training modules at Labs.</li> <li>2. Conversion of vibration to voltage using piezoelectric materials.</li> <li>3. Conversion of thermal energy into voltage using thermoelectric (using thermocouples or heat sensors) modules.</li> <li>4. Project report on Solar energy scenario in India</li> <li>5. Project report on Hydro energy scenario in India</li> <li>6. Project report on wind energy scenario in India</li> <li>7. Field trip to nearby Hydroelectric stations.</li> <li>8. Field trip to wind energy stations like Chitradurga, Hospet, Gadag, etc.</li> <li>9. Field trip to solar energy parks like Yeramaras near Raichur.</li> <li>10. Videos on solar energy, hydro energy and wind energy.</li> </ol>	
	<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi</li> <li>2. Solar energy - M P Agarwal - S Chand and Co. Ltd.</li> <li>3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.</li> <li>4. Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, Oxford University Press, in association with The Open University.</li> <li>5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009</li> <li>6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).</li> <li>7. <a href="http://en.wikipedia.org/wiki/Renewable_energy">http://en.wikipedia.org/wiki/Renewable_energy</a></li> </ol>	

# Climate Science

**Time: 2 hrs./week + 01 Hr tutorial**

**Max Marks:**

Module 1:	<p><b>Atmosphere</b>            Atmospheric Science (Meteorology) as a multidisciplinary science. Physical and dynamic meteorology, Some terminology, difference between weather and climate, weather and climate variables, composition of the present atmosphere: fixed and variable gases, volume mixing ratio (VMR), sources and sinks of gases in the atmosphere. Green house gases. Structure (layers) of the atmosphere. Temperature variation in the atmosphere, temperature lapse rate, mass, pressure and density variation in the atmosphere. Distribution of winds.</p>	(13 hours)
Module 2:	<p><b>Climate Science</b>            Overview of meteorological observations, measurement of : temperature, humidity, wind speed and direction and pressure. Surface weather stations, upper air observational network, satellite observation. Overview of clouds and precipitation, aerosol size and concentration, nucleation, droplet growth and condensation (qualitative description). Cloud seeding, lightning and discharge. Formation of trade winds, cyclones.            Modelling of the atmosphere: General principles, Overview of General Circulation Models (GCM) for weather forecasting and prediction. Limitations of the models.            R and D institutions in India and abroad dedicated to climate Science, NARL, IITM, CSIR Centre for Mathematical Modeling and Computer Simulation, and many more</p>	(13 hours)
Module 3:	<p><b>Global Climate Change</b>            Green house effect and global warming, Enhancement in concentration of carbon dioxide and other green house gases in the atmosphere, Conventional and non-conventional energy sources and their usage. EL Nino/LA Nino Southern oscillations.            Causes for global warming: Deforestation, fossil fuel burning, industrialization. Manifestations of global warming: Sea level rise, melting of glaciers, variation in monsoon patterns, increase in frequency and intensity of cyclones, hurricanes, tornadoes.            Geo-engineering as a tool to mitigate global warming? Schemes of geo-engineering.</p>	(13 hours)

	<p><b>Activities to be carried out on Climate Science:</b></p> <ol style="list-style-type: none"> <li>1. Try to find answer to the following questions:             <ol style="list-style-type: none"> <li>(a) Imagine you are going in a aircraft at an altitude greater than 100 km. The air temperature at that altitude will be greater than 200°C. If you put your hands out of the window of the aircraft, you will not feel hot.</li> <li>(b) What would have happened if ozone is not present in the stratosphere.</li> </ol> </li> <li>2. Visit a nearby weather Station and learn about their activities.</li> <li>3. Design your own rain gauge for rainfall measurement at your place.</li> </ol>	
	<ol style="list-style-type: none"> <li>4. Learn to determine atmospheric humidity using wet bulb and dry bulb thermometers.</li> <li>5. Visit the website of Indian Institute of Tropical Meteorology (IITM), and keep track of occurrence and land fall of cyclone prediction.</li> <li>6. Learn about ozone layer and its depletion and ozone hole.</li> <li>7. Keep track of melting of glaciers in the Arctic and Atlantic region through data base available over several decades.</li> <li>8. Watch documentary films on global warming and related issues (produced by amateur film makers and promoted by British Council and BBC).</li> </ol>	
	<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Basics of Atmospheric Science – A Chndrashekar, PHI Learning Private Ltd. New Delhi, 2010.</li> <li>2. Fundamentals of Atmospheric Modelling- Mark Z Jacobson, Cambridge University Press, 2000.</li> </ol>	

# Astronomy

**Time: 2 hrs./week + 01 Hr tutorial**

**Max Marks:**

Content		Hrs
<b>Unit – 1 -History and Introduction</b>		
Chapter 1	Ancient Astronomy Greek Observations, Sumerian Observations,Mayan Observations, Arabic Observations ,Chinese Observations	2
Chapter 2	Indian Astronomy Vedic Astronomy, Ancient Astronomy – Aryabhata, Varahamihira, Bhaskara Astronomy in Indian Scriptures, Precession of the Equinox,Celebrations of Equinox	2
Chapter 3	Medieval & Modern Astronomy Invention of Telescopes, Models of the Solar System & Universe, Observations by Tycho Brahe, Kepler, Galileo, Herschel and Other,Modern Astronomy	2
Chapter 4	Optical tools for Astronomy Pin Hole, Binoculars, Telescopes & Imaging.	1
Chapter 5	Mathematical Methods of Observations Angular Measurement, Trigonometric functions, Stellar Parallax	1
Chapter 6	Observational Terminologies Cardinal Directions, Azimuth, Altitude, Measurements using Compass and Hand. Equatorial Co-ordinates, Light years, Magnitude, Colors etc.	2
<b>Unit – 2: Unit 2: Observations of the Solar System</b>		
<b>Chapter 7.</b>	The Sun Ecliptic and the Orientation of the Earth, Seasons - Solstices and Equinox, Observations of the Sun from Earth during seasons. Eclipses, Zero-shadow day, Sunspots	1
Chapter 8	The Moon Earth-Moon system – Phases, Lunar Eclipses, Ecliptic and Lunar Orbital Plane – Nodes, Lunar Month, Full Moon Names	1
Chapter 9.	Inner Planets: Mercury & Venus Observational History, Observational Windows, Appearance, Apparitions, Elongations, Superior Conjunctions, Inferior Conjunctions, Transits.	2
Chapter 10	<b>Outer Planets</b> <b>Outer Planets: Mars, Jupiter &amp; Saturn</b> Observational History.Observational Windows, Appearance, Frequency of Oppositions Oppositions, Conjunctions, Moons Eclipses.Galilean Moons, Saturn’s Rings	2

<b>Unit III Major Astronomy Observations</b>		
<b>Chapter 11</b>	March to June Prominent Stars and Constellations Visible during this period, Methods of Spotting.	2
<b>Chapter 12</b>	June to September Prominent Stars and Constellations Visible during this period, Methods of Spotting.	2
<b>Chapter 13</b>	September to December Prominent Stars and Constellations Visible during this period, Methods of Spotting.	2
<b>Chapter 14</b>	December to March Prominent Stars and Constellations Visible during this period, Methods of Spotting.	2
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. The Stargazer's Guide - How to Read Our Night Sky by Emily Winterburn</li> <li>2. A guide to the Night Sky – Beginner's handbook by P.N. Shankar</li> <li>3. The Complete Idiot's guide to Astronomy by Christopher De Pree and Alan Axelrod</li> </ol> <p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. P. N. SHANKAR A GUIDE TO THE NIGHT SKY <a href="https://www.arvindguptatoys.com/arvindgupta/nightsskyshankar.pdf">https://www.arvindguptatoys.com/arvindgupta/nightsskyshankar.pdf</a></li> <li>2. BimanBasu , Joy of Star Watching , National Book Trust of India 2013</li> </ol> <p><b>References Books</b></p> <p>Christopher De Pree :The Complete Idiot's Guide to Astronomy, Penguin USA, 2008</p> <p>Emily Winterburn ,The Stargazer's Guide: How to Read Our Night Sky, Constable and Robinson, 2008</p>		

## Activities

Sl No	Experiment
1	Measuring Seasons using Sun's Position.
2	Measuring Distance using Parallax
3	Estimation of the Stellar Diameter using Pin Hole
4	Measuring Height of an Object Using Clinometer.
5	Star spotting using constellation maps
6	Constellation spotting using Skymaps
7	Estimation of 'Suitable Periods' to observe deep sky objects using Planisphere.
8	Estimation of the Size of the Solar System in using Light Years.
9	Identification of Lunar Phases across a year.
10	Measuring Constellation of the Sun using Night Skymaps or Planispheres.

# Medical Physics

Time: 2 hrs./week + 01 Hr tutorial

Max Marks:

<b>Unit I:</b>	<b>Human Anatomy and Physiology</b>  Overview of human anatomy - cells, cell structure, type of cells and their functions, tissues, organs, and their functions. Different systems in the human body, their structure and function, physiological properties of the circulatory system, digestive system, respiratory system, reproductive system, excretory system, endocrine system and nervous system	(13 hours)
<b>Unit II:</b>	<b>Physics of Medical Diagnostics</b>  Principle of production of X-rays. Use of X-rays in medical diagnosis, X-ray imaging systems. Computed Tomography (CT): principle and generation of CT. Magnetic Resonance Imaging (MRI): basic principle and image characteristics. Ultrasound Imaging: Interaction of sound waves with body tissues, production of ultrasound, transducers, acoustic coupling, image formation, modes of image display and color Doppler.	(13 hours)
<b>Unit III:</b>	<b>Physics of Radiotherapy</b>  Clinical aspects of radiation therapy: Biological basis of radiotherapy, radiation sources, radiation dose, time dose fractionation. External beam radiation therapy, radiation therapy modalities, production of radioisotopes, use of radioisotopes in therapy, particle and ion beam radiotherapy. Brachytherapy - principle of brachytherapy and classification of brachytherapy techniques.	(13 hours)

**Class Room Activities**

Unit I: Students can demonstrate the shape, size, positions and functions of different organs in the body with the help of models.

Unit II: The use of X-rays in the diagnosis of the fractured bone can be demonstrated with the help of a gamma source and a gamma ray survey meter. As the density of materials between the source and the detector changes the reading on the meter (or intensity of the beeping sound) changes.

Unit III: (i) Students can be asked to list out different type of cancers and possible causative factors. They can be asked to list out the healthy practices to reduce the risk of cancers.

(ii) As there will be students from different disciplines in the OE course, group discussion can be arranged to discuss about their programme and outcome. This will be an opportunity for the students to know about other disciplines.

**Other related activities/projects:**

1. Visit to nearby hospitals/diagnostic centers to study the working of X-ray machines.
2. Visit to ultrasound diagnostic centers to study the principle and use of ultrasound in diagnosis.
3. Project on principle and use of X-ray films in imaging.
4. Visit to radiotherapy centers to study the modalities of radiotherapy.

### **Text Books**

1. C. H. Best and N. B. Taylor. A Test in Applied Physiology. Williams and Wilkins Company, Baltimore, 1999.
2. C. K. Warrick. Anatomy and Physiology for Radiographers. Oxford University Press, 2001.
3. Jerrold T. Bushberg. The Essential Physics for Medical Imaging (2nd Edition). Lippincott Williams & Wilkins, 2002.
4. Jean A. Pope. Medical Physics: Imaging. Heinemann Publishers, 2012.
5. Faiz M. Khan and Roger A. Potish. Treatment Planning in Radiation Oncology. Williams and Wilkins, USA, 2003.
6. D. Baltas. The physics of modern brachytherapy for oncology. Taylor and Francis, 2007.

### **Reference Books**

1. J. R. Brobek. Physiological Basis of Medical Practice. Williams and Wilkins, London, 1995.
2. Edward Alcamo, Barbara Krumhardt. Barron's Anatomy and Physiology the Easy Way. Barron's Educational Series, 2004.
3. Lippincott, Anatomy and Physiology. Lippincott Williams & Wilkins, 2002.
4. W. E. Arnould Taylor. A textbook of anatomy and physiology, Nelson Thornes, 1998.
5. G. S. Pant. Advances in Diagnostic Medical Physics. Himalaya Publishing House, 2006.
6. Sabbahaga, Diagnostic Ultrasound applied to OBG. Maryland, 1980.
7. Faiz M Khan. The Physics of Radiation Therapy (3rd edition). Lippincott Williams & Wilkins, USA, 2003.
8. Jatinder R. Palta and T. Rockwell Mackie. Intensity Modulation Radiation Therapy. Medical Physics publishing, Madison, Wisconsin, 2003.
9. AAPM Report No. 72. Basic Applications of Multileaf collimators, AAPM, USA, 2001.
10. AAPM Report No. 91. Management of Respiratory motion in radiation oncology, 2006.
11. CA Joslin, A. Flynn, E. J. hall. Principles and Practice of Brachytherapy. Arnold publications, 2001.
12. Peter Hoskin, Catherine Coyle. Radiotherapy in Practice. Oxford University Press, 2011.
13. W. R. Handee. Medical Radiation Physics. Year Book Medical Publishers Inc., London, 2003.
14. Donald T. Graham, Paul J. Cloke. Principles of Radiological Physics. Churchill Livingstone, 2003.
15. Thomas S. Curry. Christensen's Physics of Diagnostic Radiology (4th Edition). Lippincott Williams & Wilkins, 1990.
16. Madison. MRI – Perry Sprawls – Medical Physics Publishing. Wisconsin, 2000.



	<p>17. Steve Webb. The Physics of Three-Dimensional Radiotherapy. Institute of Physics Publishing, Bristol and Philadelphia, 2002.</p> <p>18. Radiation oncology physics: A Handbook for teachers and students. IAEA publications, 2005.</p> <p>19. F. M. Khan. The Physics of Radiation Therapy (3rd Edition), Lippincott Williams and Wilkins, U.S.A., 2003.</p>	
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## OPTICAL INSTRUMENTS

**Time: 2 hrs./week + 01 Hr tutorial**

**Max Marks:**

Unit 1.	<p><b>Basics of Optics</b> Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin), convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation. Focal and nodal points, focal length, image formation, combination of lenses, dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation. (Expressions need not be derived, but have to be discussed qualitatively).</p>	13
Unit 2.	<p><b>Camera and microscopes</b> Human eye (constitution and working), Photographic camera (principle, construction and working), construction, working and utilities of Simple microscopes, Compound microscope, Electron microscopes, Binocular microscopes <b>Self study</b> Experimental determination of magnifying power of a microscope. (Construction part can be discussed through block diagrams)</p>	14
Unit 3.	<p><b>Telescopes and Spectrometer</b> Construction, working and utilities of Astronomical telescopes Terrestrial telescopes Reflecting telescopes, Construction, working and utilities of Eyepieces or Oculars (Huygen, Ramsden's, Gauss) Spectrometer - Construction, working and utilities, measurement of refractive index. <b>Self study</b> Telescopes used at different observatories in and outside India.</p>	13
	<p><b>Activities:</b> Find position and size of the image in a magnifying glass and magnification. Observe rain bows and understand optics. Create a rainbow. Find out what makes a camera to be of good quality. Observe the dispersion of light through prism. Make a simple telescope using magnifying glass and lenses. Learn principle of refraction using prisms. Check bending of light in different substances and find out what matters here. Learn about different telescopes used to see galaxies and their ranges. Many more activities can be tried to learn optics by going through you tubes and webistes such as <a href="https://spark.iop.org">https://spark.iop.org</a>, <a href="http://www.yenka.com">http://www.yenka.com</a>, <a href="https://publiclab.org">https://publiclab.org</a> etc.</p>	

# Sports Science

Time: 2 hrs./week + 01 Hr tutorial

Max Marks:

Content (Use maths of 10 <sup>th</sup> Std only – Only qualitative discussion)		Hrs
<b>Unit - 1</b>		
<b>Chapter No. 1</b>	<b>Measurement:</b> Physical quantities. Standards and Units. International system of Units. Standards of time, length and mass. Precision and significant figures.	04
<b>Chapter No. 2</b>	<b>Newton's laws of motion:</b> Newton's first law. Force, mass. Newton's second law. Newton's third law. Mass and weight. Applications of Newton's laws.	03
<b>Chapter No. 3</b>	<b>Projectile motion:</b> Shooting a falling target. Physics behind Shooting, Javelin throw and Discus throw.	03
<b>Topics for self study ( If any)</b>	<a href="https://www.real-world-physics-problems.com/physics-of-sports.html">https://www.real-world-physics-problems.com/physics-of-sports.html</a>	
<b>Unit - 2</b>		
<b>Chapter No. 4.</b>	<b>Conservation laws:</b> Conservation of linear momentum, collisions – elastic and inelastic. Angular momentum. (Physics behind Carom, Billiards, Racing)	04
<b>Chapter No. 5.</b>	<b>Centre of mass:</b> Physics behind Cycling, rock climbing, Skating,	02
<b>Chapter No. 6.</b>	<b>Gravitation:</b> Origin, Newton's law of gravitation. Archimedes's principle, Buoyancy (Physics behind swimming)	04
<b>Topics for self study ( If any)</b>	<a href="#">Archimedes' Principle: Made EASY   Physics</a> in You tube	
<b>Unit - 3</b>		
<b>Chapter No.7</b>	<b>Food and Nutrition:</b> Proteins, Vitamins, Fat, Blood pressure. Problems due to the deficiency of vitamins.	04
<b>Chapter No. 8</b>	<b>Energy:</b> Different forms of Energy, Conservation of mass-energy.	03
<b>Chapter No . 9</b>	<b>Physical exercises:</b> Walking, Jogging and Running, Weight management.	03
<b>Topics for self study ( If any)</b>	<a href="#">10 Best Exercises for Everyone – Healthline</a>	
<b>Suggested Activities</b>		
<b>Activity No. 1</b>	Identify the methods of measurement of time, length and mass from ancient time and build models for them.	02
	Reference : <a href="https://en.wikipedia.org/wiki/History_of_measurement">History of measurement - Wikipedia</a> <a href="https://en.wikipedia.org/wiki/History_of_measurement">https://en.wikipedia.org/wiki/History_of_measurement</a>	

<b>Activity No. 2</b>	Identify Physics principles behind various Sports activities.	01
	<a href="https://www.real-world-physics-problems.com/physics-of-sports.html">https://www.real-world-physics-problems.com/physics-of-sports.html</a>	
<b>Activity No. 3</b>	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
<b>Activity No. 4</b>	List the difficulties experienced in swimming.	01
<b>Activity No. 3</b>	List the difficulties experienced in Gymnastics, Cycling and weight lifting.	02
<b>Activity No. 4</b>	List the difficulties experienced in swimming.	01
<b>Activity No. 5</b>	Learn breathing exercises.	02
	Reference : 1) <a href="#">Simple Breathing Exercise for Beginners   Swami Ramdev</a> 2) <a href="https://www.yogajournal.com">https://www.yogajournal.com</a>	
<b>Activity No.6</b>	Write an essay on Physical health v/s Mental health or conduct a debate on Physical health v/s Mental health.	01

### Text Books

SI No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics for Entertainment	Yakov Perelman	Createspace Independent Pub.	
2	Physics Everywhere	Yakov Perelman	Prodinnova	2014
3	Mechanics for Entertainment	Yakov Perelman	Prodinnova	2014
4	Handbook of Food and Nutrition	M.Swaminathan	Bangalore Press 2012	2012
5	Food Science	B. Srilakshmi	New Age International Pub	2015

### References Books

SI No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics	Resnick, Halliday and Krane, Vol 1	Wiley Student Edition.	
2	For the love of Physics	Walter Lewin	Taxmann Publications Private Limited	2012
3	An Introduction to the Physics of Sports	VassiliosMcInnesS pathopoulos	CreateSpace Independent Publishing Platform	2013

#### Internet resources

<https://www.topendsports.com/biomechanics/physics.htm>

<https://www.real-world-physics-problems.com/physics-of-sports.html>

<https://www.healthline.com/>

<https://www.mayoclinic.org/>

<https://www.who.int/news-room/>

## NANOTECHNOLOGY

**Time: 2 hrs./week + 01 Hr tutorial**

**Max Marks:**

Unit 1:	<p>Introduction to nanomaterials</p> <p>Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nano dots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.</p>	( 13hours)
Unit 2:	<p>Synthesis and Characterization of nanostructure materials</p> <p>Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electrodeposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots. X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.</p>	(13 hours)
Unit 3:	<p>Properties and applications of nanomaterials</p> <p>Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect bandgap semiconductor nanocrystals. Quantitative treatment of quasiparticles and excitons, charging effects. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostructures and nanostructures. Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage.</p>	(13 hours)
<p><b>References Books:</b></p> <ul style="list-style-type: none"> <li>➤ C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).</li> <li>➤ S.K. Kulkarni, Nanotechnology: Principles &amp; Practices (Capital Publishing Company)</li> <li>➤ K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology (PHI Learning Private Limited).</li> <li>➤ Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).</li> <li>➤ M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier, 2007).</li> <li>➤ Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroschio, 2011, Cambridge University Press.</li> <li>➤ Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).</li> </ul>		

### Student Activities:

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. XRD pattern of nanomaterials and estimation of particle size.
4. To study the effect of size on color of nanomaterials.
5. Growth of quantum dots by thermal evaporation.
6. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
7. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
8. Prepare a thin film capacitor and measure capacitance as a function of temperature or frequency.
9. Visit to nearby research labs to study the working of XRD, SEM, UV-Visible Spectrophotometer instruments
10. Visit to nearby research labs for project work and interaction with scientists at IISc, JNCSC, Universities etc.

# ELECTRICAL INSTRUMENTS

Time: 2 hrs./week + 01 Hr tutorial

Max Marks:

Content		Hrs
<b>Unit - 1</b>		
<b>Chapter No. 1</b>	Voltage and current sources, Kirchoff's current and voltage laws, loop and nodal analysis of simple circuits with dc excitation. Ammeters,voltmeters: (DC/AC)	03
<b>Chapter No. 2</b>	Representation of sinusoidal waveforms, peak and rms values, power factor. Analysis of single-phase series and parallel R-L-C ac circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections. Wattmeters: Induction type, single phase and three phase wattmeter, Energy meters: AC. Induction type single phase and three phase energy meter	05
<b>Chapter No. 3</b>	Instrument Transformers: Potential and current transformers, ratio and phase angle errors, phasor diagram, methods of minimizing errors; testing and applications.	05
<b>Topics for self study ( If any)</b>	Types of switches and Circuits, Safety precautions and rules in handling electrical appliances, Electric shock, first aid for electrical shocks, Fuses, MCB, ELCB and Relays, Filament lamp, Tube light, CFL and LED	
<b>Suggested Activities</b>		
<b>Activity No. 1</b>	Identify variety of electrical switches and note down their applications/utility.	
	Reference: Weblink/Youtube/Book	
<b>Activity No. 2</b>	Identify the hazards involved in handling electrical circuits and instruments, make a list of safety precautions as well as first aid for electrical shocks.	
	Reference : Weblink/Youtube/Book	
<b>Unit - 2</b>		
<b>Chapter No. 4.</b>	Galvanometers: General principle and performance equations of D'ArsonvalGalvanometers, Vibration Galva nometer and Ballistic Galvanometer.	03
<b>Chapter No. 5.</b>	Potentiometers: DCPotentiometer, Crompton potentio meter, construction, standardization, application. AC Potentio meter, Drysdalepolar potentio meter; standardization, application.	03
<b>Chapter No. 6.</b>	DC/AC Bridges: General equations for bridge balance, measurement of self inductance by Maxwell's bridge (with variable inductance & variable capacitance), Hay's bridge, Owen's bridge, measurement of capacitance by Schearing bridge, errors, Wagner's earthing device, Kelvin's double bridge.	07
<b>Topics for self study ( If any)</b>	Importance of grounding and <u>Earthing</u> , Methods for <u>Earthing</u> ,	

<b>Suggested Activities</b>		
<b>Activity No. 3</b>	Make a study of importance of grounding in electrical circuits.	
	Reference : Weblink/Youtube/Book	
<b>Activity No. 4</b>	Prepare a detailed account of various methods of earthing and their utility/applications	
	Reference : Weblink/Youtube/Book	
<b>Unit - 3</b>		
<b>Chapter No.7</b>	Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Peizo-Electric transducers, Optical Transducer, Hall Effect Transducer	06
<b>Chapter No. 8</b>	CRO: Block diagram, Sweep generation, vertical amplifiers, use of CRO in measurement of frequency, phase, Amplitude and rise time of a pulse. Digital Multi-meter: Block diagram, principle of operation	03
<b>Chapter No. 9</b>	Basics of lead acid batteries, Lithium Ion Battery , Battery storage capacity, Coulomb efficiency, Numerical of high and low charging rates, Battery sizing.	04
<b>Topics for self study ( If any)</b>	Fuses, MCB, ELCB and Relays, Filament lamp, Tube light, CFL and LED	
<b>Suggested Activities</b>		
<b>Activity No. 5</b>	Prepare a document on evolution of incandescent bulbs to the present day LED lights	
	Reference : Weblink/Youtube/Book	
<b>Activity No.6</b>	Make a comparative study of Fuses, MCB, ELCB and Relays highlighting their use and applications	
	Reference : Weblink/Youtube/Book	

AK.Sawhney, A Course in Elec.&Electronics Measurements&Instrumentation ,**Dhanpatrai& Co. 1978**

A.D. Helfrick& W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques

PHI 2016

## Text Books

## References Books

1. D C Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill Publications, <b>2019</b>
2. David G Alciatore and Michel B Histand, Introduction to Mechatronics and Measurement Systems, 3rd, Tata McGraw Hill Education Private Limited, New Delhi., 2005
3. Vincent Del Toro, Electrical Engineering Fundamentals Prentice Hall India <b>2009</b>



## List of Experiments to be performed in the Laboratory

Sl No	Experiment
1	Introduction to Lab Equipment
2	Voltmeter Design
3	Ammeter Design
4	Ohmmeter Design
5	Multimeter Design
6	Measurement of Resistance using Wheatstone Bridge
7	Measurement of Capacitance using Schering Bridge
8	Measurement of Inductance using Maxwell Bridge
9	Measurement of Light Intensity
10	Measurement of Temperature
	<b>Reference Book for Laboratory Experiments</b>
	AK.Sawhney A Course in Elec.&Electronics Measurements&Instrumentation:
	Helfrick& Cooper, Modern Electronic Instrumentation and Measurement Techniques:

## PHYSICS FOR ALL

**Time: 2 hrs./week + 01 Hr tutorial**

**Max Marks:**

<b>Unit I</b>	<b>Energy and Power</b> Explosions and energy; Energy, heat and its units; Energy table and discussions; Discussion of cost of energy; Measuring energy; Power; Different power sources; Kinetic energy.	(13 Hours)
<b>Unit II</b>	<b>Gravity, Force and Space</b> The force of Gravity; Newton’s third law; Weightlessness; Low earth orbit; Geosynchronous satellites; Spy satellites; Medium Earth Orbit satellite; Circular Acceleration; momentum; Rockets; Airplanes, helicopters and fans; Hot air and helium balloons; angular momentum and torque.	(13 Hours)
<b>Unit III</b>	<b>Nuclei and radioactivity</b> Radioactivity; Elements and isotopes; Radiation and rays; Seeing radiation; The REM – The radiation poisoning; Radiation and cancer; The linear hypothesis; Different types of radiation; The half-life rule; Smoke detectors; measuring age from radioactivity; Environmental radioactivity; Glow of radioactivity; Nuclear fusion.	(13 Hours)
<b>Unit IV</b>	<b>Climate change</b> Global warming; IPCC; A brief history of climate; carbon dioxide; The greenhouse effect; Enhancement of Greenhouse effect; Hurricane and tornadoes; Antarctica; Fluctuations; Paleoclimate; Global warming vs Human caused global warming; Can we stop global warming?, Fossil Fuel Resources; Energy security; Energy efficiency and conservation; Bio-fuels; Nuclear, Wind and Solar power.	(13 Hours)
	<b>References</b> This course is extracted from the book titled “Physics and Technology for Future Presidents: An Introduction to the Essential Physics Every World Leader Needs to Know” by Richard A Muller, WW Norton and Company, 2007. (Unit-1 to 4 are from chapters 1, 3, 4 and 10, respectively).	

## SPACE MISSIONS

**Time: 2 hrs./week + 01 Hr tutorial**

**Max Marks:**

<b>Unit 1:</b>	<b>Introduction to Space Missions :</b>	<b>13 Hours</b>
	Rockets, types and their applications, Different types of orbits, Artificial satellites – basic idea and their applications, Introduction to Space Missions, Beginning of Space Missions - World and India, Applications of Space Research, Space crafts, Launching Vehicles.	
<b>Unit 2:</b>	<b>National Aeronautics and Space Administration (NASA)</b>	<b>13 Hours</b>
	About NASA and its Goals, History of Creation. Foundational human spaceflight: X-15 program (1954–1968), Project Mercury (1958–1963), Project Gemini (1961–1966), Project Apollo (1960–1972), Skylab (1965–1979), Apollo-Soyuz (1972–1975).  Modern human spaceflight programs: Space Shuttle program (1972–2011), International Space Station (1993–present), Constellation program (2005–2010), Commercial Crew Program (2011–present), Journey to Mars (2010–2017), Artemis program (2017–present).	
<b>Unit 3:</b>	<b>Indian Space Research Organisation (ISRO)</b>	<b>13 Hours</b>
	About ISRO and its Goals, History of Creation. General Satellite Programmes: The IRS series, The INSAT series. Gagan Satellite Navigation System, Navigation with Indian Constellation (NavIC), Other satellites.  Launch vehicles: Satellite Launch Vehicle (SLV), Augmented Satellite Launch Vehicle (ASLV), Polar Satellite Launch Vehicle (PSLV), Geosynchronous Satellite Launch Vehicle (GSLV). Experimental Satellites: Details and applications (Any Five) Earth Observation Satellites: Details and applications (Any Five) Communication satellites: Details and applications (Any Five)	
	<b>Self Study:</b>  Major Space Centres in the World (at least 10) – brief idea about their location, establishment, capabilities and achievements. People behind space programs – at least 2 from India. Successful Missions (Any Five).  <b>Activities*:</b>  <ul style="list-style-type: none"> <li>• Design of working model of Rocket launching.</li> <li>• Preparation of report and presentation on application of satellites in agriculture, communication, weather forecasting, exploration of natural resources and Global positioning system (GPS).</li> </ul> <p style="text-align: center;">* Faculty may suggest any other relevant activity as well.</p> Preparation of report and presentation on Apollo 11: A Success story	

**Activities:**

- Preparation of report and presentation on the recent space missions of NASA.
- Preparation of report on any one proposed space programme of NASA.

\* Faculty may suggest any other relevant activity as well.

Chandrayaan 1: Details and applications. Mars Orbiter Mission: Details and applications.

**Activities:**

- Preparation of report and presentation on the recent space missions of ISRO.
- Preparation of report and presentation on any one proposed space programme of ISRO.
- Preparation of report and presentation on the contributions of Scientists from Karnataka to Indian Space Program and use of space technology in the local district.

\* Faculty may suggest any other relevant activity as well.

# Activity Based Pedagogy:

## (Design, Activity and Assessment)

Conducting activity based teaching-learning experience for students empower students with several graduate attributes by addressing several Outcomes at different levels of the Cognitive Blooms Taxonomy of Learning: like Clarity of Concept, ability to apply knowledge, evaluate and analyse the results, while they are also learn through the Affective and Psycho-motor domains of Learning through self-learning, group dynamics and team work, communication and presentation skills, ethics, life-long learning, etc. These experiments must be ones that do not involve sophisticated instrumentation and should be able to be performed outside laboratories.

### Example 1: Elastic Properties of Solids:

The most important concept of studying elastic properties of solids is the Hooke's Law, which defines the stress-strain relationship.

**Class 1:** Defining problems, forming groups and giving instructions:

- The students should be made into forced groups of 6 to 8 members, depending on the class strength, consisting of diverse kinds of students in cognition, cultural, sex, behaviour, etc.
- Different materials of varying elastic properties should be given to each group, and should be asked to plot a graph of stress-strain of these materials in 8-10 days.
- Give clear instructions and clarify doubts, but not giving the procedure for the experiments. Students should discuss among themselves and consult books and internet to identify the procedure to obtain the Stress-strain graph. They should use only house-hold items or other commonly available tools to perform all the experiments.

**Class 2:** Presentation and discussion by students (max 8-10 mins each)

- Each group will be asked to make a presentation of 2 power point slides, where the first one explains the process they went through to arrive at the results and the second one shows their measured graph and an ideal text book plots. This slide should also contain two or three explanations of why both the plots differ.
- The student who will make the presentation on behalf of the group will be randomly selected just before the presentations. This will ensure that all group members will be mutually train each other for the presentation.
- The teacher should give equal marks to each member of a group depending on the methods adopted and clarity of concepts and results obtained and ability to analyse.

The following Program Outcomes will be attained by the students in such an activity based learning:

P.O. 1 : Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.

P.O. 3 : Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.

P.O. 5 : Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.

P.O. 6 : Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

## **Example 2: Periodic and Non-Periodic Motions**

Most important aspect of understanding this topic is to distinguish them with the amplitude versus distance and amplitude versus time plots.

### **Class 1: Defining problems and giving instructions**

- Each student will be asked to list as many observations as possible, under the two types of motion as they observe in the external world (home, market, college, etc) in 8-10 days.
- The student will be asked to identify any one motion in each of the lists and plot graphs of amplitude versus distance and amplitude versus time for each of them in the 8-10 days.

### **Class 2: Peer evaluation by students and defending self**

- Each student is asked to submit the lists of periodic and non-periodic motions observed in everyday life.
- Each student is also asked to submit the amplitude versus distance and amplitude versus time of one periodic motion and one non-periodic motion of his/her choice among his/her list.
- The submissions are randomly distributed among other students. Teacher now discusses the two types of motions in the lists of students and shows how the graphs will ideally look like.
- Now students are asked to evaluate and mark the submissions of other students they have with them and then the marked papers are returned to the respective students.
- Each student should be given an opportunity to question the marks he has got and each student who has given the marks should be able to defend his choice or marks.
- While observing the lists, marks obtained and the plots made, the teacher can assign marks to each student.

The following Program Outcomes will be attained by the students in such an activity based learning:

P.O. 1. Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.

P.O. 4. Ethics: Apply the professional ethics and norms in respective discipline.

P.O. 6. Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

### Continuous Formative Evaluation/ Internal Assessment:

Total marks for each course shall be based on continuous assessments and semester end examinations. The pattern of 40 : 60 for IA and Semester End theory examinations respectively and 50 : 50 for IA and Semester End practical examinations respectively.

Total Marks for each Course	= 100 marks
Continuous assessment (C1)	= 20 marks
Continuous assessment (C2)	= 20 marks
Semester End Examination (C3)	= 60 marks

### Evaluation process of IA marks shall be as follows:

- The first component (C1) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, project work etc. This assessment and score process should be completed after completing 50% of syllabus of the course/s and within 45 working days of semester program
- The second component (C2) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, internship / industrial practicum / project work etc. This assessment and score process should be based on completion of remaining 50 percent of syllabus of the courses of the semester.
- During the 17th – 19th week of the semester, a semester end examination shall be conducted by the University for each Course. This forms the third and final component of assessment (C3) and the maximum marks for the final component will be 60%.
- In case of a student who has failed to attend the C1 or C2 on a scheduled date, it shall be deemed that the student has dropped the test. However, in case of a student who could not take the test on scheduled date due to genuine reasons, such a candidate may appeal to the Program Coordinator / Principal. The Program Coordinator / Principal in consultation with the concerned teacher shall decide about the genuineness of the case and decide to conduct special test to such candidate on the date fixed by the concerned teacher but before commencement of the concerned semester end examinations.
- For assignments, tests, case study analysis etc., of C1 and C2, the students should bring their own answer scripts (A4 size), graph sheets etc., required for such tests/assignments and these be stamped by the concerned department using their department seal at the time of conducting tests / assignment / work etc.
- The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) of a course shall be as under.
- 

Activities	C1	C2	Total Marks
Session Test	10 marks	10 marks	20
Seminars/Presentations/Activity	10 marks		10
Case study /Assignment / Field work / Project work etc.		10 marks	10
Total	20 marks	20 marks	40

## UG-Physics- Syllabus

- For practical course of full credits, Seminar shall not be compulsory. In its place, marks shall be awarded for Practical Record Maintenance.(the ratio is 50 (25 + 25) : 50)
  - Conduct of Seminar, Case study / Assignment, etc. can be either in C1 or in C2 component at the convenience of the concerned teacher.
  - The teachers concerned shall conduct test / seminar / case study, etc. The students should be informed about the modalities well in advance. The evaluated courses / 29 assignments during component I (C1) and component II (C2) of assessment are immediately provided to the candidates after obtaining acknowledgement in the register by the concerned teachers(s) and maintained by the Chairman in the case of a University Post-Graduate Department and the Principal / Director in the case of affiliated institutions. Before commencement of the semester end examination, the evaluated test, assignment etc. of C1 and C2 shall be obtained back to maintain them till the announcement of the results of the examination of the concerned semester.
- h) The marks of the internal assessment shall be published on the notice board of the department / college for information of the students.
  - i) The Internal assessment marks shall be communicated to the Registrar (Evaluation) at least 10 days before the commencement of the University examinations and the Registrar (E) shall have access to the records of such periodical assessments.
  - j) There shall be no minimum in respect of internal assessment marks.
  - k) Internal assessment marks may be recorded separately. A candidate who has failed or rejected the result, shall retain the internal assessment marks.

### **Scheme of Valuation for Practical's**

C1 and C2 are internal tests to be conducted during 8th and 16th weeks respectively of the semester. C3 is the semester-end examination conducted for 3 hours. The student will be evaluated on the basis of skill, comprehension and recording the results. The student has to compulsorily submit the practical record for evaluation during C1 and C2. For C3, the record has to be certified by the Head of the Department.

- The student is evaluated for 25 marks in C1 and C2 as per the following scheme: Experiment: 20, Record: 05 for C1 (25 marks)



## UG-Physics- Syllabus

Experiment: 20, Record: 05 for C2 (25 marks)

- The student is evaluated for 50 marks in C3 as per the following scheme: Experiment: 35, Viva: 15 for C3 (50 marks)

The experimental portion of evaluation (C3) is carried out as per the following scheme:

Formula with proper units and explanation	08
Setting up the apparatus / circuit connections	07
Taking readings and tabulating	10
Calculations and Graph	10
Viva	15
Total	50

### QUESTION PAPER PATTERN

#### DSC Courses and similar courses

Max Marks:

Time: 3 hours

#### Unit 1

Long answer questions; Answer 1 out of 2  $1 \times 10 = 10$

#### Unit 2

Long answer questions; Answer 1 out of 2  $1 \times 10 = 10$

#### Unit 3

Long answer questions; Answer 1 out of 2  $1 \times 10 = 10$

#### Unit 4

Long answer questions; Answer 1 out of 2  $1 \times 10 = 10$

**Numerical problems:** Six numerical problems (one each from unit); 4 to be answered  $4 \times 5 = 20$



**JSS COLLEGE OF ARTS, COMMERCE AND  
SCIENCE**

**(Autonomous)**

**OOTY ROAD, MYSURU- 570 025**

**DEPARTMENT OF PHYSICS**

**Syllabus**

**CHOICE BASED CREDIT SYSTEM**

**For B.Sc programmes**

- **Physics, Mathematics and Chemistry**
- **Physics, Mathematics and Computer Science**
- **Physics, Mathematics and Electronics**
- **Physics, Mathematics and Computer Maintenance**

**wef**

**2019-20**

## Department of Physics

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2019-20) PCM01

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration		
							SEE		IA				
							Theory	Practical	Theory	Practical	Theory	Practical	
I BSc	I	DMA29001	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMA29101		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	II	DMB29001	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMB29101		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
II BSc	III	DMC29001	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMC29101		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
	IV	DMD29001	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMD29101		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
III BSc	V	DME29001	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29101		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
		DME29201	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29301		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
		DME29401	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29501		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	V	DME29601	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---	
		DME29801	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---	
		DME30001	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---	
		DME30201	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---	
	VI	DSE-1A	DMF29001	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
			DMF29101		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DSE-1B	DMF29201	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
			DMF29301		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
DSE-1C		DMF29401	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMF29501		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	

## Department of Physics

PROGRAMME: PROGRAMME CODE: BSc-01 (2019-20) PMCs02

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration		
							SEE		IA		Theory	Practical	
							Theory	Practical	Theory	Practical			
I BSc	I	DMA29002	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMA29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	II	DMB29002	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMB29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
II BSc	III	DMC29002	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMC29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
	IV	DMD29002	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMD29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
III BSc	V	DME29002	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME291012		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
		DME29202	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29302		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
		DME29402	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29502		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	V	DME29602	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---	
		DME29802	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---	
		DME30002	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---	
		DME30202	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---	
	VI	DSE-1A	DMF29002	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
			DMF29102		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DSE-1B	DMF29202	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
DMF29302			Practical		0:0:2	----		35	----	15 (7.5+7.5)	----	3h	
DSE-1C		DMF29402	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMF29502		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	

## Department of Physics

PROGRAMME: PROGRAMME CODE: BSc-01 (2019-20) PMCM03

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration		
							SEE		IA		Theory	Practical	
							Theory	Practical	Theory	Practical			
I BSc	I	DMA29002	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMA29103		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	II	DMB29003	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMB29103		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
II BSc	III	DMC29003	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMC29103		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
	IV	DMD29003	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMD29103		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
III BSc	V	DME29003	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29103		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
		DME29203	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29303		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h	
		DME29403	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29503		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	V	DME29603	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---	
		DME29803	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---	
		DME30003	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---	
		DME30203	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---	
	VI	DSE-1A	DMF29003	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
			DMF29103		Practical	0:0:2		----	35	----	15 (7.5+7.5)	---	3h
		DSE-1B	DMF29203	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
			DMF29303		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
DSE-1C		DMF29403	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMF29503		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	

## Department of Physics

PROGRAMME: PROGRAMME CODE: BSc-01 (2019-20) PME04

Year	Sem	Course code	Course type	Course Title	L:T:P	Total credits	Maximum Marks in the Exam/Assessment				Exam Duration		
							SEE		IA		Theory	Practical	
							Theory	Practical	Theory	Practical			
I BSc	I	DMA29004	DSC-1	Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMA29104		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	II	DMB29004	DSC-2	Electricity and Magnetism	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMB29104		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
II BSc	III	DMC29004	DSC-3	Thermal physics and Statistical mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMC29104		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	IV	DMD29004	DSC-4	Waves and Optics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMD29104		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
III BSc	V	DME29004	DSE-1A	Digital, Analog circuits and Instrumentation	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29104		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
		DME29204	DSE-1B	Solid State Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29304		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
		DME29404	DSE-1D	Mathematical Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DME29504		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	
	V	DME29604	SEC-1A	Renewable Energy and Energy harvesting	2:0:0	02	35	--	15	--	2h	---	
		DME29804	SEC-1B	Radiation Safety	2:0:0	02	35	--	15	--	2h	---	
		DME30004	SEC-1C	Basic Instrumentation Skills	2:0:0	02	35	--	15	--	2h	---	
		DME30204	SEC-1I	Applied Optics	2:0:0	02	35	--	15	--	2h	---	
	VI	DSE-1A	DMF29004	DSE-1A	Elements of Modern Physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
			DMF29104		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h
		DSE-1B	DMF29204	DSE-1B	Nuclear and particle physics	4:0:0	06	70	---	30 (15+15)	---	3h	--
DMF29304			Practical		0:0:2	----		35	----	15 (7.5+7.5)	----	3h	
DSE-1C		DMF29404	DSE-1C	Quantum Mechanics	4:0:0	06	70	---	30 (15+15)	---	3h	--	
		DMF29504		Practical	0:0:2		----	35	----	15 (7.5+7.5)	----	3h	

## **Programme Outcome for Bachelor of Science in Physics, Chemistry and Mathematics:**

After completing the graduation in the Bachelor of Science the students are able to:

PO1.Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.

PO2.Demonstrate the ability to justify and explain their thinking and/or approach

PO3.Develop state-of-the-art laboratory and professional communication skills

PO4.Apply the scientific method to design, execute, and analyze an experiment

PO5.Explain scientific procedures and experimental observations

PO6.Appreciate the role of chemistry in the society

PO7.Use this as a basis for ethical behaviour in issues facing chemists /drugs

PO8.Understand chemistry as an integral part for addressing social, economic, and environmental problems

PO9.Understand the value of Mathematical proof

PO10.Demonstrate proficiency in writing and understanding proofs

PO11.Apply mathematical problems and solution in aspects of science and technology

PO12.Gain experience to investigate the real world problems

PO13.Apply mathematical ideas and models to those problems

## **Programme Specific Outcome**

### **Bachelor of Science in Physics, Chemistry and Mathematics**

After completing the graduation in Physics, Chemistry and Mathematics the students are able to:

PSO1.Find career opportunities

PSO2.Develop competence to write competitive examinations

PSO3.Develop proficiency in the analysis of complex physical problems

PSO4.Use of mathematical or other appropriate techniques to solve problems

PSO5.Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries

PSO6.Create a hypothesis and appreciate how it relates to broader theories

PSO7.Demonstrate skills in the use of computers



## **Programme Outcome for Bachelor of Science in Physics, Mathematics and Computer Science:**

After completing the graduation in the Bachelor of Science the students are able to:

PO1.Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics

PO2.Demonstrate the ability to justify and explain their thinking and/or approach

PO3.Develop state-of-the-art laboratory and professional communication skills

PO4.Apply the scientific method to design, execute, and analyze an experiment

PO5.Explain scientific procedure and experimental observations

PO6.Understand the value of Mathematical proof

PO7.Demonstrate proficiency in writing an understanding proofs

PO8. Apply mathematical problems and solutions in aspects of science and technology.

PO9.Gain experience to investigate the real world problems

PO10. Apply mathematical ideas and models to those problems.

PO11. Apply Mathematical principles for computing and logical design.

PO12.Design, implements, and evaluates a computational system to meet desired needs within realistic constraints

PO13. Use the System principles in the design and development of software for systems of varying complexity.

## **Programme Specific Outcome**

### **Bachelor of Science in Physics, Mathematics, Computer Science**

After completing the graduation in the Bachelor of Science the students are able to:

PSO1.Find career opportunities

PSO2. Develop competence to write competitive examinations.

PSO3.Develop proficiency in the analysis of complex physical problems

PSO4.Use of mathematical or other appropriate techniques to solve problems

PSO5.Create a hypothesis and appreciate how it relates to broader theories.

PSO6.Demonstrate skills in the use of Computers

PSO7.Join as Entry level Technical job role for an IT Industry

PSO8. Build small database ERP software/ web applications.

**Programme Outcome for Bachelor of Science in Physics, Mathematics and Computer Maintenance:**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1.Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics
- PO2.Demonstrate the ability to justify and explain their thinking and/or approach
- PO3.Develop state-of-the-art laboratory and professional communication skills
- PO4.Apply the scientific method to design, execute, and analyze an experiment
- PO5.Explain scientific procedure and experimental observations
- PO6.Understand the value of Mathematical proof
- PO7.Demonstrate proficiency in writing and understanding proofs
- PO8.Apply mathematical problems and solutions in aspects of science and technology.
- PO9.Gain experience to investigate the real world problems
- PO10.Apply mathematical ideas and models to those problems
- PO11.Design, implement and evaluate a computational system to meet desired needs within realistic constraints
- PO12.Apply system design and development principals in the construction of software systems of varying complexity
- PO13.Apply the knowledge techniques , skills and modern tools in computer maintenance
- PO14.Understand networking applications to include basic electronics, programming, operation and computer network

## **Programme Specific Outcome**

### **Bachelor of Science in Physics, Mathematics, Computer Maintenance**

After completing the graduation in the Bachelor of Science the students are able to:

PSO1.Find career opportunities

PSO2.Develop competence to write competitive examinations

PSO3.Develop proficiency in the analysis of complex physical problems

PSO4.Use of mathematical or other appropriate techniques to solve them

PSO5.Create a hypothesis and appreciate how it relates to broader theories.

PSO6.Demonstrate skills in the use of Computers

PSO7. Start small enterprise in PC Maintenance/ Networking field.

PSO8.Join organizations related to Computer Hardware and Networking Maintenance.

## **Programme Outcome for Bachelor of Science in Physics, Mathematics and Electronics:**

After completing the graduation in the Bachelor of Science the students are able to:

PO1.Demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.

PO2.Demonstrate the ability to justify and explain their thinking and/or approach

PO3. Develop state-of-the-art laboratory skills and professional communication skills.

PO4.Apply the scientific method to design, execute, and analyze an experiment

PO5.Understand the value of Mathematical proof

PO6.Gain experience to investigate the real world problems

PO7.Explain scientific procedures and their experimental observations

PO8. Demonstrate proficiency in writing and understanding proofs.

PO9.Apply mathematical problems and solutions in aspects of science and technology

PO10. Apply mathematical ideas and models to problems.

PO11.Apply appropriate troubleshooting techniques to electronic circuits / systems and perform test procedures

PO12.Assist, Assemble, modify and test electronic circuits in accordance with job requirements.

PO13.Communicate effectively in technical and non-technical environments

## **Programme Specific Outcome**

### **Bachelor of Science in Physics, Mathematics, Electronics**

After completing the graduation in the Bachelor of Science the students are able to:

PSO1.Find career opportunities

PSO2.Develop competence to write competitive examinations.

PSO3.Develop proficiency in the analysis of complex physical problems.

PSO4.Use mathematical or other appropriate techniques to solve complex physical problems.

PSO5.Create a hypothesis and appreciate how it relates to broader theories.

PSO6.Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations

PSO7.Apply knowledge of Physics, Mathematics and Electronics fundamentals to the solve problems in electronic circuits & communication systems

PSO8.Apply appropriate troubleshooting techniques to Electronic circuits / systems and perform test procedures

**Discipline Specific Elective papers: Choose 1**

**SEMESTER V**

**Course code: DME29001/ DME29002/ DME29003/ DME29004**

**Credits: Theory – 04, Practical – 02**

**Theory: 60 Lectures**

**COURSE OUTCOME:**

After the completion of the course, Students will be able to

CO1.Deliberate in detail with examples Digital Circuits

CO2.Specify the details of Operational amplifier

CO3.Learn the characteristics of sinusoidal oscillator

CO4.Identify in detail with application Instrumentation

CO5.Deliberate the classification and characteristics of gates

CO6.Identify in detail with application of semiconductor devices

**DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION:**

**DSE 1A**

**Unit-1**

**Digital Circuits**

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. **(04 Lectures)**

De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean algebra. Fundamental Products.Minterms and Maxterms.Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(05 Lectures)**

## UG-Physics- Syllabus

Binary Addition.Binary Subtraction using 2's Complement Method).Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor. **(04 Lectures)**

### **Semiconductor Devices and Amplifiers:**

**Semiconductor Diodes:** p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics.Static and Dynamic Resistance.Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell. **(05 Lectures)**

**Bipolar Junction transistors:** n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations.Active, Cutoff, and Saturation Regions.Current gains  $\alpha$  and  $\beta$ . Relations between  $\alpha$  and  $\beta$ . Load Line analysis of Transistors.DC Load line and Q-point.Voltage Divider Bias Circuit for CE Amplifier.h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers. Two stage RC coupled amplifier. **(12 Lectures)**

## **Unit-2**

### **Operational Amplifiers (Black Box approach):**

Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop& Closed-loop Gain.CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and Non-inverting Amplifiers (2) Adder (3) Subtractor (4) Differentiator (5) Integrator (6) Zero Crossing Detector

**(13 Lectures)**

**Sinusoidal Oscillators:** Barkhausen's Criterion for Self-sustained Oscillations. Determination of Frequency of RC Oscillator **(05Lectures)**

### **Instrumentations:**

Introduction to CRO: Construction and Working of CRO Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **(03 Lectures)**

Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation. **(06 Lectures)**



## UG-Physics- Syllabus

Timer IC: IC 555 Pin diagram and its application as Astable & Monostable Multivibrator.

**(03 Lectures)**

### Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
- Microelectronic Circuits, M.H. Rashid, 2<sup>nd</sup>Edn. 2011, Cengage Learning.
- Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning
- Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7<sup>th</sup> Ed.,2011, Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6<sup>th</sup>Edn., Oxford University Press.
- Fundamentals of Digital Circuits, A. Anand Kumar, 2<sup>nd</sup> Edition, 2009, PHI Learning Pvt. Ltd.
- OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

## PRACTICALS - DSE LAB: DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTS

**Course code: DME29101/ DME29102/ DME29103/ DME29104**

### (Minimum of eight is to be conducted)

1. To verify and design AND, OR, NOT and XOR gates using IC 7400
2. To verify and design AND, OR, NOT and XOR gates using IC 7402
3. Half adder and Full adder
4. FET-characteristics
5. To study the characteristics of a Transistor in CE configuration.
6. To study the characteristics of a Transistor in CB configuration.
7. Phase shift oscillator
8. Op-amp has inverting and non-inverting amplifier
9. Wien Bridge Oscillator

## UG-Physics- Syllabus

10. CE-amplifier
11. To minimize a given logic circuit.
12. To design an astable multivibrator of given specifications using 555 Timer.
13. To design a monostable multivibrator of given specifications using 555 Timer
14. UJT Characteristics
15. Op Amp has Adder and Subtractor.

### Reference Books:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4<sup>th</sup> edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill

## SEMESTER V

**Course code:** DME29201/ DME29202/ DME29203/ DME29204

**Credits:** Theory – 04, Practical – 02

**Theories:** 60 Lectures

### **COURSE OUTCOME:**

After the completion of the course, Students will be able to

CO1. Write down in detail with application of crystal structure

CO2. Write down the details of Elementary lattice dynamics

CO3. Deliberate in detail with examples Magnetic properties of matter

CO4. Identify the characteristics of elementary band theory

CO5. Learn the classification and characteristics of superconductivity

CO6. Understand the elastic properties of solids and lattice vibrations

## **SOLID STATE PHYSICS: DSE 1B**

### **Unit-1**

**Crystal Structure:** Solids: Amorphous and Crystalline Materials. Lattice

Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Bragg spectrometer. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance. **(10 Lectures)**

**Elementary Lattice Dynamics:** Lattice Vibrations and Phonons: Linear Monatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. **(09 Lectures)**

**Magnetic Properties of Matter:** Dia, Para, Ferri and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **(11 Lectures)**

## Unit-2

**Electrical Properties of metals:** Free electron theory, Quantum theory, Conductivity of metals on the basis of free electron theory- Ohm's law. **(04 Lectures)**

**Dielectric Properties of Materials:** Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility.Polarizability.Clausius Mosotti Equation. Classical Theory of Electric Polarizability.Normal and Anomalous Dispersion.Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmon's. **(10 Lectures)**

**Elementary band theory:** Kronig Penny model. Band Gaps.Conductors, Semiconductors and insulators. P and N type Semiconductors, carrier concentration in intrinsic semiconductor, Fermi energy, effect of temperature and concentration on Fermi energy, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient. **(10 Lectures)**

**Superconductivity:** Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.BCS theory, application of Superconductors. **(06 Lectures)**

### **Reference Books:**

- Introduction to Solid State Physics, Charles Kittel, 8<sup>th</sup> Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2<sup>nd</sup> Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
- Solid State Physics, Rita John, 2014, McGraw Hill
- Solid-state Physics, H. Ibach and H Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

**PRACTICALS-DSE LAB: SOLID STATE PHYSICS**

**Course code: DME29301/ DME29302/ DME29303/ DME29304**

**(Minimum of eight is to be conducted)**

1. Determination of energy gap of a semiconductor using Meter Bridge.
2. Determination Fermi energy of metal (copper).
3. To measure the Dielectric Constant of a given solid Materials
4. Study of LDR characteristics.
5. Verification of Inverse square law for light Intensity using a Photo-diode.
6. Bridge rectifier with and without filters.
7. Clipping and clamping circuits using diodes.
8. Zener diode as a voltage regulator.
9. Study of powder X-ray photograph-the determination of inter planar distances.
10. To determine value of Planck's constant using LEDs of at least 4 different colors.
11. To determine value of Boltzmann constant using V-I characteristic of PN diode.
12. Study of Hall Effect.
13. To determine the refractive index of a dielectric layer using SPR
14. To study the PE Hysteresis loop of a Ferroelectric Crystal.
15. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (from room temperature to 150 °C) and to determine its band gap
16. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
17. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
18. Measurement of Magnetic susceptibility of solids.

**Reference Books**

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4<sup>th</sup> Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11<sup>th</sup> Ed., 2011, KitabMahal, New Delhi
- Elements of Solid State Physics, J.P. Srivastava, 2<sup>nd</sup> Ed., 2006, Prentice-Hall of India

## SEMESTER V

**Course code:** DME29401/ DME29402/ DME29403/ DME29404

**Credits:** Theory – 04, Practical – 02

**Theories:** 60 Lectures

### COURSE OUTCOME:

After successful completion of the course, the student is able to:

CO1.Learn in detail with examples calculus of functions of more than one variable

CO2.Specify the details of Fourier series.

CO3.Specify in depth integrals.

CO4.Deliberate in detail with application of partial differential equations

CO5.Understand in depth complex analysis

CO6.Deliberate in detail with examples of beta and gamma function

## MATHEMATICAL PHYSICS: DSE 1D

### Unit-1

**Calculus of functions of more than one variable:** Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. **(06 Lectures)**

**Fourier series:** Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only).Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.Application.Summing of Infinite Series. **(10 Lectures)**

**Frobenius Method and Special Functions:** Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations.Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Orthogonality. Simple recurrence relations. **(14 Lectures)**

**Unit-2**

**Some Special Integrals:** Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral). **(06 Lectures)**

**Partial Differential Equations:** Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. **(10 Lectures)**

**Complex Analysis:** Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula.

**(14 Lectures)**

**Reference Books:**

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- An Introduction to Ordinary Differential Equations, Earl A Coddington, 1961, PHI Learning.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Essential Mathematical Methods, K.F. Riley and M.P. Hobson, 2011, Cambridge University Press
- Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Books.



**PRACTICALS -DSE LAB: MATHEMATICAL PHYSICS**

**Course code: DME29501/ DME29502/ DME29503/ DME29504**

The aim of this course is not just to teach computer programming and numerical Analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems
- Use of computer language as a tool in solving physics problems (applications)
- The course will consist of lectures (both theory and practical) in the Computer Lab
- Evaluation done not on the programming but on the basis of formulating the problem
- Aim at teaching students to construct the computational problem to be solved
- Students can use anyone operating system Linux or Microsoft Windows

<b>Topics Description with Applications</b>	Introduction and Overview
Introduction and Overview	Computer architecture and organization, memory and Input/output devices
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) ( <i>If-statement. If-else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While-Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops</i> ), Arrays ( <i>1D&amp;2D</i> ) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs: using C/C++ language	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending-descending order, Binary search

**UG-Physics- Syllabus**

Random number generation	Area of circle, area of square, volume of sphere, value of pi ( $\pi$ )
Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation, solving $\alpha = \tan \alpha; I = I_0 \left( \frac{\sin \alpha}{\alpha} \right)^2$ in optics
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g. $\sin \theta$ , $\cos \theta$ , $\tan \theta$ , etc.
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice-versa. Find the area of B-H Hysteresis loop
Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	<p>First order differential equation</p> <ul style="list-style-type: none"> <li>• Radioactive decay</li> <li>• Current in RC, LC circuits with DC source</li> <li>• Newton's law of cooling</li> <li>• Classical equations of motion</li> </ul> <p>Attempt following problems using RK 4 order method:</p> <ul style="list-style-type: none"> <li>• Solve the coupled differential equations</li> </ul> $\frac{dx}{dt} = y + x - \frac{x^3}{3}; \frac{dy}{dx} = -x$ <p>for four initial conditions <math>x(0) = 0, y(0) = -1, -2, -3, -4</math>. Plot <math>x</math> vs <math>y</math> for each of the four initial conditions on the same screen for <math>0 \leq t \leq 15</math></p> <p>The differential equation describing the motion of a Pendulum is <math>\frac{d^2 \theta}{dt^2} = -\sin(\theta)</math>. The pendulum is released from rest at an angular displacement <math>\alpha</math>, i.e. <math>\theta(0) = \alpha</math>, and <math>\theta^1(0) = 0</math>. Solve the equation for <math>\alpha = 0.1, 0.5</math> and <math>1.0</math> and plot <math>\theta</math> as a function of time in the range <math>0 \leq t \leq 8\pi</math>. Also plot the analytic solution valid for small <math>\theta \sin(\theta) = \theta</math></p>

**Reference Books:**

- Introduction to Numerical Analysis, S.S. Sastry, 5thEdn., 2012, PHI Learning Pvt. Ltd.
- Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Publications.
- Numerical Recipes in C++: The Art of Scientific Computing, W.H. Press et al., 3rdEdn., 2007, Cambridge University Press.
- A first course in Numerical Methods, Uri M. Ascher and Chen Greif, 2012, PHI Learning
- Elementary Numerical Analysis, K.E. Atkinson, 3rdEdn. , 2007, Wiley India Edition.
- Numerical Methods for Scientists and Engineers, R.W. Hamming, 1973, Courier Dover Pub.
- An Introduction to Computational Physics, T. Pang, 2ndEdn., 2006, Cambridge Univ. Press

**Discipline Specific Elective papers: Choose 1**

**SEMESTER VI**

**Course code:** DMF29001/ DMF29002/ DMF29003/ DMF29004

**Credits: Theory – 04, Practical – 02**

**Theories: 60 Lectures**

**COURSE OUTCOME:**

After successful completion of the course, the student is able to:

CO1.Understand in detail with examples planks quantum

CO2.Identify the classification and characteristics of Planck's quantum

CO3.Learn the classification and characteristics of fission and fusion reaction

CO4.Write down the characteristics of matter waves

CO5.Understand the classification and characteristics of radioactivity

CO6.Specify in depth Eigen values

**ELEMENTS OF MODERN PHYSICS: DSE 1A**

**Unit-1**

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment.

**(08 Lectures)**

Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. **(04 Lectures)**

Position measurement-gamma ray microscope thought experiment; wave-particle duality, Heisenberg uncertainty principle-impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle **(04 lectures)**

## UG-Physics- Syllabus

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wave function, probabilities and normalization; Probability and probability current densities in one dimension. **(10 Lectures)**

Fission and fusion - mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions. **(04 Lectures)**

### **Unit-2**

One dimensional infinitely rigid box- energy eigenvalues and Eigen functions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier. **(12 Lectures)**

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy. **(07 Lectures)**

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & half-life; Alpha decay; Beta decay - energy released, spectrum and Pauli's prediction of neutrino; gamma-ray emission. **(11 Lectures)**

### **Reference Books:**

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
- Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, 2009, PHI Learning
- Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill

## UG-Physics- Syllabus

- Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
- Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning
- Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

### **PRACTICALS –DSE LAB: ELEMENTS OF MODERN PHYSICS**

**Course code:** DMF29101/ DMF29102/ DMF29103/ DMF29104

#### **(Minimum of eight is to be conducted)**

1. To study the Divergence of laser.
2. Characteristics of LED – To measure efficiency and output power.
3. The logic gates AND, OR, NOT gates using Transistors.
4. Phase measurement in LCR circuit using CRO.
5. Negative feedback amplifier.
6. Hartley Oscillator.
7. Determine Rydberg constant using Charging Hydrogen discharge tube.
8. Two stages RC coupled Amplifier
9. Triode characteristics.
10. Energy dissipation during charging of capacitors
11. To determine the ionization potential of mercury.
12. To study photoelectric effect.
13. Determination of dielectric constant of a material used in capacitor.
14. To determine work function of material of filament of directly heated vacuum diode.
15. To determine the absorption lines in the rotational spectrum of Iodine vapor. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.
16. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
17. To setup the Millikan oil drop apparatus and determine the charge of an electron.
18. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.
19. To determine work function of material of filament of directly heated vacuum diode.

## UG-Physics- Syllabus

20. Spectral response of solar cell.

### References:

- Physics of Radiation Therapy: F M Khan Williams and Wilkins, Third edition (2003)
- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
- A. Martin and S.A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4<sup>th</sup> Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11<sup>th</sup> Edition, 2011, KitabMahal, New Delhi.

## SEMESTER VI

**Course code:** DMF29201/ DMF29202/ DMF29203/ DMF29204

**Credits:** Theory – 04, Practical – 02

**Theories: 60 Lectures**

### COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1. Write down in detail with application and properties of nuclei

CO2. Learn in detail with application and nuclear models

CO3. Understand in detail with examples radioactivity

CO4. Identify the details of particle physics

CO5. Write down the details of particle accelerators

CO6. Write down the details of detector for nuclear radiator

## Nuclear & Particle Physics: DSE 1B

### Unit-1

**General Properties of Nuclei:** Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states.

**(10 Lectures)**

**Nuclear Models:** Liquid drop model approach, semi empirical mass formula and binding energy, significance of various terms, condition of nuclear stability. Concept of Nuclear force.

**(06 Lectures)**

**Nuclear Reactions:** Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, Rutherford alpha scattering.

**(04 Lectures)**

**Radioactivity decay :** (a) Alpha decay: basics of  $\alpha$ -decay processes, Geiger Nuttall law,  $\alpha$ -decay spectroscopy. (b) beta-decay: energy kinematics for beta-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay

**(06 Lectures)**



## UG-Physics- Syllabus

**Nuclear fission and fusion:** Estimation of the fission energy on the basis of liquid drop model, controlled and uncontrolled chain reaction, four factor formula, types of reactor

**(04 Lectures)**

### Unit-2

**Interaction of Nuclear Radiation with matter:** Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

**(06 Lectures)**

**Detector for Nuclear Radiations:** GM Counter. Basic principle of Scintillation. Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si & Ge) for charge particle and photon detection (concept of charge carrier and mobility)

**(06 Lectures)**

**Particle Accelerators:** Linear accelerator, Cyclotron, Betatron.

**(04 Lectures)**

**Particle physics:** Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

**(14 Lectures)**

## **PRACTICALS –DSE LAB: NUCLEAR AND PARTICLE PHYSICS**

**Course code:** DMF29301/ DMF29302/ DMF29303/ DMF29304

**(Minimum of eight is to be conducted)**

1. Study of Characteristics of GM tube and determination of operating voltage, plateau length.
2. Verification of inverse square law of gamma rays.
3. Study of Absorption coefficient of gamma particle.
4. Verification of inverse square law of beta rays.
5. Half-life of K-40
6. Determine the ionization potential of Xenon.
7. Cockcroft Walton voltage multiplier.
8. Solar cell characteristics – To determine efficiency and fill factor.
9. Determine wavelength of laser light.
10. To determine the value of  $e/m$  by magnetic focusing.
11. Determination of range of electron in aluminum using GM counter

## UG-Physics- Syllabus

12. Study of Absorption coefficient of beta particle
13. To determine the wavelength of H-alpha emission line of Hydrogen atom.
14. Study of counting statistics using background radiation using GM counter
15. Study of radiation in various materials (e.g. K<sub>2</sub>SO<sub>4</sub> etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.

### Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
- Theoretical Nuclear Physics, J.M. Blatt & V.F. Weisskopf (Dover Pub.Inc., 1991)

## SEMESTER VI

**Course code: DMF29401/DMF29402/DMF29403/DMF29404**

**Credits: Theory – 04, Practical – 02**

**Theories: 60 Lectures**

### **COURSE OUTCOME:**

After successful completion of the course, the student is able to:

CO1.Understand the classification and characteristics of time dependent Schrodinger equation

CO2.Understand in depth time independent Schrodinger equation

CO3.Understand the classification and characteristics of quantum theory of hydrogen like atoms

CO4.Specify the details of atoms in external magnetic field

CO5.Write down the characteristics of many electron atoms

## **QUANTUM MECHANICS: DSE 1C**

### **Unit-1**

**Time dependent Schrodinger equation:** Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. **(08 Lectures)**

**Time independent Schrodinger equation-**Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to the spread of Gaussian wavepacket for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle. **(10 Lectures)**

## UG-Physics- Syllabus

**General discussion of bound states in an arbitrary potential-** continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method. **(12 Lectures)**

### Unit-2

**Quantum theory of hydrogen-like atoms:** time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wave functions from Frobenius method; Orbital angular momentum quantum numbers  $l$  and  $m$ ; s, p, d,.. Shells (idea only) **(10 Lectures)**

**Atoms in Electric and Magnetic Fields:-** Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton. **(08 Lectures)**

**Atoms in External Magnetic Fields:-** Normal and Anomalous Zeeman Effect. **(02 Lectures)**

**Many electron atoms:-** Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table.Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings. **(10 Lectures)**

### Reference Books:

- A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill
- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn. 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldas, 2ndEdn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press
- Quantum Mechanics, EugenMerzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education

- Quantum Mechanics, Walter Greiner, 4thEdn., 2001, Springer

## PRACTICAL-DSE LAB: QUANTUM MECHANICS

Course code: DMF29501/DMF29502/DMF29503/DMF29504

Use C/C++/Scilab for solving the following problems based on Quantum Mechanics Like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

$$\frac{d^2 y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2} [V(r) - E] \text{ where } V(r) = \frac{-e^2}{r}$$

Here, m is the reduced mass of the electron. Obtain the energy Eigen values and plot the corresponding wave functions. Remember that the ground state energy of the hydrogen atom is  $\approx -13.6$  eV. Take  $e = 3.795$  (eVÅ)<sup>1/2</sup>,  $\hbar c = 1973$  (eVÅ) and  $m = 0.511 \times 10^6$  eV/c<sup>2</sup>

2. Solve the s-wave radial Schrodinger equation for an atom

$$\frac{d^2 y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2} [V(r) - E]$$

Where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

$$V(r) = \frac{-e^2}{r} e^{-\frac{r}{a}}$$

Find the energy (in eV) of the ground state of the atom to an accuracy of three Significant digits. Also, plot the corresponding wave function. Take  $e = 3.795$  (eVÅ)<sup>1/2</sup>,  $m = 0.511 \times 10^6$  eV/c<sup>2</sup>, and  $a = 3$  Å,  $5$  Å,  $7$  Å. In these units  $\hbar c = 1973$  (eVÅ). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m:

$$\frac{d^2 y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2} [V(r) - E]$$

For the anharmonic oscillator potential

$$V(r) = \frac{1}{2}kr^2 + \frac{1}{3}br^3 \quad - \quad -$$

for the ground state energy (in MeV) of the particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose  $m = 940 \text{ MeV}/c^2$ ,  $k = 100 \text{ MeV fm}^{-2}$ ,  $b = 0, 10, 30 \text{ MeV fm}^{-3}$ . In these units,  $\hbar c = 197.3 \text{ MeV fm}$ . The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule:

$$\frac{d^2 y}{dr^2} = A(r)u(r), A(r) = \frac{2\mu}{\hbar^2} [V(r) - E]$$

where  $\mu$  is the reduced mass of the two-atom system for the Morse potential

$$V(r) = D \left( e^{-2\alpha r} - e^{-\alpha r} \right)^2, r^1 = \frac{r - r_0}{r}$$

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function. Take:  $m = 940 \times 10^6 \text{ eV}/c^2$ ,  $D = 0.755501 \text{ eV}$ ,  $\alpha = 1.44$ ,  $r_0 = 0.131349 \text{ \AA}$

**Laboratory based experiments:**

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
7. To study the quantum tunnelling effect with solid state device, e.g. tunnelling current in backward diode or tunnel diode.

**Reference Books:**

- Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Publications.
- Numerical Recipes in C: The Art of Scientific Computing, W.H.Press et al., 3rdEdn., 2007, Cambridge University Press.
- Elementary Numerical Analysis, K.E.Atkinson, 3 r dEdn. , 2007, Wiley India Edition.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn., Cambridge University Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB:
- Scientific and Engineering Applications: A. VandeWouwer, P. Saucez, C. V. Fernández.2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf2012ISBN: 978-1479203444
- Scilab(A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand and Company, New Delhi ISBN: 978-8121939706
- Scilab Image Processing: Lambert M. Surhone. 2010Betascript Publishing ISBN: 978-6133459274A
- Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

**Skill Enhancement Course (SEC) (Credit: 02 each)**

**SEMESTER V**

**Course code:** DME29601/ DME29602/ DME29603/ DME29604

**Credits: Theory – 02**

**Theories: 30 Lectures**

**COURSE OUTCOME:**

After the completion of the course, Students will be able to

CO1.Understand the characteristics of fossil fuel

CO2.Learn in detail with application of wind energy

CO3.Specify in detail with application of ocean energy and hydro energy

CO4.Identify the characteristics of geothermal energy

CO5.Deliberate the characteristics of electromagnetic energy

CO6.Deliberate the characteristics of piezoelectric energy harvesting

**RENEWABLE ENERGY AND ENERGY HARVESTING: SEC 1A**

**Fossil fuels and Alternate Sources of energy:** Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(03 Lectures)**

**Solar energy:** Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(06 Lectures)**



## UG-Physics- Syllabus

**Wind Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. **(03 Lectures)**

**Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(03 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. **(02 Lectures)**

**Geothermal Energy:** Geothermal Resources, Geothermal Technologies. **(02 Lectures)**

**Hydro Energy:** Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **(02 Lectures)**

**Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(04 Lectures)**

**Electromagnetic Energy Harvesting:** Linear generators, physics mathematical models, recent applications **(02 Lectures)**

Carbon captured technologies, cell, batteries, power consumption **(02 Lectures)**

Environmental issues and Renewable sources of energy, sustainability. **(01 Lecture)**

### **Demonstrations and Experiments**

1. Demonstration of Training modules on solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

**Reference Books:**

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- [http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy)

## SEMESTER V

**Course code:** DME29801/ DME29802/ DME29803/ DME29804

**Credits: Theory – 02**

**Theories: 30 Lectures**

### COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Deliberate the details of photons

CO2.Understand the classification and characteristics of Atomic and nuclear physics

CO3.Write down the classification and characteristics of nuclear techniques

CO4.Write down the characteristics of radiation safety management

CO5.Identify in detail with application of radiation detection

### RADIATION SAFETY: SEC 1B

**Basics of Atomic and Nuclear Physics:** Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission. **(06 Lectures)**

**Interaction of Radiation with matter: Types of Radiation:** Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, **Interaction of Photons** – Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, **Interaction of Charged Particles:** Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), **Interaction of Neutrons-** Collision, slowing down and Moderation. **(07 Lectures)**

**Radiation detection and monitoring devices: Radiation Quantities and Units:** Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

## UG-Physics- Syllabus

**Radiation detection:** Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), Scintillation Detectors (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetry. **(07 Lectures)**

**Radiation safety management:** Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management. **(05 Lectures)**

**Application of nuclear techniques:** Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. *Industrial Uses:* Tracing, Gauging, Material Modification, Sterization, Food preservation. **(05 Lectures)**

### Experiments:

1. Study the background radiation levels using Radiation meter

#### Characteristics of Geiger Muller (GM) Counter:

- 2) Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
- 3) Study of counting statistics using background radiation using GM counter.
- 4) Study of radiation in various materials (e.g. KSO<sub>4</sub> etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
- 5) Study of absorption of beta particles in Aluminum using GM counter.
- 6) Detection of  $\alpha$  particles using reference source & determining its half life using spark counter
- 7) Gamma spectrum of Gas Light mantle (Source of Thorium)

**Reference Books:**

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
  2. G.F.Knoll, Radiation detection and measurements
  3. Thermoluminescence Dosimetry, Mcknlly, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
  4. W.J. Meredith and J.B. Massey, “Fundamental Physics of Radiology”. John Wright and Sons, UK, 1989.
  5. J.R. Greening, “Fundamentals of Radiation Dosimetry”, Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
  6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
  7. W.R. Hendee, “Medical Radiation Physics”, Year Book – Medical Publishers Inc. London, 1981
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## SEMESTER V

**Course code:** DME30001/ DME30002/ DME30003/ DME30004

**Credits: Theory – 02**

**Theories: 30 Lectures**

### COURSE OUTCOME:

After completion of the course the student is able to

CO1.Deliberate in details with examples basic of measurement

CO2.Specify in depth electronic voltmeter

CO3.Understand in depth Cathode ray oscilloscope

CO4.Specify the characteristics of Impedance Bridge

CO5.Specify the classification and characteristics of digital multimeter

CO6.Identify the characteristics of signal generator

### BASIC INSTRUMENTATION SKILLS: SEC 1C

**Basic of Measurement:** Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

**(04 Lectures)**

**Electronic Voltmeter:** Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/Multimeter and their significance.**AC**

**millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance. **(04 Lectures)**

**Cathode Ray Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– nonmathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance.

## UG-Physics- Syllabus

### (06 Lectures)

Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. **(03 Lectures)**

**Signal Generators and Analysis Instruments:** Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **(04 Lectures)**

**Impedance Bridges & Q-Meters:** Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q-Meter. Digital LCR bridges. **(03 Lectures)**

**Digital Instruments:** Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. **(03 Lectures)**

**Digital Multimeter:** Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution. **(03 Lectures)**

### **The test of lab skills will be of the following test items:**

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges

## UG-Physics- Syllabus

### Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

### Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

### Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand and Co.
- Performance and design of AC machines - M G Say ELBS Edn.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
- Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, SpringerElectronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India



## SEMESTER V

**Course code:** DME30201/ DME30202/ DME30203/ DME30204

**Credits: Theory – 02**

**Theories: 30 Lectures**

### COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Specify the details of sources and detector

CO2.Deliberate the classification and characteristics of experiments on lasers

CO3.Specify the details of experiments on semiconductor sources

CO4.Write down in details with examples Fourier optics

CO5.Specify the classification and characteristics of photonic and holography

CO6.Specify the characteristics of photonic

## APPLIED OPTICS: SEC 1I

### (i) Sources and Detectors

**(09 Lectures)**

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

### Experiments on Lasers:

- Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser.
- To find the width of the wire or width of the slit using diffraction pattern Obtained by a He-Ne or solid state laser.
- To find the polarization angle of laser light using polarizer and analyzer
- Thermal expansion of quartz using laser

### Experiments on Semiconductor Sources and Detectors:

- V-I characteristics of LED

## UG-Physics- Syllabus

- b. Study the characteristics of solid state laser
- c. Study the characteristics of LDR
- d. Photovoltaic Cell
- e. Characteristics of IR sensor

### (ii) Fourier Optics

(06 Lectures)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

#### Experiments on Fourier Optics:

##### a. Fourier optic and image processing

- 1. Optical image addition/subtraction
- 2. Optical image differentiation
- 3. Fourier optical filtering
- 4. Construction of an optical 4f system

##### b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

#### Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

### (iii) Holography

(06 Lectures)

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

#### Experiments on Holography and interferometry:

- 1. Recording and reconstructing holograms
- 2. Constructing a Michelson interferometer or a Fabry Perot interferometer

## UG-Physics- Syllabus

3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram

### (iv) Photonics: Fibre Optics

(09 Lectures)

Optical fibers and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating

#### Experiments on Photonics: Fibre Optics

- a. To measure the numerical aperture of an optical fibre
- b. To study the variation of the bending loss in a multimode fibre
- c. To determine the mode field diameter (MFD) of fundamental mode in a Single-mode fibre by measurements of its far field Gaussian pattern
- d. To measure the near field intensity profile of a fibre and study its refractive Index profile
- e. To determine the power loss at a splice between two multimode fibre

#### Reference Books:

- Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
- LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010,Tata McGraw Hill
- Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
- Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
- Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
- Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
- Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

The marks distribution for the final practical examination is as follows:

Formula/Formulae with explanation of symbols	<b>04 marks</b>
Diagram/Circuit diagram and tabular column	<b>08 marks</b>
Experimental setup+ taking readings	<b>08 marks</b>
Graph and Calculations	<b>05 marks</b>
Final result and units	<b>05 marks</b>
Record	<b>05 marks</b>
Total for the practical examination	<b>35 marks</b>

**Question Paper Pattern for DSC and DSE theory papers of 04 credits**

**From the academic year 2017-2018 onwards**

**Time: 3 hours**

**Max. Marks: 70**

**Part A:**

- I. Answer all the questions ( Multiple choice questions)** **1 x 4 = 4 marks**  
(One question should be selected from 15 lectures)

**Part B:**

- II. Answer any seven questions.** **2 x 7 =14 marks**  
**Ten questions should be set**  
(At least two questions should be selected from 15 lectures)

**Part C:**

- III. Answer any four questions.** **4 x 10 = 40 marks**  
**Six questions should be set**  
(At least one question should be set out of fifteen lectures)

**Part D:**

- IV. Answer any three out of four questions** **4 x 3 = 12 marks**  
(One problem should be selected from 15 lecturers)

**Question Paper Pattern for SEC theory paper of 02 credits**

**Time: 2 hours**

**Max. Marks: 35**

**Part A:**

**I. Answer any Five Questions out of eight.**

**1 x 5 = 05 marks**

(Six questions from 15 lectures.)

**Part B:**

**II. Answer any Three Questions out of five.**

**10 x 03 = 30marks**

(Five questions from 30 lectures)

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
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**NEP-UG Syllabus  
For B.A Programmes**

- **History, Political Science (HP)**
- **Journalism, Political science (JP)**

**2021-22**

**2022-23 onwards**

**DEPARTMENT OF POLITICAL SCIENCE**

## NEP Syllabus for BA-HP& JP2021-2022 (I sem-II sem)

Sem	Course No C1/C2	combination	Course Code	Title of the course	Course Type	Credit Pattern L:T:P	Total Credit	Teaching hrs/week	Evaluation Pattern			
									C1	C2	C3	Total Marks
III					DSC/AECC/S EC							
I	C1	HP	FHA47032	Basic concepts of Political science	DSC1	3:0:0	3	3	20	20	60	100
I	C1	JP	FHA47035	Basic concepts of Political science	DSC1	3:0:0	3	3	20	20	60	100
I	C2	HP	FHA48032	Political theory	DSC2	3:0:0	3	3	20	20	60	100
I	C2	JP	FHA48035	Political theory	DSC2	3:0:0	3	3	20	20	60	100
I			FHA860	Human Rights	OE1	3:0:0	3	3	20	20	60	100
			FHA870	Administration in India								
II	C1	HP	FHB47032	Western Political Thought	DSC3	3:0:0	3	3	20	20	60	100
II	C1	JP	FHB47035	Western Political Thought	DSC3	3:0:0	3	3	20	20	60	100
II	C2	HP	FHB48032	Indian National Movement and Constitutional Development	DSC4	3:0:0	3	3	20	20	60	100
II	C2	JP	FHB48035	Indian National Movement and Constitutional Development	DSC4	3:0:0	3	3	20	20	60	100
II			FHB860	India Polity: Issues and Concerns	OE2	3:0:0	3	3	20	20	60	100
			FHB 870	International Relations								

## Proposed Structure for Political Science Discipline

<b>Semester I</b>				
<b>Course</b>	<b>Paper</b>	<b>Credits</b>	<b>No. of Teaching Hours/Week (L+T+P)</b>	<b>Total Marks/ Assessment</b>
<b>DSC-1</b>	<b>Basic Concepts in Political Science</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>DSC-2</b>	<b>Political Theory</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>OE</b>	<b>1. Human Rights</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
	<b>2. Administration in India</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>Semester II</b>				
<b>DSC-3</b>	<b>Western Political Thought</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>DSC-4</b>	<b>Indian National Movement and Constitutional Development</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>OE</b>	<b>1. Indian Polity: Issues and Concerns</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
	<b>2. International Relations</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>



## Structure for Political Science Discipline

<b>Semester III</b>				
<b>Course</b>	<b>Paper</b>	<b>Credits</b>	<b>No. of Teaching Hours/Week</b>	<b>Total Marks/ Assessment</b>
<b>DSC-5</b>	<b>Indian Government and Politics</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>DSC-6</b>	<b>Parliamentary Procedures in India</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>OE-3</b>	<b>3.1 Gender and Politics</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>3.2 Understanding Gandhi</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>3.3 Citizen, Citizenship and the Indian Constitution</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>Semester IV</b>				
<b>DSC-7</b>	<b>Ancient Indian Political Ideas and Institutions</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>DSC-8</b>	<b>Modern Political Analysis</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>OE-4</b>	<b>4.1 Good Governance in India</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>4.2 Understanding Dr.B. R. Ambedkar</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>4.3 Political Journalism</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>Ability Enhancement Compulsory Courses (AECC)</b>	<b>Constitution of India</b>	<b>2</b>	<b>2</b>	<b>50(30+20)</b>

## **Political Science Model Curriculum (III & IV Semester)**

**Name of the Degree Program: BA/BSc/BCom/BBA/BCA... Without Practical Course**

**Discipline Core: Political Science**

**Total Credits for the Program:**

**Starting year of implementation: 2021-22**

**Program Outcomes:**

**By the end of the program the students will be able to:**

- Not only upgrade the learning of Political Science as a contemporary discipline but also to inculcate the Indian political ethos and the moral standards of functioning of political institutions in India. These in fact, brought laurels to our acumen in politics and Kautilya's Arthashastra stands as a proof of this.
- Understand voluminously about the dimensions of Indian Government, its Parliamentary Procedures, the concerns of Gender in Politics, Gandhian Philosophy and an understanding of the citizens duties and responsibilities in the 3rd semester.
- Understand the papers such as Ancient Indian Political Ideas and Institutions throws light on the wisdom of Indian Political Thought bringing along its side the Modern Political Analysis which is skill based paper.
- Understand the papers which are hybridised like Political Journalism and focused papers like Good Governance and Understanding Dr.B.R.Ambedkar which will bring to the fore facts and normative ways of running governments.

Thus, these semesters represent both knowledge and skill components and making it contemporary in its content. Learning among the students will thus make it interesting and lively.

**Assessment:****Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA	Summative Assessment
<b>Theory</b>	<b>40</b>	<b>(60+40) =100</b>
<b>Practical</b>	-	-
<b>Projects</b>	-	-
<b>Experiential Learning (Internships etc.)</b>	-	-
<b>AECC</b>	<b>20</b>	<b>(30+20)=50</b>

<b>Formative Assessment</b>		
<b>Assessment Occasion/ type</b>		<b>Weightage in Marks</b>
<b>C-1</b>	<b>Assessment Test-1</b>	10
	Seminar/Presentation/Group Discussion /Assignment/ Quiz	10
<b>C-2</b>	<b>Assessment Test-2</b>	10
	Assignment/ Book reviews / Reports on field visits / Seminars	10
<b>Total</b>		<b>40</b>

# **SEMESTER -I**

## BASIC CONCEPTS IN POLITICAL SCIENCE

### DSC-1

<b>Course Title: BASIC CONCEPTS IN POLITICAL SCIENCE</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>
No. of Teaching Hours/Week: <b>3+1=4(L+T)</b>	Duration of ESA/Exam: <b>3Hours</b>
Formative Assessment Marks: <b>40</b>	Summative Assessment Marks: <b>60+40=100</b>

#### **Course Objective:**

Develop an understanding about the nature and philosophy of Political Science and its interface with society. Enable the students to develop qualities of responsible and active citizens in a democracy.

#### **Learning Outcome:**

At the end of the course the students shall understand -

- Political Science, theoretically and will gain knowledge to explain and analyze politics at large.
- The dynamics of politics.
- To inculcate the democratic spirit

Unit	Contents of Course- 1	45 Hours
<b>Unit-I</b>	<p><b>Chapter -1</b> Meaning, Nature, Scope and Importance of Political Science, Approaches – Philosophical, Historical, Observational, Comparative and Experimental. Emergence of Political Science as a Discipline.</p> <p><b>Chapter- 2</b> Meaning and Elements of State, Difference between State and Government, State and Society, State and Association, Theories on Origin of State- Historical Theory, Divine Rights Theory, Social Contract Theory, Marxist and Gandhian Theory of State</p> <p><b>Chapter-3</b> Civil Society- Meaning and Importance.</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4</b> Meaning, Characteristics, and Kinds of Sovereignty.</p>	<b>15 Hours</b>
	<p><b>Chapter-5:</b> Austin’s Concept of Sovereignty and Pluralistic Critique, Pluralistic Theory of Sovereignty, Challenges to the State Sovereignty in the age of Globalization.</p> <p><b>Chapter-6,</b> Law meaning, Sources, Relations between Law and Liberty , law and Justice.</p>	

<b>Unit- III</b>	<b>Chapter-7</b> Liberty: Meaning and Kinds; Positive and Negative <b>Chapter-8</b> Equality: Meaning and Kinds (Social, Economic and Political) <b>Chapter-9</b> Power and Justice: Meaning and kinds, Political Obligation: Nature AND Importance, Grounds of Political Obligation.	<b>15 Hours</b>
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**Exercise:**

1. List out the modern elements of State
2. List out the countries and identify the issues related to equality
3. Identify an issue and discuss the role of civil society

**Suggested Readings:**

1. Political Theory: Ideas & Concepts, S. Ramswamy, Delhi, Macmillan, 2002.
2. Modern Political Theory, S. P. Verma, New Delhi, Vikas, 1983.
3. Principles of Modern, Political Science, J C Johri, Sterling Publishers Pvt. Ltd. 1995.
4. Principles of Political Science, AC Kapur, New Delhi, Sultan Chand and Sons, 2004.
5. Principles of Political Science, N.N Agarwal, Vidya Bhushan, Vishnoo Bhawan, R. Chand & Co, New Delhi, 1998.
6. Political Science Theory, S.C Pant, Prakashan Kendra, Lucknow, 1998.
7. Political Science Theory, S. N Dubey, Lakshmi Narain Agarwal, Agra, 2002.
8. Principle of Modern Political Science, J C Johari, Sterling Publications, New York, 2009.
9. Principles of Political Science, Anup Chand Kapur, S Chand & Co Ltd, 2010.

**Pedagogy:**

The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Resources (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

<b>Formative Assessment</b>		
<b>Assessment Occasion/ type</b>		<b>Weightage in Marks</b>
<b>C-1</b>	<b>Assessment Test-1</b>	10
	Seminar/Presentation/Group Discussion /Assignment/ Quiz	10
<b>C-2</b>	<b>Assessment Test-2</b>	10
	Assignment/ Book reviews / Reports on field visits / Seminars	10
<b>Total</b>		<b>40</b>

# POLITICAL THEORY

## DSC-2

<b>Course Title: POLITICAL THEORY</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

### Course Outcome:

This course aims to introduce certain key aspects of conceptual analysis in political theory and the skills required to engage in debates surrounding the application of the concepts.

### Learning Outcomes:

At the end of the course the students shall understand -

- The nature and relevance of Political Theory.
- The different concepts like Liberty, Equality, Justice and Rights.
- To reflect upon some of the important debates in Political Theory.

Unit	Contents of Course- 2	45 Hours
<b>Unit-I</b>	<b>Chapter-1</b> Meaning, Nature and Importance of Political Theory, <b>Chapter-2</b> Modern Approaches- Behavioral, Post-Behavioral, David Easton's Political System and Marxian Approach <b>Chapter-3</b> Relevance of Political Theory, Decline and Resurgence of Political Theory	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Liberalism: J.S Mill <b>Chapter-5</b> Neo- Liberalism: John Rawls <b>Chapter-6</b> Libertarianism: Robert Nozick	<b>15 Hours</b>
<b>Unit- III</b>	<b>Chapter-7</b> Communitarianism and Multiculturalism: Indian perspective, Colonial Discourse and Post Colonialism, Post Colonial Response and its Limitations <b>Chapter-8</b> Proponents of Secularism – Nehru, Gandhi, Moulana Azad. <b>Chapter-9-</b> Dmocracy and Liberalism- Dr.B.R.Ambedker, Lohia, Jaya Prakash Narayan.	<b>15 Hours</b>

### Exercise:

- Write about the Myth and Reality on Communitarianism in India
- Compare the concept of Liberty, Equality and Justice to the Modern world
- Write the understanding of secularism in India

### Suggested Readings:

1. Ahmed. V, Theory: Classes, Nations Literatures.: Verso, London, 1992.
2. Arendt. H., On Revolution, Viking, New York, 1963
3. Ahmed. V, Theory: Classes, Nations Literatures.: Verso, London, 1992.

## HUMAN RIGHTS

### Open Elective OE-1

<b>Course Title: HUMAN RIGHTS</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

#### Course Objective:

This course aims to introduce the students to basic concepts and practices of Human Rights in the global and local domain. This course also exposes them to certain recent issues confronting the Human Rights debates.

#### Learning Outcomes:

After completing this course students will be able to-

- Explain the basic concept of Human Rights and its various formulations.
- Have necessary knowledge and skills for analyzing, interpreting, and applying the Human Rights standards and sensitize them to the issues.
- Develop ability to critically analyse Human Rights situations around them.

Unit	Contents of Course- OE-1	45Hours
<b>Unit-I</b>	<b>Chapter-1</b> Meaning, nature, scope and Classification of Human Rights <b>Chapter-2</b> The Human Rights of First generation (Civil and Political Rights), Second generation (Economic, Social and Cultural Rights), Third generation (Collective Rights) and Fourth generation (Subjective Rights) <b>Chapter-3</b> Universal Declaration of Human Rights, RTI as Human Right.	<b>15Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Human Rights and Fundamental Rights, Fundamental Rights and Fundamental Duties in India <b>Chapter- 5</b> National Human Rights Commission (NHRC) - Composition and its function <b>Chapter-6</b> Karnataka State Human Rights Commissions (KSHRCs) – Composition and its functions	<b>15Hours</b>
<b>Unit-III</b>	<b>Chapter -7</b> National Commission for SCs/STs, Minorities' Commission, Women' Commission <b>Chapter-8</b> Major issues and concerns of Human Rights- Discrimination and violence against women, children, Dalits and Minorities, Child Labour and Bonded Labour <b>Chapter-9</b> Challenges to Human Rights	<b>15Hours</b>

#### Suggested Readings:

1. Baxi Upendra (ed.), The Right to be Human, Lancer International, Crawford, New Delhi, 1987.
2. James(ed.), The Rights of People, Oxford, New York, 1988.
3. Craston, M. What are Human Rights, Bodely Head, London, 1973
4. Rhond L.Callaway&JulieHarrelson- Stephen,“InternationalHuman Rights





## ADMINISTRATION IN INDIA

### Open Elective OE-2

<b>Course Title: ADMINISTRATION IN INDIA</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

#### Course Objective:

This course aims to introduce the students to basic aspects of Administration in India. This course also exposes them to the working of Administrative system in India.

#### Learning Outcomes:

After completing this course students will be able to-

- Acquire General Knowledge required to competitive Examinations
- To Have necessary knowledge and skills, Competency required for understanding Conceptual and Practical dimensions of Administrative process in India.

Unit	Contents of Course- OE-2	45 Hours
<b>Unit-I</b>	<b>Chapter-1</b> Meaning, Feature and Functions of Civil Service. <b>Chapter-2</b> Growth of Civil service in India, kinds of Civilservices in India and Concept of Lateral Entry into Civil Services. <b>Chapter-3</b> UPSC, Staff Selection Commission, DPAR – Composition, Powers and Function.	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Central Administration, PMO, Central Secretariat, Cabinet Secretary- role, Powers and Function. <b>Chapter- 5</b> Ministry of Personnel and Personal Grievances, Ministry of Home affairs, Ministry of Defense, Ministry of Finance, powers and function <b>Chapter-6</b> State Administration – State secretariat and Chief Secretary. Role, Power and Function.	<b>15 Hours</b>
<b>Unit-III</b>	<b>Chapter -7</b> Deputy commissioner, role Powers and Functions, administrative Organization below the District level. <b>Chapter-8</b> Control over the Administration-Legislative, Executive, Judicial and Popular <b>Chapter-9</b> Good Governance and E-Governance - Meaning, features and Importance, Bhoomi, Panchatantra , sakala, Khajane.	<b>15 Hours</b>

#### Exercise:

- Seminar and Group Discussion on Administration and Its kinds.
- Students can be asked to go for field visit to know the working of Local Bodies and E-Governance Initiative.

#### Suggested Readings:

1. Central Administration – A. Avasthi
2. Indian Administration – S.R.Maheswari

# SEMESTER -II

**WESTERN POLITICAL THOUGHT  
DSC-3**

<b>Course Title: WESTERN POLITICAL THOUGHT</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

**Course Objective:** The Syllabus is designed to understand Political Philosophy, traditions that evolved in Europe from Ancient to the beginning of modern era. To examine the contributions of the Greek, Medieval and early Modern thinker's Philosophical thought.

**Learning Outcomes:**

At the end of the course the students shall understand -

- And get an introduction to the Schools of Political Thought and Theory making in the West.
- And introduce the richness and variations in the political perceptions of Western Thinkers.
- And familiarize themselves to the Thought and Theory of Western Philosophy.

Unit	Contents of Course-3	45 Hours
<b>Unit-I</b>	<p><b>Chapter -1</b> Salient Features of the Greek Political Thought, <b>Plato:</b> Theory of Justice, Philosopher King, <b>Aristotle:</b> State and Its Classification, Theory of Revolution</p> <p><b>Chapter -2</b> Salient Features of Medieval - Political Thought, Christian Tradition, <b>St. Thomas Aquinas:</b> Church v/s State, <b>St. Augustine:</b> Theory of Two Swords</p> <p><b>Chapter -3, Machiavelli:</b> On Politics and State Craft, Views on ends and means</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter -1 Hobbes:</b> Theory of Sovereignty, <b>Locke:</b> Social Contract and Theory of Government, Tolerance;</p> <p><b>Rousseau:</b> Social Contract, General Will</p> <p><b>Chapter -2 Bentham: Theory of Utilitarianism</b></p> <p><b>Chapter -3 J.S. Mill: Views on Liberty</b></p>	<b>15 Hours</b>
<b>Unit- III</b>	<p><b>Chapter -1 . Karl Marx – Historical Materialism, Class Struggle, Surplus theory And Revolution.</b></p> <p>Classless and stateless society</p> <p><b>Chapter -2 Jurgen Habermas-</b> Communicative action, Public Sphere, Theory of truth and knowledge</p> <p><b>Chapter -3 Noam Chomsky-</b> Responsibility of Intellectuals, Manufacturing consent.</p>	<b>15 Hours</b>

**Exercise:**

- Compare Greek State with the Roman state and make points
- Imagine the present situation with that of Contractualist's Social Contract Theory and write the summary
- Can we have a classless society in the modern world? Comment

**Suggested Readings:**

1. A. Hacker, Political Theory: Philosophy, Ideology, Science New York, Macmillan, 1961.
2. G.H. Sabine. A History of Political Theory. New Delhi: Oxford and IBH, 1937

## INDIAN NATIONAL MOVEMENT AND CONSTITUTIONAL DEVELOPMENT

### DSC-4

<b>Course Title: INDIAN NATIONAL MOVEMENT AND CONSTITUTIONAL DEVELOPMENT</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

#### Course Objective:

- To familiarize the students with the ideas of Nationalism and contemplate on how colonial rule was overthrown by the Indian Nationalists.
- To acquaint the students with the problems of Independent India.
- To enable the students to understand the role of India in World affairs and the contributions of great men towards freedom.

#### Learning Outcome:

At the end of the course the students shall -

- Understand how the colonial rule was overthrown by the Indian nationalists.
- Appreciate the ideals and values of Gandhi that resulted in freedom.
- Examine the problem of Independent India and the role played by great leaders in solving them.

Unit	Contents of Course-4	45 Hours
<b>Unit-I</b>	<b>Chapter-1</b> Indian National Movement: Features, The Liberal, The Extremist and Revolutionary Phase <b>Chapter-2</b> The Gandhian Phase: Non-Cooperation movement, Civil Disobedience Movement and the Quit India <b>movement</b> . <b>Chapter-3</b> Political Issues during National movement- Swaraj, Reservation, Gandhian Swadeshi Concept.	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Morley-Minto Reform Act of 1909, Montague Chelmsford Act of 1919: main provisions and Dyarchy, Simon Commission, The Nehru Report. <b>Chapter-5-</b> Round Table Conferencess, Government of India Act of 1935: main provisions:, provincial Autonomy and federal system <b>Chapter-6-</b> Cabinet Mission Plan, Indian Independence Act of 1947: main provisions. Constituent Assembly Debates on	<b>15 Hours</b>
<b>Unit-III</b>	<b>Chapter-7</b> Citizenship and State Structure <b>Chapter-8</b> Minority Rights, Fundamental Rights. <b>Chapter-9</b> Language and National Integration. (The above three should be discussed in the context of Constituent Assembly Debates)	<b>15 Hours</b>

**INDIAN POLITY: ISSUES AND CONCERNS**  
**Open Elective OE-2**

<b>Course Title: INDIAN POLITY AND CONCERNS</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

**Course Objective:** To make the students aware on different issues that exists in Indian polity. Through this paper students need to understand the emerging issues and their causes to the Indian Democracy.

**Learning Outcome:**

At the end of the course the students shall -

- Understand the reasons behind the causes of these issues and also the constitutional provisions that existed.
- Familiarize with the debates that emerged.
- Be able to suggest the measures to control such issues.

Unit	Contents of Course-OE-2	45 Hours
<b>Unit-I</b>	<b>Chapter-1 National Integration and Social Harmony</b> - Meaning and importance of National Integration and Essentials of National Integration. <b>Chapter-2 Society and Politics in India:</b> Caste, Class, Ethnicity and Gender, role and Impact on Indian Polity. <b>Chapter-3 Language-</b> Role and Constitutional Provisions, Issues	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Religion and Traditions - Role and Constitutional Provisions <b>Chapter-5</b> Development and Inclusiveness: Issues and Concerns <b>Chapter-6</b> Regionalism – Reasons for the Growth, Forms and Measures	<b>15 Hours</b>
<b>Unit-III</b>	<b>Chapter-7</b> Corruptions- Causes and Measures <b>Chapter-8</b> Terrorism- Types, Causes and Measures <b>Chapter-9</b> Celebrating Diversity – Consensus and Challenges	<b>15 Hours</b>

**Suggested Readings:**

1. M. Galanter, 'The Long Half-Life of Reservations', in Z. Hasan, E. Sridharan and R. Sudarshan (eds.) India's Living Constitution: Ideas, Practices, Controversies, New Delhi: Permanent Black, 2002.

## International Relations

### Open Elective OE- 2

<b>Course Title: International Relations</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

#### **Course Objective:**

This course aims to introduce the students to basic concepts , Institutions and Issues of Global Politics. This course also exposes them to the Understanding OF Power Politics of Regional and Global level.

#### **Learning Outcomes:**

After completing this course students will be able to-

- Understand and reflect on basic concepts ,Institutions and Issues of International Relations Global Politics
- Develop and deepen the sense of Cosmopolitanism.
- To acquire General knowledge for Competitive exam

Unit	Contents of Course- OE-4	45 Hours
<b>Unit-I</b>	<b>Chapter-1</b> Meaning, Nature, scope and Importance of International Relations. <b>Chapter-2</b> Key Concepts- National Power, National interest, National Security, Diplomacy, Balance of Power, Collective security, Deterrence. <b>Chapter-3</b> India and her Neighbors- Pakistan and China.	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> World Organizations- UN, Principles and Objectives, Major Organs, Working of UN, Achievements and Failures. <b>Chapter- 5</b> UNESCO, WHO, ILO, WB. Chapter-6Regionalism in World Politics- Meaning and Importance- SAARC,ASEAN,EU, OPEC, SHANGHAI COOPERATION Organization , BRICS,	<b>15 Hours</b>
<b>Unit-III</b>	<b>Chapter -7</b> Global Issues- Poverty, Development, Environment <b>Chapter-8</b> Military alliances- NATO,SEATO,NSG,QUAD (India, America ,Japan, Australia), <b>Chapter-9</b> Pacific settlement of International Disputes.	<b>15 Hour s</b>

#### **Suggested Readings:**

1. Palmer and Perkins-International Relations.
2. H.J Morgenthau, Politica among Nations.
3. Mahendra Kumar, Theoretical Aspects of International Relations.
4. Prakash Chandra, International politics.

# SEMESTER -III



**DSC-5**  
**INDIAN GOVERNMENT AND POLITICS**

**Course Objective:**

The course will explain the functioning of the Indian government and the performance of both the union and the state governments. It discusses the philosophy of our constitution and the commitment of the Indian state to its citizenry. It will help the students to develop interest in politics and grasp the dynamics/nuances of the politics, dynamics of leadership and the role of socio-economic, religious and lingual issues.

**Learning Outcome:**

At the end of the course the students shall -

- Learn how the governments both at the union as well state level operates and what are its challenges.
- Understand the characteristics of power structures in India and the response of the political parties to the socio-political dynamics.
- Measure and understand the effects of judicial decisions on policy making and social development in India.

Unit	Contents of Course-5	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1:</b> Indian Politics: Approaches to study of State and politics in India (Liberal, Marxist and Gandhian).</p> <p><b>Chapter-2:</b> Constituent Assembly- Composition and Major Debates regarding the Structure of Indian State.</p> <p><b>Chapter-3:</b> Preamble and Salient Features of Indian Constitution.</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4:</b> The Union Executive: The President, Vice- President, Prime Minister and the Council of Ministers.</p> <p><b>Chapter-5:</b>Parliament: Powers and Functions of Lok Sabha and Rajya Sabha, Relationship between the two Chambers, Amendment Process and Major Amendments (42nd, 73rd, 74th , 86th , 101st).</p> <p><b>Chapter-6:</b> Judiciary and Judicial Review, Appellate Authority.</p>	<b>15 Hours</b>
<b>Unit-III</b>	<p><b>Chapter-7:</b> Nature of Indian Political System, Union-State Relations (Commissions and Committees), President's Rule: Processes and politics.</p> <p><b>Chapter-8:</b> Political parties and party system in India Coalition Politics and Elections in Indian Politics.</p> <p><b>Chapter-9:</b> Issues in Indian Democracy: Casteism, Communalism, Regionalism, Criminalization, Social and Distributive Justice.</p>	<b>15 Hours</b>

**Exercise:**

- Debate on the 'basic structure of Indian Constitution' and the need for changes in the constitution, functioning of the Constitution - Cases regard to Governor and President's Rule.
- List out the major amendments to the constitution, Commission and committee to review power sharing.
- Examine the functioning of various political parties, its inclusive approaches, influence of dynasties on their performance.

**Suggested Readings**

1. Iqbal Narain, State Politics in India, Meenakshi Prakashan, New Delhi, 1967.
2. Rajani Kothari, Politics in India, Orient Longman, 1970.
3. D. Basu, An Introduction to the Constitution of India, New Delhi, Prentice Hall, 1980.
4. Granville Austin, The Indian Constitution: Corner Stone of a Nation, Oxford University Press, India, 1966.
5. C.P. Bhambhari, The Indian State, Fifty Years, New Delhi, Shipra, 1997.
6. V. Pylee, Constitutional Government in India, Bombay, Asia Publishing House, 1977.
7. J. C. Johri, Indian Government and Politics, Vol. 1, Shoban Lal and Company, India, 2012.
8. Weiner, Party Politics in India, Princeton University Press, 1957.
9. A. G. Noorani, Constitutional Questions in India: The President, Parliament and the States, Delhi, Oxford University Press, 2000.
10. A. S. Narang, Indian Government and Politics, Geetanjali Publishing House, New Delhi, 1996.
11. Bidyut Chakrabarty & Rajendra Kumar Pandey, Indian Government and Politics, SAGE, New Delhi, 2008.
12. D. D. Basu, An Introduction to the Constitution of India, 25<sup>th</sup> Edition, Lexis Nexis, India.
13. M. P. Singh & Rekha Saxena, Indian Politics: Contemporary issues and Concerns, Prentice Hall of India, Delhi, 2008.
14. M. V. Pylee, An Introduction to the Constitution of India, New Delhi, Vikas, 1998.
15. Nirja Gopal Jayal & Pratap Bhanu Mehta, The Oxford Companion to Politics in India

## DSC-6

### PARLIAMENTARY PROCEDURES IN INDIA

#### Course Objective:

The course attempts to make the students familiar with legislative practices in India with an orientation to equip them with the adequate skills of participation in deliberative processes and democratic decision making. This aims at providing the basic understanding of the constitutional provisions relating to parliamentary procedures and the accessories of the same. This will help the students to understand the working of democracy through an institutional mechanism.

#### Learning Outcome:

At the end of the course the students shall -

- Aim at understanding the procedural aspects of parliamentary system of governments.
- Learn about the privileges of people's representatives and match it with their performance.
- Understand the working of committees, budgetary aspects and deliberative mechanism within the parliament.

Unit	Contents of Course-6	45 Hours
<b>Unit-I</b>	<b>Chapter-1:</b> Elections to the Legislatures: Parliament and State Legislatures. <b>Chapter-2:</b> Powers, Functions of People's Representatives - Members of Parliament and State Legislature. <b>Chapter-3:</b> Legislative Procedures of the Parliament: Articles 107-122.	
<b>Unit-II</b>	Chapter-4: Kinds of Bills: Ordinary Bills, Money Bills, Finance Bills, Private Member Bills. Chapter-5: Drafting of the Bill, First Reading and Departmental Standing Committee, Second Reading, Third Reading, Passage of the Bill, Consent by the President, Gazette Notifications. Chapter-6: Parliamentary Committees: Composition and Functioning (Departmental Standing Committees, Select Committees, Joint Parliamentary Committees, Public Accounts Committee on Privilege Business, Advisory Committee, Ethics Committee).	15 Hours
<b>Unit-III</b>	Chapter-7: Motions and Hours in the House : Question Hour, Zero Hour, Half an Hour Discussion, Calling Attention Motion, Adjournment Motion, Privilege motion, Censure motion, 'No-confidence' motion, Cut motion. Chapter-8: Parliamentary Questions: Types, Starred and Unstarred Questions, Questions Addressed to Private Members and Short Notice Questions. Chapter-9: Parliamentary Privileges: Constitutional Provisions, Codification of Privileges, Privileges of Parliamentarians and Legislators, Breach of Privilege.	15 Hours

**Exercise:**

- The college can organise mock parliaments and teach students the etiquettes of parliamentary behaviour.
- Canorganisedebatesonthecodificationofprivilegesandmatchitwiththeperformance of people'srepresentatives.
- Can organise special lectures by inviting officers/bureaucrats to deliberate on the procedural aspects of democracy.

**Suggested Readings**

1. M.N.KaulandS.L.Shakdher,PracticeandProcedureofParliament,Metropolitan,New Delhi,1968.
2. SubhashC.Kashyap,OurParliament,NationalBookTrust,NewDelhi,2021.
7. SH.Belavadi,TheoryandPracticeofParliamentaryProcedureinIndia,1988.
8. Dr. K. S. Chauhan, Parliament Powers Functions And Privileges, LexisNexis, India, 2013.
9. Ajit Ranjan Mukharjea, Parliamentary Procedure in India, Oxford University Press, 1958.
10. M N. Kaul, Parliamentary Institutions and Procedures, National Publishing House, 1978.
11. Jalan, India's Politics, Penguin, New Delhi,2007.
12. Abbas, H., Kumar, R. & Alam M. A., Indian Government and Politics, Pearson, New Delhi,2011.
13. Chakravarty, B. & Pandey, K. P, Indian Government and Politics, Sage, New Delhi, 2006.
14. K.Sanyal,StrengtheningParliamentaryCommittees,PRS,CentreforPolicy Research, New Delhi,2011.

## GENDER AND POLITICS

### Open Elective- OE- 3.1

#### Course Objective:

The course provides an overview of political participation of women in general and specifically in India. It enables students to understand the issues related to women leadership, participation and governance and how they have progressively become integrated into political science to inform and shape contemporary social sciences. It helps in sensitizing the patriarchal society to improve the relationship between men and women removing the obstacles of exploitation, violation of her rights, bringing into focus the need for the education and empowerment.

#### Learning Outcomes:

At the end of the course the students shall -

- Answer how ideologies have shaped the women in politics
- Bring awareness of the relevance of gender issues in politics.
- Through discussions on women and governance understand the ground realities about politics in relation to women.

Unit	Contents of Course-OE-3.1	45 Hours
Unit-I	<b>Chapter-1:</b> Defining Gender, Significance of Gender Studies, Difference between Gender Studies and Women Studies, Feminist Perspectives <b>Chapter-2:</b> Gender Imbalance in Political Representation and Electoral Process, Gender Discrimination in Indian Politics – including LGBTQ, Feminist Critique of Politics. <b>Chapter-3:</b> Governance and Gender Structures, Gender Budgeting and Gender Issues in Governance.	15 Hours
Unit-II	Chapter-4: Gender and Empowerment Process: Education, Economic, Political and Socializing and sensitizing gender issues. Chapter-5: Gender Differentiation in Political Parties and Leadership, Challenging Gender Stereotypes in Socio-Political sphere. Chapter-6: Capacity Building and Role of Women in Karnataka Politics, Women Representation in Local Governments.	15 Hours
Unit-III	<b>Chapter-7:</b> Women and Poverty, Women and Health, Women and wealth creation, Violence against Women, Chapter-8: Women and Literature, Women and the Media, Women and the Environment. Chapter-9: Women and Societal Challenges: Dowry, Domestic Violence, Girl Child - Programmes for Empowerment of Women, Educating <b>children and socio-religious taboos including patriarchy.</b>	15 Hours

**Exercise:**

- Conduct one day workshop and make an assessment of role of women in politics.
- Collage making, short films and video watching can be done by the students and measures can be discussed to minimise the gender gap.
- Students can make field visits to understand the persistence of patriarchal values and traditions.

**Suggested Readings**

1. P.K.Swaib and S.N.Tripathy, "Unequal Treatment to Women and Gender", Bias, Sonali Publications, New Delhi, 2006.
2. Malashrilal, Chandra Mohan, Enakshi K.Sharma, Devika Khanna Narula and Amrit Kaur Basra, "Gender and Diversity", Rawat Publications, Jaipur, 2015.
3. Andrew Heywood, "Global Politics", Palgrave Macmillan Publication, New York, 2014.
4. Kranti Rana, "Modern Working Women and the Development Debate", Kanishka Publishers, New Delhi, 1998.
5. Dr.Tanuja Trivedi, "Encyclopedia of Women's Empowerment", Janapada Prakashan, New Delhi, 2012.
6. Bhaswati Das and Vimal Khawas, "Gender Issues in Development –Concerns for the 21<sup>st</sup> century", Rawat Publications, New Delhi, 2009.
7. U. Kalpagam, "Gender and Development in India: Current Issues", Rawat Publication, 2011.
8. B.N.Singh, "Rural Women and Education", Vista International Publishing House, Delhi, 2016.
9. Meera Kosambi, "Women Writing Gender", Permanent Black Publication, New Delhi,

**UNDERSTANDING GANDHI**  
**Open Elective – OE- 3.2**

**Course Objective:**

The course objective is to bring to the attention of the younger generation the core elements of Gandhian thought and Gandhi's approach to the key issues of contemporary India. This paper covers a wide range of issues including politics, economics, social reconstruction, religion and issues of sustainable development which provides insight into the idea of what Gandhi propagated as a political thinker. His ideas of Hindu-Muslim relations or critique of modern society, Swadeshi etc., makes Gandhi relevant to the current political discourses.

**Learning Outcome:**

At the end of the course the students shall -

- Be able to explain the idea of truth and non-violence which is the foundation of Gandhian Philosophy.
- Know the position of Gandhi on issues like Hindu-Muslim relations, gender question, cow protection, caste and untouchability questions.
- Answer his reason for his choice of Swadeshi and his critique of modern Civilization

Unit	Contents of Course- OE-3.2	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1:</b> Background Influences: Historical: South Africa, Intellectual: Thoreau, Ruskin and Tolstoy.</p> <p><b>Chapter-2:</b> Gandhian Experiments: Satyagraha, Non-Violence, Truth, Movements led by Gandhi- Champaran, Bardoli, Khilafat, Non-Cooperation, Salt Satayagraha.</p> <p><b>Chapter-3:</b> Social Movements- Ahmedabad Mill Strike, Vaikom Satyagraha, Forest, Health and Naturopathy, Sustainable Development.</p>	15 Hours
<b>Unit-II</b>	<p>Chapter-4: Gandhi as a Leader: Gandhi as a model, Gandhian Methodology: Prayer, Consensus Building and Fasting.</p> <p>Chapter-5: Gandhian Views on Politics: Role of Ethics, Morality, Religion and Service.</p> <p>Chapter-6: Gandhi's critique on English Parliament, Gandhi on Nation and Nationalism.</p>	15 Hours
<b>Unit- III</b>	<p>Chapter-7: Gandhian Swadeshi and Swaraj, Critique on Modern Civilization, Modern Education and Machines.</p> <p>Chapter-8: Gandhian Violence (Doctrine of the Sword) Gandhi and Sins, Gandhi's views on Women and Sustainable Development.</p> <p>Chapter-9 Gandhian Political Strategist, Gandhi's Views on Hindu-Muslim Unity, Untouchability .</p>	15 Hours

**Exercise:**

- Students shall have a group reading of Gandhiji's texts like Hindswarj, My Experiment with truth, Sarvodaya, etc,
- Shall conduct the group discussion on the significance of Satyagraha, Sustainable Development, Swadeshi, etc.
- By reviewing literature on Gandhian critiques students can discuss the strengths and weakness of Gandhian Philosophy and his relevance in 21st century.

**Suggested Readings**

1. Lal, V, The Gandhi Everyone Loves to Hate, Economic and Political Weekly, 43(40), 2008, pp. 55-64.

## CITIZEN, CITIZENSHIP AND THE INDIAN CONSTITUTION

### Open Elective OE- 3.3

#### Course Objective:

This course aims at understanding the concept of citizenship. This course supports to develop an understanding of mindfulness, empathy and compassion and use these as tools to enhance one's emotional wellbeing and social relationships within a society. It further helps nation building by inculcating responsible citizenship among the students.

#### Learning Outcome:

At the end of the course the students shall -

- Take part in social reconstruction as responsible individuals and will learn to develop own identities.
- Demonstrate pro-social behaviour towards others, including those belonging to a different race, ethnicity, culture, colour, gender or nationality.
- Understand and appreciate rights and privacy of other fellow citizens.

Unit	Contents of Course- OE- 3.3	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1: Concept of Citizen:</b> Subject- Slave-Citizen: a Comparison.</p> <p><b>Chapter-2: Citizenship in India: Milestones-</b> Citizenship and Partition of India (Nehru and Liyaqat Ali Khan Pact) The Citizenship Act, 1955, The Citizenship (Amendment) Act, 1986, The Citizenship (Amendment) Act, 2003 and 2005, National Register of Citizens (NRC) with reference to North - East</p> <p><b>Chapter-3: Citizens and Constitutional Provisions:</b> Fundamental Rights and Duties, Socio-Economic and Cultural Rights</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p>Chapter-4: Citizenship Issues in India: Laws for Immigrants, Laws for Migrants and Asylum seekers, Process of acquiring Citizenship.</p> <p>Chapter-5: Dual Citizenship: Needs and Demands- Impact of Globalization, Advantages of Dual Citizenship.</p> <p>Chapter-6: IPC and Citizens Rights: First Information Report, Arrest, Detention, Bail Provisions, Sedition Act, Citizen and Civic Culture.</p>	15 Hours
Unit-III	<p>Chapter-7: Citizen and His Responsibility: Constitutional Provisions, Right to Privacy.</p> <p>Chapter-8: Citizen and Discrimination: Caste, Gender (LGBTQ), language, Race, Color, Place of Birth.</p> <p>Chapter-9: Protection of Citizens: Women and Property Rights, Rights of Forest Dwellers, and Displaced People (War, Natural Calamities and Rehabilitation) and Universal Declaration of Human Rights.</p>	15 Hours

#### Exercise:

- Students and teachers collectively work towards building communication network among vulnerable citizens who have no knowledge about their own rights.
- Through activities they may form empowering groups and support immigrants/ migrants



resolve their legal issues with authorities like police and government.

They may visit courts, police stations, regional passport offices and spread the laws relating to migrants, immigrants regarding their rights.

### **Suggested Readings**

1. Marcus Raskin, 'Nation Building and Citizenship: Studies of a Changing Order' Rutledge India, New Delhi, 1996.
2. Atul Kohli, 'Democracy and Discontent: India's growing crises of Governability, Cambridge University Press, 1991.
3. Atul Kohli, 'The Success of India Democracy', Cambridge University Press, 2001.
4. Savitaha Rao, 'India's Positive Citizen Building- A Great Nation One Action At A Time, Wings Publishing, Bangalore, 2020.
5. Anupama Roy, 'Mapping Citizenship in India', (Oxford India short introductions), Oxford University Press, New Delhi, 2012.
6. Nirag Gopal Jayal, 'Citizenship and its Discontents', Harvard University Press, 2013.
7. Ornit Shani, 'How India became a democratic citizenship and making of the Universal Franchise', Cambridge University Press, New Delhi, 2017.
8. Koenig Lion, 'Cultural Citizenship in India; Politics Power and Media', Oxford University Press, New Delhi, 2016.
9. Blog.mygov.in/we-the-people-we-the-citizen.
10. Subrata .K. Mitra, 'Citizenship as cultural flow, structure agency and flow', e-Book, 2013, springerlink.

# ANCIENT INDIAN POLITICAL IDEAS AND INSTITUTIONS

## DSC - 7

### Course Objectives:

The paper aims at developing an understanding of the Social and political philosophy of ancient India to assess the modern notions about socio-political arrangements. Further it helps to analyze the process of decolonizing Indian minds related to India's glorious past. The objective thus being to throw light on the indigenous political theory and its relevance to changing times.

### Learning Outcome:

At the end of the course the students shall -

- Reflect on the native concepts like Dharma, Rajadharma, Nyaya, Viveka etc., in the light of their modern connotations.
- Understand the role of texts and stories in the Indian context by reflecting upon our own experiences.
- Revisit our own socio-political structures through the textual and non-textual sources from the early Indian period in order to quell the European representation of Indian Society and heritage.

Unit	Contents of Course- DSC 7	45 Hours
Unit-I	<b>Chapter-1: Sources of Early Indian Thought:</b> Sources and Limitations: Pre and Post Colonial. <b>Chapter-2: Perspectives:</b> Orientalists, Nationalists, Marxian (Asiatic Mode of Production) and Gandhiji on Varnashrama Dharma. <b>Chapter-3: Indian Culture:</b> Max Muller, Swami Vivekananda, Dr. Radhakrishnan	15 Hours
Unit-II	<b>Chapter-4: Socio-Political Ideas in the Early Indian Thought:</b> Dharma, Rajadharma, Dandaniti, Nyaya, Vaisheshika, Shunya, Ratnin Ceremony, Varnadharma, and Ashramadharma. <b>Chapter-5: Kingship:</b> Origin, Nature and Structure. <b>Chapter-6: Functions of Institutions:</b> Sabha, Samiti, Vidhata, Paura-Janapada.	15 Hours
Unit- III	<b>Chapter-7: Ganasanghas:</b> Nature, Structure, Functions <b>Chapter-8: Ramayana (Valmiki):</b> Ramarajya, <b>Chapter-9: Mahabharata (Vyasa):</b> Rajadharma in Shantiparva, Idea of war and Peace –values in Thirukural, Manu Smruthi (Caste)	15 Hours

### Exercise:

- Close reading sessions to be organised to understand the ancient text in its original context by way of discussions.
- Students shall visit the nearby historical places and collect artifacts, stories, and other relics with the help of the native people.
- Students shall respond to accommodate the important criticisms of Ramayana and

Mahabharata by its critics and enact dramas and costumes.

### **Suggested Readings**

1. Alterkar A.S, State and Government in Ancient India, Motilal Banarsidass, Chowk Banaras, 1949.
2. R.S. Sharma, Early Indian Social and Political Thought and Institutions (Aspects of the Political Ideas and Institutions in Ancient India, Motilal Banarsidass, Delhi, 1991.
3. Jayaswal K.P, Hindu Polity, Bangalore Printing and Publishing Co. LTD, Bangalore, 1943.
4. Goshal U.N, History of Hindu Political Theory, Oxford University Press, Calcutta, 1923.
5. Kangle R.P, Kautilya's Arthashastra, Motilal Banarsidass Publishers Pvt.Ltd, New Delhi, 1986.
6. Bhandarkar D.D, Some Aspects of Ancient Indian Culture, Madras, University of Madras, 1940.
7. Romila Thapar. From Lineage to State, Oxford University Press, United Kingdom, 1984.
8. R.S.Sharma, Shudaras in Ancient India, Motilal Banarsidass, Delhi, 1957.
9. Sharma, R. S India's, Ancient Past, Oxford University Press, New Delhi, 2006.
10. Sharma, R. S, Rethinking India's Past, Oxford University Press, New Delhi, 2010.
11. Kraedar Lawrence, "Formation of the state", Prentice Hall, United State, 1968.
12. Kosambi D.D, "Introduction to the Study of Indian History", Popular Prakashan, Mumbai, 1956.
13. Said Edward, Orientalism, Pantheon Books, USA, 1978.
14. Misra Vibhuti Bhushan, From the Vedas to the Manusamhita, City/Country Brill Academic, United States, 1982.
15. Sircar D.C, Studies in the Religious life of Ancient and Medieval India, Motilal Banarsidass, Delhi, 1971.
16. Aiyangar K.R, Ancient Indian Polity, Oriental Books Agency, Poona, 1941.
17. Pargiter R, Ancient Indian Historical Tradition, Oxford University Press, London, 1922.
18. Levin G.M, Bongard, A Complex Study of Ancient India – Multidisciplinary Approach, American Oriental Society, USA, 1989.
19. Kumar S, "Role of State in Ancient India Economy", Ramanand Vidya Bhawan, Delhi, 1986.
20. Sircar D.C, Political and Administrative System of Ancient and Medieval India. Motilal Banarsidass, Delhi, 1975.
21. Maity S. K and Upendra Thakur, Indological Studies, Abhinav Publications, New Delhi, 1991.
22. Mukherjee Shobha, The Republican trends in Ancient India. Munshiram Manoharial Publishers Private Limited, New Delhi, 1989.
23. Bandyopadhyaya N.C, Development of Hindu Polity and Political Theories, Munshiram Manoharlal Publishers, New Delhi, 1980.

## MODERN POLITICAL ANALYSIS

### DSC-8

**Course Objective:** The objective is to equip students to develop insights into political institutional functioning keeping in insight both the normative and empirical ways of understanding. This paper also throws light on value laden functioning and value neutral aspects of systems output that will help students to understand and evaluate Governments. It aims at scientifically assessing the functioning of the government as result oriented institutions.

**Learning Outcome:**

At the end of the course the students shall -

- Understand the key concepts of Political Institutional working and science within them.
- Befamiliar with the Phenomenon of politics and various explanations relating to the influences that mould the decision making process.
- Help the students to visualize the working of political institutions and the process of decision making through diagrammatic presentations.

. Unit	Contents of Course: DSC-8	45 Hours
<b>Unit-I</b>	<p><b>Chapte-1</b> Genesis and Emergence of Modern Political Analysis, Modern Political Analysis -Meaning, Nature, Scope and Goals</p> <p><b>Chapter-2</b> Political System-Types, similarities and differences, classification.</p> <p><b>Chapter-3</b> Approaches – Traditional- Philosophical, Historical Institutional, Modern- Behavioral, Systems, Game.</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4</b> Talcott Parson's General Systems theory- Pattern of Inter Relationship, Hierarchical order, Integration.</p> <p><b>Chapter-5</b> David Easton's Input-Output model of Political System, Features, Functions and Critical Evaluation.</p> <p><b>Chapter-6</b> Power-Meaning, significance, and measurement, difference between Power, Authority, Legitimacy and Influence, Harold Lasswell's contribution.</p>	<b>15 Hours</b>
<b>Unit- III</b>	<p><b>Chapter-7</b> Almond on Structural – Functional Analysis Karl Deutsch's Communication Theory.</p> <p><b>Chapter-8</b> Richard C Snyder's Decision Making Theory,</p> <p><b>Chapter - 9</b> Political Development - Concept of Political Development - its variables, Theory of Lucian Pye.</p>	<b>15 Hours</b>

**Exercise:**

- The department can lead the students to a nearby political institution and explain to them the process of administrative decision making.
- The department may invite functionaries of these institutions to deliberate upon issues of redundancy and simplifying administration.
- Assignments can be given to the students to innovate methods of simplification of administrative procedures in offices of Governments and offer consultancy.

**Suggested Readings**

1. Almond, G. and Coleman. J.S. "The politics of the Developing Areas", Princeton University Press, Princeton NJ, 1960.
2. Almond, G.A. and Verba, S, "The Civic Culture: political Attitudes and Democracy in Five Nations", Princeton NJ, Princeton University Press, 1963.
3. Amin, S, "Accumulation on an old Scale: A Critique of the Theory of Underdevelopment", Monthly Review Press, New York, 1974.

## Open Elective OE - 4.1

### Good Governance in India

#### Course Objective:

The course directed to familiarize the student to understand the elements of Good Governance which has the effect on day today life. The purpose is to show to them that states are changing their approach to Administration giving importance to stakeholders. Some of the programs mentioned in the syllabi exemplifies the same. The aim is to help students to link the theory in the class room with realities in the outside world.

#### Learning Outcome:

At the end of the course the students shall -

- Understand the difference between traditional form of Administration and the concept of Governance
- Get a perspective of changing modes of Governance with the examples drawn from central and state Governments.
- Appreciate the participation of citizens in day to day Administration through a charter and other programmes like Sakala, Bhoomi etc.,.

Unit	Contents of Course: OE-4.1	45 Hours
Unit-I	<b>Chapter- 1</b> Meaning, Characteristics, Elements, Growth and need for Good Governance. <b>Chapter-2</b> Theories and Concepts of Governance- Public Choice and Public Value Theory, Good Governance and Globalization. <b>Chapter-3</b> Corporate Governance- Networking and collaborative Governance.	15 Hours
Unit-II	<b>Chapter-4</b> Public Service Guarantee Act 2011: Features, Provisions and Impact, Right to Information Act- Meaning, Characteristics and Importance. <b>Chapter-5</b> E-Governance - Meaning, Characteristics, Importance and E Governance Policy, ICT and Governance. <b>Chapter-6</b> Citizens Charter, Digital India, Gender and Governance.	15 Hours
Unit- III	<b>Chapter-7</b> Sakala Project, Bhoomi Yojana, SWAYAM and eKissan, eCourt. <b>Chapter-8</b> People's Participation and Role of Civil Society, Ethics and Accountability in Governance. <b>Chapter-9</b> Challenges before good governance in India.	15 Hours

#### Exercise:

- Students and the department can undertake survey regarding causes and consequences of failed administration.
- Through activities they can visit their respective villages and prepare papers regarding the working of programmes like Sakala, Bhoomi etc.,.
- The department may invite officers connected to Governance projects and have interaction with the students.

## UNDERSTANDING Dr. B.R. AMBEDKAR

### Open Elective OE -4.2

#### Course Objective:

This course is designed to familiarize the students with arguments and position of Dr. B.R. Ambedkar on key social, political, constitutional and democratic issues in India and enable them to critically examine his perceptions. Besides the constitutional questions and fight for the oppressed communities which are largely popular in academic and political discourses, has been designed to make students to understand his ideas. On the partition of the country and the Indian historiography his views have been valuable and this paper intends to bring to the reach of the students.

#### Learning Outcome:

At the end of the course the students shall -

- Be able to understand his life, mission, vision and his key role in the making of the Indian Constitution.
- Be able to appreciate and sensitize his views on democracy, citizenship, freedom, equality equal treatment and justice.
- Understand his views on the some of the important debates like Aryan Invasion Theory, Uniform Civil Code, Islam and partition of India.

Unit	Contents of Course OE 4.2	45 Hours
Unit-I	<b>Chapter: 1-</b> Dr. B. R. Ambedkar's Journey of Life and Experiences. <b>Chapter: 2-</b> Dr. B. R. Ambedkar's perception on Hindu Social Order, Caste and Untouchability (refer Annihilation of Caste). <b>Chapter-3-</b> Dr. B. R. Ambedkar's Initiatives: Mahad Satyagraha, Kalaram Temple Entry Movement.	15 Hours
Unit-II	<b>Chapter: 4-</b> Dr. B. R. Ambedkar and Round Table Conference: His Memorandum, Communal Award and Poona Pact. <b>Chapter: 5-</b> Dr. B. R. Ambedkar's contribution as the Chairman of the Drafting Committee. <b>Chapter 6 -</b> Dr. B. R. Ambedkar's deliberations on key issues in the Constituent Assembly (Article 40, Article 370, Uniform Civil Code, Hindu Code Bill, and on reservation)	15 Hours
Unit- III	<b>Chapter: 7-</b> Dr. B. R. Ambedkar's Political Ideas: Democracy, Citizenship, Equality, Freedom and Justice. <b>Chapter: 8:</b> Dr. B. R. Ambedkar's views: on Islam, Buddhism, on Religious Conversion, on Aryan Invasion Theory. <b>Chapter: 9-</b> Dr. B. R. Ambedkar and Language Question, Dr. B. R. Ambedkar on Education and Women Empowerment and Nationalism.	15 Hours

### Exercise:

- Students and teachers collectively debate on the issues of Reservation, Constitutional provisions of reservation, reservation within reservation, creamy layer theory, etc.,.
- Give assignments to students to visit colonies of Scheduled Caste and Scheduled Tribes and discuss it in the group about the perception that they have carried.
- Debate on the need for social reform, inclusiveness, changing the cultural and religious outlook among the Indian citizens keeping the view inhuman practice like untouchability, exploitation. And further visit courts, police stations, etc. to understand conflict resolution mechanisms.

1. Ambedkar, B.R. "What Congress and Gandhi have Done Untouchables" <http://www.ambedkar.org/ambcd/41A.What%20Congress%20and%20Gandhi%20Preface.htm>.
2. Ambedkar Annihilation of Caste, Navayana, 11th Edition, 2015.
3. Dhanjaya Keer, Dr. Ambedkar-Life and Mission, Popular Prakashana, Bombay, 1964.
4. Valerian Rodrigues, Essential Writings on Ambedkar, OUP, New Delhi, 2003.
5. Marcus Raskin, 'Nation Building and Citizenship: Studies of four Changing order' Rutledge India, New Delhi, 1996.
6. Atul Kohli, 'Democracy and Discontent: India's growing crises of Governability, Cambridge University Press, 1991.
7. Atul Kohli, The Success of Indian Democracy, Cambridge University Press, 2001.
8. Savitaha Rao, India's Positive Citizen Building- A Great Nation One Action At A Time, Wings Publishing, Bangalore, 2020.
9. Nirag Gopal Jayal, 'Citizenship and its Discontents', Harvard University Press, 2013.
10. Koenig Lion, 'Cultural Citizenship in India; politics power and media', Oxford University Press, New Delhi, 2016.
11. Subrata K. Mitra, 'Citizenship as cultural flow; structure agency and flow', e-Book, Springer link, 2013.
12. Sharma, A, Dr. B.R. Ambedkar on the Aryan Invasion and the Emergence of the Caste System in India, Journal of the American Academy of Religion, 73(3), 2005, pp. 843-870.
13. Ambedkar, B. R. (1946). Pakistan or The Partition of India, In Narke, H. (2nd ed.), 2014.
14. Dr. B. R. Ambedkar Writing and Speeches, Vol. 8. Delhi: Dr. Ambedkar Foundation, Ministry of Social Justice & Empowerment, Govt. of India.  
Available at: [https://mea.gov.in/Images/attach/amb/Volume\\_08.pdf](https://mea.gov.in/Images/attach/amb/Volume_08.pdf).
15. Misra, J., & Mishra, J. Dr. B.R. Ambedkar and The Constitution - Making In India, Proceedings of the Indian History Congress, 1991, 52, pp.534-541

## POLITICAL JOURNALISM

### Open Elective OE- 4.3

#### Course Objective:

The objective is to equip students to develop insights into political reporting with an understanding of writing skills supported by grammatical strength and economy of words. Further to provide a broad overview of the nuances of interpreting the political phenomena that takes place in political institutions starting from the grass roots to the parliament.

#### Learning Outcome:

At the end of the course the students shall -

- Understand the skills of reporting and research insights about the system and its structural contours focusing on Politics.
- Carry out political reporting covering Government and Governance, campaigns and candidates, tactics and strategies and policy issues in the public arena.
- Develop writing and interpretative skills.

. Unit	Contents of Course- OE-4.3	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1:</b> Defining Political Journalism, Traditional and Modern views about State and Politics.</p> <p><b>Chapter-2:</b> Understanding of Political Development: Caste, Religion, Linguistic and Party Perspectives.</p> <p><b>Chapter-3:</b> Defining the Role of Mass Media- Print, Electronic and Web (Social Media).</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4: Political Culture- Shared Beliefs, Values, Ideologies and Norms, Process of Socialisation.</b></p> <p><b>Chapter-5: Political Participation –Modes of participation, Political Apathy.</b></p> <p><b>Chapter- 6: Methods of Political Journalism- Interviews, Political Debates, Commentary on Legislations.</b></p>	<b>15 Hours</b>
<b>Unit-III</b>	<p><b>Chapter-7: Communication-Defining Communication, Shaping Public Opinion, Encoding and Decoding.</b></p> <p><b>Chapter-8: Skills of Writing - Vocabulary, Epitomizing, Punctuation.</b></p> <p><b>Chapter-9: Report Writing-Journalistic Writing Skills, Yellow Journalism, Use of Facts and Figures and Interpretations.</b></p>	<b>15 Hours</b>

#### Exercise:

- Conducting classroom Common seminars on Media and Politics
- Making students to read and write newspaper headlines focusing on politics,
- Visit to media houses and talks with senior political newsroom heads.

#### Suggested Readings

1. Iorio, Sharon Hartin. Qualitative Research In Journalism, Erlbaum Associates, London,2004.
2. Merritt, Davis, Public Journalism And Public Life, Erlbaum Associates, London,2004.



## INDIA AND INDIAN CONSTITUTION

<b>Ability Enhancement Compulsory Courses (AECC)</b>	
<b>Course Title: INDIA AND INDIAN CONSTITUTION</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>
No. of Teaching Hours/Week: <b>3</b>	Duration of ESA/Exam: <b>2 Hours</b>
Formative Assessment Marks: <b>40</b>	Summative Assessment Marks: <b>60+40=100</b>

### Course Objective

The purpose of the course is to help students to learn and explain the journey of India as a republic. They will, through this paper, learn to contextualise the depth of India as a nation with its diverse socio-political culture, its philosophical traditions, values and Ideals. It will give them knowledge to expound the breadth of freedom struggle in various parts of India, its significance in nation building and the sacrifices made both by its leaders and followers. It will help them to demonstrate their knowledge regarding the efforts made at working towards a constitution as India's conscience cherishing the values of Justice, Liberty, Equality and Fraternity. Consequently, it will enable students to contextualise the powers and functions of various offices under the Constitution. It will help them determine the role and responsibilities of citizens as enshrined in the Constitution, offering insights into the contributions of personalities like Gandhiji, Dr B.R. Ambedkar and Jawahar Lal Nehru, Bal Gangadhar Tilak, the values tolerance, equality of treatment, scientific secularism and swarajya and the processes of policymaking keeping national wellbeing in the forefront. This paper will enable students to illustrate how vibrant our Constitution is, how farsighted were its makers and how efficient are the various institutions that are functioning under it.

### Learning outcomes

Upon completion of this course, students will be able to—

- Explain the philosophy and the structure of the Constitution.
- Measure the powers, functions and limitations of various offices under the Constitution.

- Demonstrate the values, ideals and the role of Constitution in a democratic India.

Unit	Contents of Course:	45 Hours
<b>Unit-I</b>	<p><b>Background to the study of Indian Constitution**</b></p> <p><b>Chapter 1: Philosophical and Political foundations of India:</b> Dharma and Danda, Buddhist, liberal (Raja Rammohun Roy) and Subaltern (Ranajit Guha)* Colonial impact on Indian society,** Nationalist perspective (Swamy Vivekananda and Sri Aurobindo).</p> <p><b>Chapter 2: Political values and Ideals during freedom struggle:</b> Non Violence, Tolerance, Satyagraha and Swadeshi (Gandhi), Swarajya (Tilak), Integral Humanism (Deen Dayal Upadhyay) and Voluntarism (Vinoba Bhave).</p> <p><b>Chapter 3: Political Contribution of Regional freedom struggle:</b> Kittur Rani Chennamma, Hardekar Manjappa, Madikeri Peasants, Halagali Bedas.</p>	<p><b>6 Hours</b></p> <p><b>5 Hours</b></p> <p><b>4 Hours</b></p>
<b>Unit-II</b>	<p><b>Constitutional Development and its Philosophy</b></p> <p><b>Chapter- 4: Historical background of Constitutional development in India</b> - Developments between 1857 to 1952 (only Acts during this period must be taught), Composition and debates of Constituent Assembly (in brief), working of committees.</p> <p><b>Chapter 5: Philosophy and features of Indian Constitution</b> - Preamble*, Salient features**, Constitutionalism, Dr B.R. Ambedkar and Nehru's contribution in the making of the Constitution.</p> <p><b>Chapter- 6: Working of the Constitution</b> - Fundamental Rights, Union-State and Inter-State Relations (Art. 263, Inter-State disputes and trade and commerce), important Amendments to the Constitution**, Parliamentary Committees* (Standing, Ad hoc and Departmental).</p>	<p><b>5 Hours</b></p> <p><b>5 Hours</b></p> <p><b>5 Hours</b></p>

Unit-III	<p><b>Constitutional Institutions and Citizen's role</b></p> <p><b>Chapter 7: Parliamentary and Constitutional Institutions:</b> Legislature* (Upper and Lower house), Executive (composition and powers), Judiciary (High Court and Supreme Court, its composition and jurisdiction), Comptroller and Auditor General, Inter-State Council, Election Commission.</p> <p><b>Chapter 8: Role and Responsibilities of Citizens under Indian Constitution:</b> Concept of Citizenship, Citizenship Amendment Act, Fundamental Duties, Right to Information Act, Civil Society.*</p> <p><b>Chapter 9: Goals and Policies of National Development enshrined in the Constitution:</b> Concept of National Development, Unity and Integrity of the nation, Goals of Educational Policies*, Role of teachers and students in Nation Building**.</p>	<p><b>6 Hours</b></p> <p><b>4 Hours</b></p> <p><b>5 Hours</b></p>
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(\*\*Note-This is a compulsory, foundational and value additional course to be taught to students at the graduate level under NEP 2020. The paper is expected to impart the structure and functional aspects of constitution while giving them the background of a diverse country like India and the nuances of its social fabric and the why of such an elaborate constitution. The introductory chapter therefore is designed to familiarise students about their country and culture before they understand their constitution).

(Please note: The question paper pattern is indicative of the way a teacher needs to teach this paper. The pedagogical choice of a teacher helps to make an impact of his/her teaching on the student. Activity based and experiential teaching methods help student centric learning process - these are tips to make this paper more meaningful- the ultimate choice is left to the teacher)

#### Exercise:

- Department can debate on the role of Constitution in the development of India.
- Students can empirically evidence the effectiveness of concepts like Freedom, Equality, Justice, Rights and Duties by conducting empirical studies.
- Can invite expert to deliver special lectures on various provisions and amendments of the Constitution like the functioning of Election Commission, Article 246, 356 etc.

#### Important Notes:

##### Chapter 1:

\* These are introductory courses. Teachers should give a brief introduction to these for a better understanding of the philosophical and political foundations of Indian society taking suggested thinkers as examples (Max 2hrs).

\*\* Here teachers should briefly teach about the contributions and impact of British and Arabs as invaders, Mughals as settlers (Max 2hrs).

**Chapter2:**

\*These are to be taught briefly as concepts against the backdrop of freedom struggle

**Chapter3:**

\*BOS can alter this chapter to bring in the personalities and movements in their region who have made an impact on freedom struggle.

**Chapter5:**

\*While teaching the preamble please cover secularism and its criticism keeping in mind the neutrality of state in matters of religion and bring in the discussion regarding the differences in the usage of the terms like Religion, Dharma, Pantha(□□□), Matha(□□), Caste, Jatyathithate and the meaning of scientific secularism as expounded by Nehru.

\*\* In the salient features the teachers must teach at least 10 features of the constitution like Written constitution, Parliamentary form of government, Quasi federalism, Directive Principles of State Policy, Amendment procedure, Universal adult franchise, Integrated citizenship, Independent judiciary, Judicial Review, Emergency provisions and Three tier system of governance etc. The BOS has the discretion in selecting the salient features.

**Chapter6:**

\*In the committee they should teach the nature of these committees, their types, categories and subcategories.

\*\* In this the teacher should teach the amendments like 42nd, 73<sup>rd</sup>, 74th, 101st, etc which have major impact on the working of the Constitution. The BOS has the discretion in selecting the amendments but must ensure that they have a bearing on the working of the constitution.

**Chapter7:**

\*Here teachers are expected to teach the institutions in general and contextualise them to state and central governments.

**Chapter8:**

\*In this the teacher should discuss issues like paying taxes, exercising vote, discouraging corruption, Knowledge of laws that govern them.

**Chapter9:**

\*Teachers can touch upon Kothari Commission, NEP(1986 and 2020 while teaching Educational Policies)

\*\*Teachers can touch upon the teacher taught relations (vedantic tradition), teacher as a role model, student as future citizen, the need for ethical and moral responsibility among them etc.,

**Suggested Readings:**

1. Aiyangar K.R. 1941. "Ancient Indian Polity". Oriental Books Agency. Poona.

2. Altekar A.S. 1949. “*State and Government in Ancient India*”. Motilal Banarsidass Chowk, Banaras
3. Andre Beteille, 1965. *Caste, class, and Power*. Berkley: University of California Press.
4. Arora & Mukherji, *Federalism in India, Origin and Developments*, Vikas Publishing House, New Delhi, 1992.
5. Bhandarkar D.D. 1940. “*Some Aspects of Ancient Indian Culture*”. University of Madras.
6. Chandra Bipan. 1979. “*Nationalism and Colonialism in India*”. Orient, Lang.
7. Constitution of India (Full Text), India.gov.in., National Portal of India, [https://www.India.gov.in/sites/upload\\_files/npi/files/coi\\_part\\_full.pdf](https://www.India.gov.in/sites/upload_files/npi/files/coi_part_full.pdf)
8. D.C. Gupta, *Indian Government and Politics*, Vikas Publishing House, New Delhi, 1975.
9. Desai, A.R. 2016. *Social Background of Indian Nationalism*. Los Angeles: Popular Prakashan.
10. Durga Das Basu, *Introduction to the Constitution of India*, Gurgaon; Lexis Nexis, 2018 (23rd edn.)
11. Gandhi, M.K. "Hind Swaraj", [http://www.mkgandhi.org/ebks/hind\\_swaraj.pdf](http://www.mkgandhi.org/ebks/hind_swaraj.pdf)
12. Goshal U.N. 1923. “*History of Hindu Political Theory*”. Oxford University Press, Calcutta.
13. Granville Austin, 2000. *The Indian Constitution: Cornerstone of a Nation*. Melbourne: Oxford University Press.
14. Hanson and Douglas, 1972. *India's Democracy*. New York city: W.W. Norton & Co Inc.
15. Harish Ramaswamy and S. S. Patagundi (Ed.) 2007. *Karnataka- Government and Politics*. Delhi: Concept Publishing Company.
16. J.N. Pandey, *The Constitutional Law of India*, Allahabad; Central Law Agency, 2018 (55th edn.)
17. Jayaswal K.P. 1943. “*Hindu Polity*”. Bangalore Printing and Publishing Co. LTD, Bangalore.
18. Johari J.C. 1974. *Indian Government and Politics*. New Delhi: Vishal Publications.
19. K B Merunandan, *Bharatada Samvidhana Ondu Parichaya*, Bangalore, Meragu Publications, 2015.
20. K. Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, New Delhi, 2002.
21. Kapoor, Kapil (Ed), 2005, *Indian Knowledge System- Vol-1*, New Delhi: D>K Printworld LTD.

22. Kapoor, Kapil, 1994, *Texts of the Oral Tradition, Language, Linguistics and Literature: The Indian Perspective*. Delhi: Academic Foundation
23. Kosambi D.D. 1965. "*The Culture and Civilization of Ancient India and Historical Outline*". Vikas Publishing House pvt. ltd, Noida.
24. Krishana Rao, M. & G.S. Halappa. 1962. *History of Freedom Movement in Karnataka*. Mysore: Government of Mysore.
25. M.V. Pylee, *India's Constitution*, New Delhi; S. Chand Pub., 2017 (16th edn.)
26. Nagel, Stuart, 2017, *India's Development and Public Policy*. UK: Routledge.
27. P.M Bakshi, *Constitution of India*, Universal Law Publishing House, New Delhi, 1999.
28. Patham and Thomas Patham. 1986. "*Political Thought in Modern India*." Sage Publications, United State.
29. Rajni Kothari, 1995. *Caste in Indian Politics*. Telangana: Orient Blackswan.
30. Rghavendra Rao, K. 2000. *Imagining Unimaginable Communities*. Hampi: Prasranga, Kannada University.
31. Bhargava, Rajeev. ed. 1998. *Secularism and Its Critics*, New Delhi: Oxford University Press.
32. S.N. Jha, *Indian Political System, : Historical Developments*, Ganga Kaveri Publishing House, Varanasi, 2005.
33. Said Edarard. 1978. "*Orientalism*". Pantheon Books, USA.
34. Sharma, R.S. 1991. "*Early Indian Social and Political Thought and Institutions (Aspects of the Political Ideas and Institutions in Ancient India)*". Motilal Banarsidass, Delhi.

<b>FormativeAssessment</b>	
<b>AssessmentOccasion/type</b>	<b>WeightageinMarks</b>
AssessmentTest-1	10
Seminar/Presentation/GroupDiscussion	10
AssessmentTest-2	10
Assignment	10
<b>Total</b>	<b>40</b>



**I. Term End Examination for India and Indian Constitution (IIC)**

Paper will be for maximum of 60 marks. The minimum marks to pass the examination is 40% (24 marks).

**Note:** Duration of Examination for **India and Indian Constitution (IIC)** is **2 hours**.

Question paper pattern for **India and Indian Constitution**—

**Section A: Multiple Choice Questions**

**Section B: Short Answer Questions**

**Section C: Medium Answer Questions**

**Section D: Long Answer Questions**

**Section A: Multiple Choice Questions**

All Questions are Compulsory (10x1=10)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

**Section B: Short Answer Questions (5x5=25)**

Answer any Five questions. Answer the following questions in not more than 3-5 sentences.

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.

**SectionC:MediumAnswerQuestions (1x10=10)**

AnsweranyOnequestion.Answerthefollowingquestioninnotmorethan500words

18.

19.

**SectionD:LongAnswerQuestions (1x15=15)**

AnsweranyOnequestion.Answerthefollowingquestioninnotmorethan800words

20.

21.

**Department of Political science  
Pattern of Question Paper**

**1. International Assessment**

Each paper will have an internal assessment component for **40** marks out of the maximum **100** marks

**2. Theory Examination**

**Max.Marks 60**

Theory question paper pattern

Theory question paper for Itoiv Semester ( 2 papers) will have 1 parts

**Question Paper Pattern**

**Theory (3 Credits)**

**Time :2 Hours**

**Max.Marks:60**

**Anwer any five questions each question carries 10 marks**

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....
- 6.....
- 7.....
- 8.....
- 9.....

10.....

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**DEPARTMENT OF POLITICAL SCIENCE**

**UG Syllabus  
CHOICE BASED CREDIT SYSTEM  
For B.A.Programmes**

- History,Economics,Political science(HEP)
- Kannada, Economics,Political science(KEP)

## ➤ Journalisam,Politicalscience,English(JPE)

**2019-20****ELE26022/25/26**

**V Semester**  
**Discipline Specific Elective (DSE1A)**  
**Themes on Comparative Political Theory**

**Course Outcome:**

On completion of the Course, students will:

- CO1 Understand in details with application, if applicable, democracy and governance
- CO2 Understand in details with application, if applicable, Indian political thought
- CO3 Specify in depth Indian political thought
- CO4 Identify the classification and characteristics of western political thought
- CO5 Understand in details with examples western political thought
- CO6 Understand in depth local government
- CO7 Learn the details of regulatory institutions
- CO8 Identify the classification and characteristics of lobbying institutions

**Unit I**

- a. Distinctive features of Indian political thought
- b. Kautilya on State
- c. Tilak and Gandhi on Swaraj

**Unit II**

- a. Ambedkar and Lohia on Social Justice
- b. Nehru and Jayaprakash Narayan on Democracy
- c. John Locks on Rights

**Unit III**

- a. Distinctive features of western political thought
- b. Aristotle on citizenship
- c. plato –ideal state

**Unit IV**

- a. J.J. Rousseous on Inequality
- b. J.S. Mill on liberty and democracy



- b. The comptroller and auditor general of India-powers and functions
- c. public accounts committee, estimate committee

### Essential Readings:

- Avasthi and maheshwaripublic administration
  - Madhavan, M R & N Wahi financing of election campaigns
  - Vanka, S primer on MPLADS centre for policy research
  - Karla, H Public engagement with the legislative process
  - Agerwalo.P and T V Somanathan, “Public Policy Making in India: Issu

ELF26022/25/26

## VI SEMESTER(DSE1A) MODERN GOVERNMENTS (U.K U,S.A.SWISS)

### Course Outcome:

On completion of the Course, students will:

CO1 Understanding the world politics

CO2 Enlighting the world governmental system

CO3 Develop comparative study on governmental systems

### Unit I UNITED KINGDOM

- a. Evolution, features of UK Constitution and role of conventions
- b. Parliament- Composition powers and functions
- c. Crown-prime minister-powers and functions

### Unit II

- a. Judiciary in UK- Composition and jurisdiction
- b. Role of political parties in UK

### Unit III : UNITED STATES OF AMERICA

- a. Features of USA Constitution
- b. Congress - Composition powers and functions
- c. President-Election, Role powers and functions

### Unit IV:

- a. Judiciary in USA- Composition and jurisdiction
- b. political parties in USA

### Unit IV: SWISS

- a. Features of Swiss Constitution

- b. Federal Assembly-Composition powers
- c. Federal Council-Composition powers
- d. Federal Tribunal-Composition powers
- e. Devices of Direct Democracy in Swiss

**Reference:**

- A.C Kapoor - Select constitution
- H.t.Ramakrishna - Adunikasarakaragalu
- U.Gurumurthy - Adunikasarakaragalu
- Vidyabhushan and- World Constitution
- Vishnu Bagavan

ELF26222/25/26

**VI Semester**  
**Skill Enhancement Course (DSE1B):**  
**Public Administration Concepts & Theories**

**Course Outcome:**

On completion of the Course, students will:

- CO1 Learn in depth Administration and Public Policy
- CO2 Specify the details of administrative theories
- CO3 Learn the classification and characteristics of administrative theories
- CO4 Deliberate the details of public policy
- CO5 Deliberate in details with examples public policy in India
- CO6 Identify the characteristics of public policy in India

**Unit I Public Administration**

- a. Meaning, Scope and Significance
- b. Public & Private Administration
- c. Approaches to Public Administration

**Unit II Administrative Theories**

- a. Classical Theory & Human Relations Theory
- b. Scientific Theory
- c. Rational decision making theory

**Unit III. Management**

- a. Meaning, importance and principles
- b. Features and functions of management
- c. Chief executive –functions and its role

**Unit IV. contemporary issues in administration**

- a. Meaning and modes of corruption
- b. Good governance
- c. E-governance

**Reference:**

- Awasthi A and Maheshwari - Public Administration
- BasuRumki, Public Administration - Concepts and Theories
- Henry N - Public Administration and Public Affairs
- Mouzelis N P - The Ideal type of Bureaucracy
- Mooney - The Principles of Organization
- Esman M T - Politics & Development Administration



ELE26242/25/26

**Generic Elective: Interdisciplinary Reading Gandhi****Course Outcome:**

On completion of the Course, students will:

- CO1 Specify the details of reading Gandhi
- CO2 Deliberate in depth Gandhi and hind swaraj
- CO3 Learn the details of Gandhi's views on nationalism
- CO4 Understand the details of Gandhi's views on communal unity
- CO5 Understand in details with examples Gandhi's views on women

**Unit I: Introduction**

- a. Biography (a brief)
- b. Commentaries on hind swaraj
  - c. Truth –non-violence
- d. Satyagraha
  - e. Modernity

**Unit II:**

- a. State and religion
  - b. Nationalism
  - c. Communal Unity
- d. Women's Question
  - e. Untouchability
  - f. Capt of ramarajya
  - g. Economical idias

**Reference:**

- A.J. Parel(1997)- Introduction, M.K Gandhi , Hinda swaraj and other writings
- B Parekh, -Gandhi(1997)
- D.hardiman, -Gandhi in his time and ours(2003)

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**NEP-UG Syllabus  
For B.A Programmes**

- **History, Political Science (HP)**
- **Journalism, Political science (JP)**

**2021-22**

**2022-23 onwards**

**DEPARTMENT OF POLITICAL SCIENCE**

## NEP Syllabus for BA-HP& JP2021-2022 (I sem-II sem)

Sem	Course No C1/C2	combination	Course Code	Title of the course	Course Type	Credit Pattern L:T:P	Total Credit	Teaching hrs/week	Evaluation Pattern			
									C1	C2	C3	Total Marks
III					DSC/AECC/S EC							
I	C1	HP	FHA47032	Basic concepts of Political science	DSC1	3:0:0	3	3	20	20	60	100
I	C1	JP	FHA47035	Basic concepts of Political science	DSC1	3:0:0	3	3	20	20	60	100
I	C2	HP	FHA48032	Political theory	DSC2	3:0:0	3	3	20	20	60	100
I	C2	JP	FHA48035	Political theory	DSC2	3:0:0	3	3	20	20	60	100
I			FHA860	Human Rights	OE1	3:0:0	3	3	20	20	60	100
			FHA870	Administration in India								
II	C1	HP	FHB47032	Western Political Thought	DSC3	3:0:0	3	3	20	20	60	100
II	C1	JP	FHB47035	Western Political Thought	DSC3	3:0:0	3	3	20	20	60	100
II	C2	HP	FHB48032	Indian National Movement and Constitutional Development	DSC4	3:0:0	3	3	20	20	60	100
II	C2	JP	FHB48035	Indian National Movement and Constitutional Development	DSC4	3:0:0	3	3	20	20	60	100
II			FHB860	India Polity: Issues and Concerns	OE2	3:0:0	3	3	20	20	60	100
			FHB 870	International Relations								

## Proposed Structure for Political Science Discipline

<b>Semester I</b>				
<b>Course</b>	<b>Paper</b>	<b>Credits</b>	<b>No. of Teaching Hours/Week (L+T+P)</b>	<b>Total Marks/ Assessment</b>
<b>DSC-1</b>	<b>Basic Concepts in Political Science</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>DSC-2</b>	<b>Political Theory</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>OE</b>	<b>1. Human Rights</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
	<b>2. Administration in India</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>Semester II</b>				
<b>DSC-3</b>	<b>Western Political Thought</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>DSC-4</b>	<b>Indian National Movement and Constitutional Development</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
<b>OE</b>	<b>1. Indian Polity: Issues and Concerns</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>
	<b>2. International Relations</b>	<b>3</b>	<b>3+1+0=4</b>	<b>100 (60+40)</b>

## Structure for Political Science Discipline

<b>Semester III</b>				
<b>Course</b>	<b>Paper</b>	<b>Credits</b>	<b>No. of Teaching Hours/Week</b>	<b>Total Marks/ Assessment</b>
<b>DSC-5</b>	<b>Indian Government and Politics</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>DSC-6</b>	<b>Parliamentary Procedures in India</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>OE-3</b>	<b>3.1 Gender and Politics</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>3.2 Understanding Gandhi</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>3.3 Citizen, Citizenship and the Indian Constitution</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>Semester IV</b>				
<b>DSC-7</b>	<b>Ancient Indian Political Ideas and Institutions</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>DSC-8</b>	<b>Modern Political Analysis</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>OE-4</b>	<b>4.1 Good Governance in India</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>4.2 Understanding Dr.B. R. Ambedkar</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
	<b>4.3 Political Journalism</b>	<b>3</b>	<b>3</b>	<b>100 (60+40)</b>
<b>Ability Enhancement Compulsory Courses (AECC)</b>	<b>Constitution of India</b>	<b>2</b>	<b>2</b>	<b>50(30+20)</b>

## **Political Science Model Curriculum (III & IV Semester)**

**Name of the Degree Program: BA/BSc/BCom/BBA/BCA... Without Practical Course**

**Discipline Core: Political Science**

**Total Credits for the Program:**

**Starting year of implementation: 2021-22**

**Program Outcomes:**

**By the end of the program the students will be able to:**

- Not only upgrade the learning of Political Science as a contemporary discipline but also to inculcate the Indian political ethos and the moral standards of functioning of political institutions in India. These in fact, brought laurels to our acumen in politics and Kautilya's Arthashastra stands as a proof of this.
- Understand voluminously about the dimensions of Indian Government, its Parliamentary Procedures, the concerns of Gender in Politics, Gandhian Philosophy and an understanding of the citizens duties and responsibilities in the 3rd semester.
- Understand the papers such as Ancient Indian Political Ideas and Institutions throws light on the wisdom of Indian Political Thought bringing along its side the Modern Political Analysis which is skill based paper.
- Understand the papers which are hybridised like Political Journalism and focused papers like Good Governance and Understanding Dr.B.R.Ambedkar which will bring to the fore facts and normative ways of running governments.

Thus, these semesters represent both knowledge and skill components and making it contemporary in its content. Learning among the students will thus make it interesting and lively.

**Assessment:****Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40	(60+40) =100
Practical	-	-
Projects	-	-
Experiential Learning (Internships etc.)	-	-
AECC	20	(30+20)=50

Formative Assessment		
Assessment Occasion/ type		Weightage in Marks
C-1	Assessment Test-1	10
	Seminar/Presentation/Group Discussion /Assignment/ Quiz	10
C-2	Assessment Test-2	10
	Assignment/ Book reviews / Reports on field visits / Seminars	10
<b>Total</b>		<b>40</b>



# **SEMESTER -I**

## BASIC CONCEPTS IN POLITICAL SCIENCE

### DSC-1

<b>Course Title: BASIC CONCEPTS IN POLITICAL SCIENCE</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>
No. of Teaching Hours/Week: <b>3+1=4(L+T)</b>	Duration of ESA/Exam: <b>3Hours</b>
Formative Assessment Marks: <b>40</b>	Summative Assessment Marks: <b>60+40=100</b>

#### **Course Objective:**

Develop an understanding about the nature and philosophy of Political Science and its interface with society. Enable the students to develop qualities of responsible and active citizens in a democracy.

#### **Learning Outcome:**

At the end of the course the students shall understand -

- Political Science, theoretically and will gain knowledge to explain and analyze politics at large.
- The dynamics of politics.
- To inculcate the democratic spirit

<b>Unit</b>	<b>Contents of Course- 1</b>	<b>45 Hours</b>
<b>Unit-I</b>	<p><b>Chapter -1</b> Meaning, Nature, Scope and Importance of Political Science, Approaches – Philosophical, Historical, Observational, Comparative and Experimental. Emergence of Political Science as a Discipline.</p> <p><b>Chapter- 2</b> Meaning and Elements of State, Difference between State and Government, State and Society, State and Association, Theories on Origin of State- Historical Theory, Divine Rights Theory, Social Contract Theory, Marxist and Gandhian Theory of State</p> <p><b>Chapter-3</b> Civil Society- Meaning and Importance.</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4</b> Meaning, Characteristics, and Kinds of Sovereignty.</p>	<b>15 Hours</b>
	<p><b>Chapter-5:</b> Austin’s Concept of Sovereignty and Pluralistic Critique, Pluralistic Theory of Sovereignty, Challenges to the State Sovereignty in the age of Globalization.</p> <p><b>Chapter-6,</b> Law meaning, Sources, Relations between Law and Liberty , law and Justice.</p>	

<b>Unit- III</b>	<b>Chapter-7</b> Liberty: Meaning and Kinds; Positive and Negative <b>Chapter-8</b> Equality: Meaning and Kinds (Social, Economic and Political) <b>Chapter-9</b> Power and Justice: Meaning and kinds, Political Obligation: Nature AND Importance, Grounds of Political Obligation.	<b>15 Hours</b>
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**Exercise:**

1. List out the modern elements of State
2. List out the countries and identify the issues related to equality
3. Identify an issue and discuss the role of civil society

**Suggested Readings:**

1. Political Theory: Ideas & Concepts, S. Ramswamy, Delhi, Macmillan, 2002.
2. Modern Political Theory, S. P. Verma, New Delhi, Vikas, 1983.
3. Principles of Modern, Political Science, J C Johri, Sterling Publishers Pvt. Ltd. 1995.
4. Principles of Political Science, AC Kapur, New Delhi, Sultan Chand and Sons, 2004.
5. Principles of Political Science, N.N Agarwal, Vidya Bhushan, Vishnoo Bhawan, R. Chand & Co, New Delhi, 1998.
6. Political Science Theory, S.C Pant, Prakashan Kendra, Lucknow, 1998.
7. Political Science Theory, S. N Dubey, Lakshmi Narain Agarwal, Agra, 2002.
8. Principle of Modern Political Science, J C Johari, Sterling Publications, New York, 2009.
9. Principles of Political Science, Anup Chand Kapur, S Chand & Co Ltd, 2010.

**Pedagogy:**

The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Resources (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

<b>Formative Assessment</b>		
<b>Assessment Occasion/ type</b>		<b>Weightage in Marks</b>
<b>C-1</b>	<b>Assessment Test-1</b>	10
	Seminar/Presentation/Group Discussion /Assignment/ Quiz	10
<b>C-2</b>	<b>Assessment Test-2</b>	10
	Assignment/ Book reviews / Reports on field visits / Seminars	10
<b>Total</b>		<b>40</b>

# POLITICAL THEORY

## DSC-2

<b>Course Title: POLITICAL THEORY</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

### Course Outcome:

This course aims to introduce certain key aspects of conceptual analysis in political theory and the skills required to engage in debates surrounding the application of the concepts.

### Learning Outcomes:

At the end of the course the students shall understand -

- The nature and relevance of Political Theory.
- The different concepts like Liberty, Equality, Justice and Rights.
- To reflect upon some of the important debates in Political Theory.

Unit	Contents of Course- 2	45 Hours
<b>Unit-I</b>	<b>Chapter-1</b> Meaning, Nature and Importance of Political Theory, <b>Chapter-2</b> Modern Approaches- Behavioral, Post-Behavioral, David Easton's Political System and Marxian Approach <b>Chapter-3</b> Relevance of Political Theory, Decline and Resurgence of Political Theory	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Liberalism: J.S Mill <b>Chapter-5</b> Neo- Liberalism: John Rawls <b>Chapter-6</b> Libertarianism: Robert Nozick	<b>15 Hours</b>
<b>Unit- III</b>	<b>Chapter-7</b> Communitarianism and Multiculturalism: Indian perspective, Colonial Discourse and Post Colonialism, Post Colonial Response and its Limitations <b>Chapter-8</b> Proponents of Secularism – Nehru, Gandhi, Moulana Azad. <b>Chapter-9-</b> Dmocracy and Liberalism- Dr.B.R.Ambedker, Lohia, Jaya Prakash Narayan.	<b>15 Hours</b>

### Exercise:

- Write about the Myth and Reality on Communitarianism in India
- Compare the concept of Liberty, Equality and Justice to the Modern world
- Write the understanding of secularism in India

### Suggested Readings:

1. Ahmed. V, Theory: Classes, Nations Literatures.: Verso, London, 1992.
2. Arendt. H., On Revolution, Viking, New York, 1963
3. Ahmed. V, Theory: Classes, Nations Literatures.: Verso, London, 1992.

## HUMAN RIGHTS

### Open Elective OE-1

<b>Course Title: HUMAN RIGHTS</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

#### Course Objective:

This course aims to introduce the students to basic concepts and practices of Human Rights in the global and local domain. This course also exposes them to certain recent issues confronting the Human Rights debates.

#### Learning Outcomes:

After completing this course students will be able to-

- Explain the basic concept of Human Rights and its various formulations.
- Have necessary knowledge and skills for analyzing, interpreting, and applying the Human Rights standards and sensitize them to the issues.
- Develop ability to critically analyse Human Rights situations around them.

Unit	Contents of Course- OE-1	45Hours
<b>Unit-I</b>	<b>Chapter-1</b> Meaning, nature, scope and Classification of Human Rights <b>Chapter-2</b> The Human Rights of First generation (Civil and Political Rights), Second generation (Economic, Social and Cultural Rights), Third generation (Collective Rights) and Fourth generation (Subjective Rights) <b>Chapter-3</b> Universal Declaration of Human Rights, RTI as Human Right.	<b>15Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Human Rights and Fundamental Rights, Fundamental Rights and Fundamental Duties in India <b>Chapter- 5</b> National Human Rights Commission (NHRC) - Composition and its function <b>Chapter-6</b> Karnataka State Human Rights Commissions (KSHRCs) – Composition and its functions	<b>15Hours</b>
<b>Unit-III</b>	<b>Chapter -7</b> National Commission for SCs/STs, Minorities' Commission, Women' Commission <b>Chapter-8</b> Major issues and concerns of Human Rights- Discrimination and violence against women, children, Dalits and Minorities, Child Labour and Bonded Labour <b>Chapter-9</b> Challenges to Human Rights	<b>15Hours</b>

#### Suggested Readings:

1. Baxi Upendra (ed.), The Right to be Human, Lancer International, Crawford, New Delhi, 1987.
2. James(ed.), The Rights of People, Oxford, New York, 1988.
3. Craston, M. What are Human Rights, Bodely Head, London, 1973
4. Rhond L.Callaway&JulieHarrelson- Stephen,“InternationalHuman Rights



## ADMINISTRATION IN INDIA

### Open Elective OE-2

<b>Course Title: ADMINISTRATION IN INDIA</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

#### Course Objective:

This course aims to introduce the students to basic aspects of Administration in India. This course also exposes them to the working of Administrative system in India.

#### Learning Outcomes:

After completing this course students will be able to-

- Acquire General Knowledge required to competitive Examinations
- To Have necessary knowledge and skills, Competency required for understanding Conceptual and Practical dimensions of Administrative process in India.

Unit	Contents of Course- OE-2	45 Hours
<b>Unit-I</b>	<b>Chapter-1</b> Meaning, Feature and Functions of Civil Service. <b>Chapter-2</b> Growth of Civil service in India, kinds of Civilservices in India and Concept of Lateral Entry into Civil Services. <b>Chapter-3</b> UPSC, Staff Selection Commission, DPAR – Composition, Powers and Function.	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Central Administration, PMO, Central Secretariat, Cabinet Secretary- role, Powers and Function. <b>Chapter- 5</b> Ministry of Personnel and Personal Grievances, Ministry of Home affairs, Ministry of Defense, Ministry of Finance, powers and function <b>Chapter-6</b> State Administration – State secretariat and Chief Secretary. Role, Power and Function.	<b>15 Hours</b>
<b>Unit-III</b>	<b>Chapter -7</b> Deputy commissioner, role Powers and Functions, administrative Organization below the District level. <b>Chapter-8</b> Control over the Administration-Legislative, Executive, Judicial and Popular <b>Chapter-9</b> Good Governance and E-Governance - Meaning, features and Importance, Bhoomi, Panchatantra , sakala, Khajane.	<b>15 Hours</b>

#### Exercise:

- Seminar and Group Discussion on Administration and Its kinds.
- Students can be asked to go for field visit to know the working of Local Bodies and E-Governance Initiative.

#### Suggested Readings:

1. Central Administration – A. Avasthi
2. Indian Administration – S.R.Maheswari

# SEMESTER -II



**WESTERN POLITICAL THOUGHT  
DSC-3**

<b>Course Title: WESTERN POLITICAL THOUGHT</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

**Course Objective:** The Syllabus is designed to understand Political Philosophy, traditions that evolved in Europe from Ancient to the beginning of modern era. To examine the contributions of the Greek, Medieval and early Modern thinker's Philosophical thought.

**Learning Outcomes:**

At the end of the course the students shall understand -

- And get an introduction to the Schools of Political Thought and Theory making in the West.
- And introduce the richness and variations in the political perceptions of Western Thinkers.
- And familiarize themselves to the Thought and Theory of Western Philosophy.

Unit	Contents of Course-3	45 Hours
<b>Unit-I</b>	<p><b>Chapter -1</b> Salient Features of the Greek Political Thought, <b>Plato:</b> Theory of Justice, Philosopher King, <b>Aristotle:</b> State and Its Classification, Theory of Revolution</p> <p><b>Chapter -2</b> Salient Features of Medieval - Political Thought, Christian Tradition, <b>St. Thomas Aquinas:</b> Church v/s State, <b>St. Augustine:</b> Theory of Two Swords</p> <p><b>Chapter -3, Machiavelli:</b> On Politics and State Craft, Views on ends and means</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter -1 Hobbes:</b> Theory of Sovereignty, <b>Locke:</b> Social Contract and Theory of Government, Tolerance;</p> <p><b>Rousseau:</b> Social Contract, General Will</p> <p><b>Chapter -2 Bentham: Theory of Utilitarianism</b></p> <p><b>Chapter -3 J.S. Mill: Views on Liberty</b></p>	<b>15 Hours</b>
<b>Unit- III</b>	<p><b>Chapter -1 . Karl Marx – Historical Materialism, Class Struggle, Surplus theory And Revolution.</b></p> <p>Classless and stateless society</p> <p><b>Chapter -2 Jurgen Habermas-</b> Communicative action, Public Sphere, Theory of truth and knowledge</p> <p><b>Chapter -3 Noam Chomsky-</b> Responsibility of Intellectuals, Manufacturing consent.</p>	<b>15 Hours</b>

**Exercise:**

- Compare Greek State with the Roman state and make points
- Imagine the present situation with that of Contractualist's Social Contract Theory and write the summary
- Can we have a classless society in the modern world? Comment

**Suggested Readings:**

1. A. Hacker, Political Theory: Philosophy, Ideology, Science New York, Macmillan, 1961.
2. G.H. Sabine. A History of Political Theory. New Delhi: Oxford and IBH, 1937

## INDIAN NATIONAL MOVEMENT AND CONSTITUTIONAL DEVELOPMENT

### DSC-4

<b>Course Title: INDIAN NATIONAL MOVEMENT AND CONSTITUTIONAL DEVELOPMENT</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

#### Course Objective:

- To familiarize the students with the ideas of Nationalism and contemplate on how colonial rule was overthrown by the Indian Nationalists.
- To acquaint the students with the problems of Independent India.
- To enable the students to understand the role of India in World affairs and the contributions of great men towards freedom.

#### Learning Outcome:

At the end of the course the students shall -

- Understand how the colonial rule was overthrown by the Indian nationalists.
- Appreciate the ideals and values of Gandhi that resulted in freedom.
- Examine the problem of Independent India and the role played by great leaders in solving them.

Unit	Contents of Course-4	45 Hours
<b>Unit-I</b>	<b>Chapter-1</b> Indian National Movement: Features, The Liberal, The Extremist and Revolutionary Phase <b>Chapter-2</b> The Gandhian Phase: Non-Cooperation movement, Civil Disobedience Movement and the Quit India <b>movement</b> . <b>Chapter-3</b> Political Issues during National movement- Swaraj, Reservation, Gandhian Swadeshi Concept.	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Morley-Minto Reform Act of 1909, Montague Chelmsford Act of 1919: main provisions and Dyarchy, Simon Commission, The Nehru Report. <b>Chapter-5-</b> Round Table Conferencess, Government of India Act of 1935: main provisions:, provincial Autonomy and federal system <b>Chapter-6-</b> Cabinet Mission Plan, Indian Independence Act of 1947: main provisions. Constituent Assembly Debates on	<b>15 Hours</b>
<b>Unit-III</b>	<b>Chapter-7</b> Citizenship and State Structure <b>Chapter-8</b> Minority Rights, Fundamental Rights. <b>Chapter-9</b> Language and National Integration. (The above three should be discussed in the context of Constituent Assembly Debates)	<b>15 Hours</b>

**INDIAN POLITY: ISSUES AND CONCERNS**  
**Open Elective OE-2**

<b>Course Title: INDIAN POLITY AND CONCERNS</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

**Course Objective:** To make the students aware on different issues that exists in Indian polity. Through this paper students need to understand the emerging issues and their causes to the Indian Democracy.

**Learning Outcome:**

At the end of the course the students shall -

- Understand the reasons behind the causes of these issues and also the constitutional provisions that existed.
- Familiarize with the debates that emerged.
- Be able to suggest the measures to control such issues.

Unit	Contents of Course-OE-2	45 Hours
<b>Unit-I</b>	<b>Chapter-1 National Integration and Social Harmony</b> - Meaning and importance of National Integration and Essentials of National Integration. <b>Chapter-2 Society and Politics in India:</b> Caste, Class, Ethnicity and Gender, role and Impact on Indian Polity. <b>Chapter-3 Language-</b> Role and Constitutional Provisions, Issues	<b>15 Hours</b>
<b>Unit-II</b>	<b>Chapter-4</b> Religion and Traditions - Role and Constitutional Provisions <b>Chapter-5</b> Development and Inclusiveness: Issues and Concerns <b>Chapter-6</b> Regionalism – Reasons for the Growth, Forms and Measures	<b>15 Hours</b>
<b>Unit-III</b>	<b>Chapter-7</b> Corruptions- Causes and Measures <b>Chapter-8</b> Terrorism- Types, Causes and Measures <b>Chapter-9</b> Celebrating Diversity – Consensus and Challenges	<b>15 Hours</b>

**Suggested Readings:**

1. M. Galanter, 'The Long Half-Life of Reservations', in Z. Hasan, E. Sridharan and R. Sudarshan (eds.) India's Living Constitution: Ideas, Practices, Controversies, New Delhi: Permanent Black, 2002.

## International Relations

### Open Elective OE- 2

<b>Course Title: International Relations</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>

**Course Objective:**

This course aims to introduce the students to basic concepts , Institutions and Issues of Global Politics. This course also exposes them to the Understanding OF Power Politics of Regional and Global level.

**Learning Outcomes:**

After completing this course students will be able to-

- Understand and reflect on basic concepts ,Institutions and Issues of International Relations Global Politics
- Develop and deepen the sense of Cosmopolitanism.
- To acquire General knowledge for Competitive exam

Unit	Contents of Course- OE-4	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1</b> Meaning, Nature, scope and Importance of International Relations.</p> <p><b>Chapter-2</b> Key Concepts- National Power, National interest, National Security, Diplomacy, Balance of Power, Collective security, Deterrence.</p> <p><b>Chapter-3</b> India and her Neighbors- Pakistan and China.</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4</b> World Organizations- UN, Principles and Objectives, Major Organs, Working of UN, Achievements and Failures.</p> <p><b>Chapter- 5</b> UNESCO, WHO, ILO, WB.</p> <p>Chapter-6Regionalism in World Politics- Meaning and Importance- SAARC,ASEAN,EU, OPEC, SHANGHAI COOPERATION Organization , BRICS,</p>	<b>15 Hours</b>
<b>Unit-III</b>	<p><b>Chapter -7</b> Global Issues- Poverty, Development, Environment</p> <p><b>Chapter-8</b> Military alliances- NATO,SEATO,NSG,QUAD (India, America ,Japan, Australia),</p> <p><b>Chapter-9</b> Pacific settlement of International Disputes.</p>	<b>15 Hour s</b>

**Suggested Readings:**

1. Palmer and Perkins-International Relations.
2. H.J Morgenthau, Politica among Nations.
3. Mahendra Kumar, Theoretical Aspects of International Relations.
4. Prakash Chandra, International politics.

# SEMESTER -III

**DSC-5**  
**INDIAN GOVERNMENT AND POLITICS**

**Course Objective:**

The course will explain the functioning of the Indian government and the performance of both the union and the state governments. It discusses the philosophy of our constitution and the commitment of the Indian state to its citizenry. It will help the students to develop interest in politics and grasp the dynamics/nuances of the politics, dynamics of leadership and the role of socio-economic, religious and lingual issues.

**Learning Outcome:**

At the end of the course the students shall -

- Learn how the governments both at the union as well state level operates and what are its challenges.
- Understand the characteristics of power structures in India and the response of the political parties to the socio-political dynamics.
- Measure and understand the effects of judicial decisions on policy making and social development in India.

Unit	Contents of Course-5	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1:</b> Indian Politics: Approaches to study of State and politics in India (Liberal, Marxist and Gandhian).</p> <p><b>Chapter-2:</b> Constituent Assembly- Composition and Major Debates regarding the Structure of Indian State.</p> <p><b>Chapter-3:</b> Preamble and Salient Features of Indian Constitution.</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4:</b> The Union Executive: The President, Vice- President, Prime Minister and the Council of Ministers.</p> <p><b>Chapter-5:</b>Parliament: Powers and Functions of Lok Sabha and Rajya Sabha, Relationship between the two Chambers, Amendment Process and Major Amendments (42nd, 73rd, 74th , 86th , 101st).</p> <p><b>Chapter-6:</b> Judiciary and Judicial Review, Appellate Authority.</p>	<b>15 Hours</b>
<b>Unit-III</b>	<p><b>Chapter-7:</b> Nature of Indian Political System, Union-State Relations (Commissions and Committees), President's Rule: Processes and politics.</p> <p><b>Chapter-8:</b> Political parties and party system in India Coalition Politics and Elections in Indian Politics.</p> <p><b>Chapter-9:</b> Issues in Indian Democracy: Casteism, Communalism, Regionalism, Criminalization, Social and Distributive Justice.</p>	<b>15 Hours</b>

**Exercise:**

- Debate on the 'basic structure of Indian Constitution' and the need for changes in the constitution, functioning of the Constitution - Cases regard to Governor and President's Rule.
- List out the major amendments to the constitution, Commission and committee to review power sharing.
- Examine the functioning of various political parties, its inclusive approaches, influence of dynasties on their performance.

**Suggested Readings**

1. Iqbal Narain, State Politics in India, Meenakshi Prakashan, New Delhi, 1967.
2. Rajani Kothari, Politics in India, Orient Longman, 1970.
3. D. Basu, An Introduction to the Constitution of India, New Delhi, Prentice Hall, 1980.
4. Granville Austin, The Indian Constitution: Corner Stone of a Nation, Oxford University Press, India, 1966.
5. C.P. Bhambhari, The Indian State, Fifty Years, New Delhi, Shipra, 1997.
6. V. Pylee, Constitutional Government in India, Bombay, Asia Publishing House, 1977
7. J. C. Johri, Indian Government and Politics, Vol. 1, Shoban Lal and Company, India, 2012.
8. Weiner, Party Politics in India, Princeton University Press, 1957.
9. A. G. Noorani, Constitutional Questions in India: The President, Parliament and the States, Delhi, Oxford University Press, 2000.
10. A. S. Narang, Indian Government and Politics, Geetanjali Publishing House, New Delhi, 1996.
11. Bidyut Chakrabarty & Rajendra Kumar Pandey, Indian Government and Politics, SAGE, New Delhi, 2008
12. D. D. Basu, An Introduction to the Constitution of India, 25<sup>th</sup> Edition, Lexis Nexis, India,
13. M. P. Singh & Rekha Saxena, Indian Politics: Contemporary issues and Concerns, Prentice Hall of India, Delhi, 2008.
14. M. V. Pylee, An Introduction to the Constitution of India, New Delhi, Vikas, 1998.
15. Nirja Gopal Jayal & Pratap Bhanu Mehta, The Oxford Companion to Politics in India

## DSC-6

### PARLIAMENTARY PROCEDURES IN INDIA

#### Course Objective:

The course attempts to make the students familiar with legislative practices in India with an orientation to equip them with the adequate skills of participation in deliberative processes and democratic decision making. This aims at providing the basic understanding of the constitutional provisions relating to parliamentary procedures and the accessories of the same. This will help the students to understand the working of democracy through an institutional mechanism.

#### Learning Outcome:

At the end of the course the students shall -

- Aim at understanding the procedural aspects of parliamentary system of governments.
- Learn about the privileges of people's representatives and match it with their performance.
- Understand the working of committees, budgetary aspects and deliberative mechanism within the parliament.

Unit	Contents of Course-6	45 Hours
<b>Unit-I</b>	<b>Chapter-1:</b> Elections to the Legislatures: Parliament and State Legislatures. <b>Chapter-2:</b> Powers, Functions of People's Representatives - Members of Parliament and State Legislature. <b>Chapter-3:</b> Legislative Procedures of the Parliament: Articles 107-122.	
<b>Unit-II</b>	Chapter-4: Kinds of Bills: Ordinary Bills, Money Bills, Finance Bills, Private Member Bills. Chapter-5: Drafting of the Bill, First Reading and Departmental Standing Committee, Second Reading, Third Reading, Passage of the Bill, Consent by the President, Gazette Notifications. Chapter-6: Parliamentary Committees: Composition and Functioning (Departmental Standing Committees, Select Committees, Joint Parliamentary Committees, Public Accounts Committee on Privilege Business, Advisory Committee, Ethics Committee).	15 Hours
<b>Unit-III</b>	Chapter-7: Motions and Hours in the House : Question Hour, Zero Hour, Half an Hour Discussion, Calling Attention Motion, Adjournment Motion, Privilege motion, Censure motion, 'No-confidence' motion, Cut motion. Chapter-8: Parliamentary Questions: Types, Starred and Unstarred Questions, Questions Addressed to Private Members and Short Notice Questions. Chapter-9: Parliamentary Privileges: Constitutional Provisions, Codification of Privileges, Privileges of Parliamentarians and Legislators, Breach of Privilege.	15 Hours



**Exercise:**

- The college can organise mock parliaments and teach students the etiquettes of parliamentary behaviour.
- Canorganisedebatesonthecodificationofprivilegesandmatchitwiththeperformance of people'srepresentatives.
- Can organise special lectures by inviting officers/bureaucrats to deliberate on the procedural aspects of democracy.

**Suggested Readings**

1. M.N.KaulandS.L.Shakdher,PracticeandProcedureofParliament,Metropolitan,New Delhi,1968.
2. SubhashC.Kashyap,OurParliament,NationalBookTrust,NewDelhi,2021.
7. SH.Belavadi,TheoryandPracticeofParliamentaryProcedureinIndia,1988.
8. Dr. K. S. Chauhan, Parliament Powers Functions And Privileges, LexisNexis, India, 2013.
9. Ajit Ranjan Mukharjea, Parliamentary Procedure in India, Oxford University Press, 1958.
10. M N. Kaul, Parliamentary Institutions and Procedures, National Publishing House, 1978.
11. Jalan, India's Politics, Penguin, New Delhi,2007.
12. Abbas, H., Kumar, R. & Alam M. A., Indian Government and Politics, Pearson, New Delhi,2011.
13. Chakravarty, B. & Pandey, K. P, Indian Government and Politics, Sage, New Delhi, 2006.
14. K.Sanyal,StrengtheningParliamentaryCommittees,PRS,CentreforPolicy Research, New Delhi,2011.

## GENDER AND POLITICS

### Open Elective- OE- 3.1

#### Course Objective:

The course provides an overview of political participation of women in general and specifically in India. It enables students to understand the issues related to women leadership, participation and governance and how they have progressively become integrated into political science to inform and shape contemporary social sciences. It helps in sensitizing the patriarchal society to improve the relationship between men and women removing the obstacles of exploitation, violation of her rights, bringing into focus the need for the education and empowerment.

#### Learning Outcomes:

At the end of the course the students shall -

- Answer how ideologies have shaped the women in politics
- Bring awareness of the relevance of gender issues in politics.
- Through discussions on women and governance understand the ground realities about politics in relation to women.

Unit	Contents of Course-OE-3.1	45 Hours
Unit-I	<b>Chapter-1:</b> Defining Gender, Significance of Gender Studies, Difference between Gender Studies and Women Studies, Feminist Perspectives <b>Chapter-2:</b> Gender Imbalance in Political Representation and Electoral Process, Gender Discrimination in Indian Politics – including LGBTQ, Feminist Critique of Politics. <b>Chapter-3:</b> Governance and Gender Structures, Gender Budgeting and Gender Issues in Governance.	15 Hours
Unit-II	Chapter-4: Gender and Empowerment Process: Education, Economic, Political and Socializing and sensitizing gender issues. Chapter-5: Gender Differentiation in Political Parties and Leadership, Challenging Gender Stereotypes in Socio-Political sphere. Chapter-6: Capacity Building and Role of Women in Karnataka Politics, Women Representation in Local Governments.	15 Hours
Unit-III	<b>Chapter-7:</b> Women and Poverty, Women and Health, Women and wealth creation, Violence against Women, Chapter-8: Women and Literature, Women and the Media, Women and the Environment. Chapter-9: Women and Societal Challenges: Dowry, Domestic Violence, Girl Child - Programmes for Empowerment of Women, Educating <b>children and socio-religious taboos including patriarchy.</b>	15 Hours

**Exercise:**

- Conduct one day workshop and make an assessment of role of women in politics.
- Collage making, short films and video watching can be done by the students and measures can be discussed to minimise the gender gap.
- Students can make field visits to understand the persistence of patriarchal values and traditions.

**Suggested Readings**

1. P.K.Swaib and S.N.Tripathy, "Unequal Treatment to Women and Gender", Bias, Sonali Publications, New Delhi, 2006.
2. Malashrilal, Chandra Mohan, Enakshi K.Sharma, Devika Khanna Narula and Amrit Kaur Basra, "Gender and Diversity", Rawat Publications, Jaipur, 2015.
3. Andrew Heywood, "Global Politics", Palgrave Macmillan Publication, New York, 2014.
4. Kranti Rana, "Modern Working Women and the Development Debate", Kanishka Publishers, New Delhi, 1998.
5. Dr.Tanuja Trivedi, "Encyclopedia of Women's Empowerment", Janapada Prakashan, New Delhi, 2012.
6. Bhaswati Das and Vimal Khawas, "Gender Issues in Development –Concerns for the 21<sup>st</sup> century", Rawat Publications, New Delhi, 2009.
7. U. Kalpagam, "Gender and Development in India: Current Issues", Rawat Publication, 2011.
8. B.N.Singh, "Rural Women and Education", Vista International Publishing House, Delhi, 2016.
9. Meera Kosambi, "Women Writing Gender", Permanent Black Publication, New Delhi,

**UNDERSTANDING GANDHI**  
**Open Elective – OE- 3.2**

**Course Objective:**

The course objective is to bring to the attention of the younger generation the core elements of Gandhian thought and Gandhi's approach to the key issues of contemporary India. This paper covers a wide range of issues including politics, economics, social reconstruction, religion and issues of sustainable development which provides insight into the idea of what Gandhi propagated as a political thinker. His ideas of Hindu-Muslim relations or critique of modern society, Swadeshi etc., makes Gandhi relevant to the current political discourses.

**Learning Outcome:**

At the end of the course the students shall -

- Be able to explain the idea of truth and non-violence which is the foundation of Gandhian Philosophy.
- Know the position of Gandhi on issues like Hindu-Muslim relations, gender question, cow protection, caste and untouchability questions.
- Answer his reason for his choice of Swadeshi and his critique of modern Civilization

Unit	Contents of Course- OE-3.2	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1:</b> Background Influences: Historical: South Africa, Intellectual: Thoreau, Ruskin and Tolstoy.</p> <p><b>Chapter-2:</b> Gandhian Experiments: Satyagraha, Non-Violence, Truth, Movements led by Gandhi- Champaran, Bardoli, Khilafat, Non-Cooperation, Salt Satayagraha.</p> <p><b>Chapter-3:</b> Social Movements- Ahmedabad Mill Strike, Vaikom Satyagraha, Forest, Health and Naturopathy, Sustainable Development.</p>	15 Hours
<b>Unit-II</b>	<p>Chapter-4: Gandhi as a Leader: Gandhi as a model, Gandhian Methodology: Prayer, Consensus Building and Fasting.</p> <p>Chapter-5: Gandhian Views on Politics: Role of Ethics, Morality, Religion and Service.</p> <p>Chapter-6: Gandhi's critique on English Parliament, Gandhi on Nation and Nationalism.</p>	15 Hours
<b>Unit- III</b>	<p>Chapter-7: Gandhian Swadeshi and Swaraj, Critique on Modern Civilization, Modern Education and Machines.</p> <p>Chapter-8: Gandhian Violence (Doctrine of the Sword) Gandhi and Sins, Gandhi's views on Women and Sustainable Development.</p> <p>Chapter-9 Gandhian Political Strategist, Gandhi's Views on Hindu-Muslim Unity, Untouchability .</p>	15 Hours

**Exercise:**

- Students shall have a group reading of Gandhiji's texts like Hindswarj, My Experiment with truth, Sarvodaya, etc,
- Shall conduct the group discussion on the significance of Satyagraha, Sustainable Development, Swadeshi, etc.
- By reviewing literature on Gandhian critiques students can discuss the strengths and weakness of Gandhian Philosophy and his relevance in 21st century.

**Suggested Readings**

1. Lal, V, The Gandhi Everyone Loves to Hate, Economic and Political Weekly, 43(40), 2008, pp. 55-64.

## CITIZEN, CITIZENSHIP AND THE INDIAN CONSTITUTION

### Open Elective OE- 3.3

#### Course Objective:

This course aims at understanding the concept of citizenship. This course supports to develop an understanding of mindfulness, empathy and compassion and use these as tools to enhance one's emotional wellbeing and social relationships within a society. It further helps nation building by inculcating responsible citizenship among the students.

#### Learning Outcome:

At the end of the course the students shall -

- Take part in social reconstruction as responsible individuals and will learn to develop own identities.
- Demonstrate pro-social behaviour towards others, including those belonging to a different race, ethnicity, culture, colour, gender or nationality.
- Understand and appreciate rights and privacy of other fellow citizens.

Unit	Contents of Course- OE- 3.3	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1: Concept of Citizen:</b> Subject- Slave-Citizen: a Comparison.</p> <p><b>Chapter-2: Citizenship in India: Milestones-</b> Citizenship and Partition of India (Nehru and Liyaqat Ali Khan Pact) The Citizenship Act, 1955, The Citizenship (Amendment) Act, 1986, The Citizenship (Amendment) Act, 2003 and 2005, National Register of Citizens (NRC) with reference to North - East</p> <p><b>Chapter-3: Citizens and Constitutional Provisions:</b> Fundamental Rights and Duties, Socio-Economic and Cultural Rights</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p>Chapter-4: Citizenship Issues in India: Laws for Immigrants, Laws for Migrants and Asylum seekers, Process of acquiring Citizenship.</p> <p>Chapter-5: Dual Citizenship: Needs and Demands- Impact of Globalization, Advantages of Dual Citizenship.</p> <p>Chapter-6: IPC and Citizens Rights: First Information Report, Arrest, Detention, Bail Provisions, Sedition Act, Citizen and Civic Culture.</p>	15 Hours
Unit-III	<p>Chapter-7: Citizen and His Responsibility: Constitutional Provisions, Right to Privacy.</p> <p>Chapter-8: Citizen and Discrimination: Caste, Gender (LGBTQ), language, Race, Color, Place of Birth.</p> <p>Chapter-9: Protection of Citizens: Women and Property Rights, Rights of Forest Dwellers, and Displaced People (War, Natural Calamities and Rehabilitation) and Universal Declaration of Human Rights.</p>	15 Hours

#### Exercise:

- Students and teachers collectively work towards building communication network among vulnerable citizens who have no knowledge about their own rights.
- Through activities they may form empowering groups and support immigrants/ migrants

resolve their legal issues with authorities like police and government.

They may visit courts, police stations, regional passport offices and spread the laws relating to migrants, immigrants regarding their rights.

### **Suggested Readings**

1. Marcus Raskin, 'Nation Building and Citizenship: Studies of a Changing Order' Rutledge India, New Delhi, 1996.
2. Atul Kohli, 'Democracy and Discontent: India's growing crises of Governability, Cambridge University Press, 1991.
3. Atul Kohli, 'The Success of India Democracy', Cambridge University Press, 2001.
4. Savitaha Rao, 'India's Positive Citizen Building- A Great Nation One Action At A Time, Wings Publishing, Bangalore, 2020.
5. Anupama Roy, 'Mapping Citizenship in India', (Oxford India short introductions), Oxford University Press, New Delhi, 2012.
6. Nirag Gopal Jayal, 'Citizenship and its Discontents', Harvard University Press, 2013.
7. Ornit Shani, 'How India became a democratic citizenship and making of the Universal Franchise', Cambridge University Press, New Delhi, 2017.
8. Koenig Lion, 'Cultural Citizenship in India; Politics Power and Media', Oxford University Press, New Delhi, 2016.
9. Blog.mygov.in/we-the-people-we-the-citizen.
10. Subrata .K. Mitra, 'Citizenship as cultural flow, structure agency and flow', e-Book, 2013, springerlink.

# ANCIENT INDIAN POLITICAL IDEAS AND INSTITUTIONS

## DSC - 7

### Course Objectives:

The paper aims at developing an understanding of the Social and political philosophy of ancient India to assess the modern notions about socio-political arrangements. Further it helps to analyze the process of decolonizing Indian minds related to India's glorious past. The objective thus being to throw light on the indigenous political theory and its relevance to changing times.

### Learning Outcome:

At the end of the course the students shall -

- Reflect on the native concepts like Dharma, Rajadharma, Nyaya, Viveka etc., in the light of their modern connotations.
- Understand the role of texts and stories in the Indian context by reflecting upon our own experiences.
- Revisit our own socio-political structures through the textual and non-textual sources from the early Indian period in order to quell the European representation of Indian Society and heritage.

Unit	Contents of Course- DSC 7	45 Hours
Unit-I	<b>Chapter-1: Sources of Early Indian Thought:</b> Sources and Limitations: Pre and Post Colonial. <b>Chapter-2: Perspectives:</b> Orientalists, Nationalists, Marxian (Asiatic Mode of Production) and Gandhiji on Varnashrama Dharma. <b>Chapter-3: Indian Culture:</b> Max Muller, Swami Vivekananda, Dr. Radhakrishnan	15 Hours
Unit-II	<b>Chapter-4: Socio-Political Ideas in the Early Indian Thought:</b> Dharma, Rajadharma, Dandaniti, Nyaya, Vaisheshika, Shunya, Ratnin Ceremony, Varnadharma, and Ashramadharma. <b>Chapter-5: Kingship:</b> Origin, Nature and Structure. <b>Chapter-6: Functions of Institutions:</b> Sabha, Samiti, Vidhata, Paura-Janapada.	15 Hours
Unit- III	<b>Chapter-7: Ganasanghas:</b> Nature, Structure, Functions <b>Chapter-8: Ramayana (Valmiki):</b> Ramarajya, <b>Chapter-9: Mahabharata (Vyasa):</b> Rajadharma in Shantiparva, Idea of war and Peace –values in Thirukural, Manu Smruthi (Caste)	15 Hours

### Exercise:

- Close reading sessions to be organised to understand the ancient text in its original context by way of discussions.
- Students shall visit the nearby historical places and collect artifacts, stories, and other relics with the help of the native people.
- Students shall respond to accommodate the important criticisms of Ramayana and

Mahabharata by its critics and enact dramas and costumes.

### **Suggested Readings**

1. Alterkar A.S, State and Government in Ancient India, Motilal Banarsidass, Chowk Banaras, 1949.
2. R.S. Sharma, Early Indian Social and Political Thought and Institutions (Aspects of the Political Ideas and Institutions in Ancient India, Motilal Banarsidass, Delhi, 1991.
3. Jayaswal K.P, Hindu Polity, Bangalore Printing and Publishing Co. LTD, Bangalore, 1943.
4. Goshal U.N, History of Hindu Political Theory, Oxford University Press, Calcutta, 1923.
5. Kangle R.P, Kautilya's Arthashastra, Motilal Banarsidass Publishers Pvt.Ltd, New Delhi, 1986.
6. Bhandarkar D.D, Some Aspects of Ancient Indian Culture, Madras, University of Madras, 1940.
7. Romila Thapar. From Lineage to State, Oxford University Press, United Kingdom, 1984.
8. R.S.Sharma, Shudaras in Ancient India, Motilal Banarsidass, Delhi, 1957.
9. Sharma, R. S India's, Ancient Past, Oxford University Press, New Delhi, 2006.
10. Sharma, R. S, Rethinking India's Past, Oxford University Press, New Delhi, 2010.
11. Kraedar Lawrence, "Formation of the state", Prentice Hall, United State, 1968.
12. Kosambi D.D, "Introduction to the Study of Indian History", Popular Prakashan, Mumbai, 1956.
13. Said Edward, Orientalism, Pantheon Books, USA, 1978.
14. Misra Vibhuti Bhushan, From the Vedas to the Manusamhita, City/Country Brill Academic, United States, 1982.
15. Sircar D.C, Studies in the Religious life of Ancient and Medieval India, Motilal Banarsidass, Delhi, 1971.
16. Aiyangar K.R, Ancient Indian Polity, Oriental Books Agency, Poona, 1941.
17. Pargiter R, Ancient Indian Historical Tradition, Oxford University Press, London, 1922.
18. Levin G.M, Bongard, A Complex Study of Ancient India – Multidisciplinary Approach, American Oriental Society, USA, 1989.
19. Kumar S, "Role of State in Ancient India Economy", Ramanand Vidya Bhawan, Delhi, 1986.
20. Sircar D.C, Political and Administrative System of Ancient and Medieval India. Motilal Banarsidass, Delhi, 1975.
21. Maity S. K and Upendra Thakur, Indological Studies, Abhinav Publications, New Delhi, 1991.
22. Mukherjee Shobha, The Republican trends in Ancient India. Munshiram Manoharial Publishers Private Limited, New Delhi, 1989.
23. Bandyopadhyaya N.C, Development of Hindu Polity and Political Theories, Munshiram Manoharlal Publishers, New Delhi, 1980.



## MODERN POLITICAL ANALYSIS

### DSC-8

**Course Objective:** The objective is to equip students to develop insights into political institutional functioning keeping in insight both the normative and empirical ways of understanding. This paper also throws light on value laden functioning and value neutral aspects of systems output that will help students to understand and evaluate Governments. It aims at scientifically assessing the functioning of the government as result oriented institutions.

**Learning Outcome:**

At the end of the course the students shall -

- Understand the key concepts of Political Institutional working and science within them.
- Befamiliar with the Phenomenon of politics and various explanations relating to the influences that mould the decision making process.
- Help the students to visualize the working of political institutions and the process of decision making through diagrammatic presentations.

. Unit	Contents of Course: DSC-8	45 Hours
<b>Unit-I</b>	<p><b>Chapte-1</b> Genesis and Emergence of Modern Political Analysis, Modern Political Analysis -Meaning, Nature, Scope and Goals</p> <p><b>Chapter-2</b> Political System-Types, similarities and differences, classification.</p> <p><b>Chapter-3</b> Approaches – Traditional- Philosophical, Historical Institutional, Modern- Behavioral, Systems, Game.</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4</b> Talcott Parson's General Systems theory- Pattern of Inter Relationship, Hierarchical order, Integration.</p> <p><b>Chapter-5</b> David Easton's Input-Output model of Political System, Features, Functions and Critical Evaluation.</p> <p><b>Chapter-6</b> Power-Meaning, significance, and measurement, difference between Power, Authority, Legitimacy and Influence, Harold Lasswell's contribution.</p>	<b>15 Hours</b>
<b>Unit- III</b>	<p><b>Chapter-7</b> Almond on Structural – Functional Analysis Karl Deutsch's Communication Theory.</p> <p><b>Chapter-8</b> Richard C Snyder's Decision Making Theory,</p> <p><b>Chapter - 9</b> Political Development - Concept of Political Development - its variables, Theory of Lucian Pye.</p>	<b>15 Hours</b>

**Exercise:**

- The department can lead the students to a nearby political institution and explain to them the process of administrative decision making.
- The department may invite functionaries of these institutions to deliberate upon issues of redundancy and simplifying administration.
- Assignments can be given to the students to innovate methods of simplification of administrative procedures in offices of Governments and offer consultancy.

**Suggested Readings**

1. Almond, G. and Coleman. J.S. "The politics of the Developing Areas", Princeton University Press, Princeton NJ, 1960.
2. Almond, G.A. and Verba, S, "The Civic Culture: political Attitudes and Democracy in Five Nations", Princeton NJ, Princeton University Press, 1963.
3. Amin, S, "Accumulation on an old Scale: A Critique of the Theory of Underdevelopment", Monthly Review Press, New York, 1974.

## Open Elective OE - 4.1

### Good Governance in India

#### Course Objective:

The course directed to familiarize the student to understand the elements of Good Governance which has the effect on day today life. The purpose is to show to them that states are changing their approach to Administration giving importance to stakeholders. Some of the programs mentioned in the syllabi exemplifies the same. The aim is to help students to link the theory in the class room with realities in the outside world.

#### Learning Outcome:

At the end of the course the students shall -

- Understand the difference between traditional form of Administration and the concept of Governance
- Get a perspective of changing modes of Governance with the examples drawn from central and state Governments.
- Appreciate the participation of citizens in day to day Administration through a charter and other programmes like Sakala, Bhoomi etc.,

Unit	Contents of Course: OE-4.1	45 Hours
Unit-I	<b>Chapter- 1</b> Meaning, Characteristics, Elements, Growth and need for Good Governance. <b>Chapter-2</b> Theories and Concepts of Governance- Public Choice and Public Value Theory, Good Governance and Globalization. <b>Chapter-3</b> Corporate Governance- Networking and collaborative Governance.	15 Hours
Unit-II	<b>Chapter-4</b> Public Service Guarantee Act 2011: Features, Provisions and Impact, Right to Information Act- Meaning, Characteristics and Importance. <b>Chapter-5</b> E-Governance - Meaning, Characteristics, Importance and E Governance Policy, ICT and Governance. <b>Chapter-6</b> Citizens Charter, Digital India, Gender and Governance.	15 Hours
Unit- III	<b>Chapter-7</b> Sakala Project, Bhoomi Yojana, SWAYAM and eKissan, eCourt. <b>Chapter-8</b> People's Participation and Role of Civil Society, Ethics and Accountability in Governance. <b>Chapter-9</b> Challenges before good governance in India.	15 Hours

#### Exercise:

- Students and the department can undertake survey regarding causes and consequences of failed administration.
- Through activities they can visit their respective villages and prepare papers regarding the working of programmes like Sakala, Bhoomi etc.,
- The department may invite officers connected to Governance projects and have interaction with the students.

## UNDERSTANDING Dr. B.R. AMBEDKAR

### Open Elective OE -4.2

#### Course Objective:

This course is designed to familiarize the students with arguments and position of Dr. B.R. Ambedkar on key social, political, constitutional and democratic issues in India and enable them to critically examine his perceptions. Besides the constitutional questions and fight for the oppressed communities which are largely popular in academic and political discourses, has been designed to make students to understand his ideas. On the partition of the country and the Indian historiography his views have been valuable and this paper intends to bring to the reach of the students.

#### Learning Outcome:

At the end of the course the students shall -

- Be able to understand his life, mission, vision and his key role in the making of the Indian Constitution.
- Be able to appreciate and sensitize his views on democracy, citizenship, freedom, equality equal treatment and justice.
- Understand his views on the some of the important debates like Aryan Invasion Theory, Uniform Civil Code, Islam and partition of India.

Unit	Contents of Course OE 4.2	45 Hours
Unit-I	<b>Chapter: 1-</b> Dr. B. R. Ambedkar's Journey of Life and Experiences. <b>Chapter: 2-</b> Dr. B. R. Ambedkar's perception on Hindu Social Order, Caste and Untouchability (refer Annihilation of Caste). <b>Chapter-3-</b> Dr. B. R. Ambedkar's Initiatives: Mahad Satyagraha, Kalaram Temple Entry Movement.	15 Hours
Unit-II	<b>Chapter: 4-</b> Dr. B. R. Ambedkar and Round Table Conference: His Memorandum, Communal Award and Poona Pact. <b>Chapter: 5-</b> Dr. B. R. Ambedkar's contribution as the Chairman of the Drafting Committee. <b>Chapter 6 -</b> Dr. B. R. Ambedkar's deliberations on key issues in the Constituent Assembly (Article 40, Article 370, Uniform Civil Code, Hindu Code Bill, and on reservation)	15 Hours
Unit- III	<b>Chapter: 7-</b> Dr. B. R. Ambedkar's Political Ideas: Democracy, Citizenship, Equality, Freedom and Justice. <b>Chapter: 8:</b> Dr. B. R. Ambedkar's views: on Islam, Buddhism, on Religious Conversion, on Aryan Invasion Theory. <b>Chapter: 9-</b> Dr. B. R. Ambedkar and Language Question, Dr. B. R. Ambedkar on Education and Women Empowerment and Nationalism.	15 Hours

### Exercise:

- Students and teachers collectively debate on the issues of Reservation, Constitutional provisions of reservation, reservation within reservation, creamy layer theory, etc.,.
- Give assignments to students to visit colonies of Scheduled Caste and Scheduled Tribes and discuss it in the group about the perception that they have carried.
- Debate on the need for social reform, inclusiveness, changing the cultural and religious outlook among the Indian citizens keeping the view inhuman practice like untouchability, exploitation. And further visit courts, police stations, etc. to understand conflict resolution mechanisms.

1. Ambedkar, B.R. "What Congress and Gandhi have Done Untouchables" <http://www.ambedkar.org/ambcd/41A.What%20Congress%20and%20Gandhi%20Preface.htm>.
2. Ambedkar Annihilation of Caste, Navayana, 11th Edition, 2015.
3. Dhanjaya Keer, Dr. Ambedkar-Life and Mission, Popular Prakashana, Bombay, 1964.
4. Valerian Rodrigues, Essential Writings on Ambedkar, OUP, New Delhi, 2003.
5. Marcus Raskin, 'Nation Building and Citizenship: Studies of four Changing order' Rutledge India, New Delhi, 1996.
6. Atul Kohli, 'Democracy and Discontent: India's growing crises of Governability, Cambridge University Press, 1991.
7. Atul Kohli, The Success of Indian Democracy, Cambridge University Press, 2001.
8. Savitaha Rao, India's Positive Citizen Building- A Great Nation One Action At A Time, Wings Publishing, Bangalore, 2020.
9. Nirag Gopal Jayal, 'Citizenship and its Discontents', Harvard University Press, 2013.
10. Koenig Lion, 'Cultural Citizenship in India; politics power and media', Oxford University Press, New Delhi, 2016.
11. Subrata K. Mitra, 'Citizenship as cultural flow; structure agency and flow', e-Book, Springer link, 2013.
12. Sharma, A, Dr. B.R. Ambedkar on the Aryan Invasion and the Emergence of the Caste System in India, Journal of the American Academy of Religion, 73(3), 2005, pp. 843-870.
13. Ambedkar, B. R. (1946). Pakistan or The Partition of India, In Narke, H. (2nd ed.), 2014.
14. Dr. B. R. Ambedkar Writing and Speeches, Vol. 8. Delhi: Dr. Ambedkar Foundation, Ministry of Social Justice & Empowerment, Govt. of India.  
Available at: [https://mea.gov.in/Images/attach/amb/Volume\\_08.pdf](https://mea.gov.in/Images/attach/amb/Volume_08.pdf).
15. Misra, J., & Mishra, J. Dr. B.R. Ambedkar and The Constitution - Making In India, Proceedings of the Indian History Congress, 1991, 52, pp.534-541

## POLITICAL JOURNALISM

### Open Elective OE- 4.3

#### Course Objective:

The objective is to equip students to develop insights into political reporting with an understanding of writing skills supported by grammatical strength and economy of words. Further to provide a broad overview of the nuances of interpreting the political phenomena that takes place in political institutions starting from the grass roots to the parliament.

#### Learning Outcome:

At the end of the course the students shall -

- Understand the skills of reporting and research insights about the system and its structural contours focusing on Politics.
- Carry out political reporting covering Government and Governance, campaigns and candidates, tactics and strategies and policy issues in the public arena.
- Develop writing and interpretative skills.

. Unit	Contents of Course- OE-4.3	45 Hours
<b>Unit-I</b>	<p><b>Chapter-1:</b> Defining Political Journalism, Traditional and Modern views about State and Politics.</p> <p><b>Chapter-2:</b> Understanding of Political Development: Caste, Religion, Linguistic and Party Perspectives.</p> <p><b>Chapter-3:</b> Defining the Role of Mass Media- Print, Electronic and Web (Social Media).</p>	<b>15 Hours</b>
<b>Unit-II</b>	<p><b>Chapter-4:</b> Political Culture- Shared Beliefs, Values, Ideologies and Norms, Process of Socialisation.</p> <p><b>Chapter-5:</b> Political Participation –Modes of participation, Political Apathy.</p> <p><b>Chapter- 6:</b> Methods of Political Journalism- Interviews, Political Debates, Commentary on Legislations.</p>	<b>15 Hours</b>
<b>Unit-III</b>	<p><b>Chapter-7:</b> Communication-Defining Communication, Shaping Public Opinion, Encoding and Decoding.</p> <p><b>Chapter-8:</b> Skills of Writing - Vocabulary, Epitomizing, Punctuation.</p> <p><b>Chapter-9:</b> Report Writing-Journalistic Writing Skills, Yellow Journalism, Use of Facts and Figures and Interpretations.</p>	<b>15 Hours</b>

#### Exercise:

- Conducting classroom Common seminars on Media and Politics
- Making students to read and write newspaper headlines focusing on politics,
- Visit to media houses and talks with senior political newsroom heads.

#### Suggested Readings

1. Iorio, Sharon Hartin. Qualitative Research In Journalism, Erlbaum Associates, London,2004.
2. Merritt, Davis, Public Journalism And Public Life, Erlbaum Associates, London,2004.

## INDIA AND INDIAN CONSTITUTION

<b>Ability Enhancement Compulsory Courses (AECC)</b>	
<b>Course Title: INDIA AND INDIAN CONSTITUTION</b>	
Total Contact Hours: <b>45</b>	Course Credits: <b>3</b>
No. of Teaching Hours/Week: <b>3</b>	Duration of ESA/Exam: <b>2 Hours</b>
Formative Assessment Marks: <b>40</b>	Summative Assessment Marks: <b>60+40=100</b>

### Course Objective

The purpose of the course is to help students to learn and explain the journey of India as a republic. They will, through this paper, learn to contextualise the depth of India as a nation with its diverse socio-political culture, its philosophical traditions, values and Ideals. It will give them knowledge to expound the breadth of freedom struggle in various parts of India, its significance in nation building and the sacrifices made both by its leaders and followers. It will help them to demonstrate their knowledge regarding the efforts made at working towards a constitution as India's conscience cherishing the values of Justice, Liberty, Equality and Fraternity. Consequently, it will enable students to contextualise the powers and functions of various offices under the Constitution. It will help them determine the role and responsibilities of citizens as enshrined in the Constitution, offering insights into the contributions of personalities like Gandhiji, Dr B.R. Ambedkar and Jawahar Lal Nehru, Bal Gangadhar Tilak, the values tolerance, equality of treatment, scientific secularism and swarajya and the processes of policymaking keeping national wellbeing in the forefront. This paper will enable students to illustrate how vibrant our Constitution is, how farsighted were its makers and how efficient are the various institutions that are functioning under it.

### Learning outcomes

Upon completion of this course, students will be able to—

- Explain the philosophy and the structure of the Constitution.
- Measure the powers, functions and limitations of various offices under the Constitution.

- Demonstrate the values, ideals and the role of Constitution in a democratic India.

Unit	Contents of Course:	45 Hours
<b>Unit-I</b>	<p><b>Background to the study of Indian Constitution**</b></p> <p><b>Chapter 1: Philosophical and Political foundations of India:</b> Dharma and Danda, Buddhist, liberal (Raja Rammohun Roy) and Subaltern (Ranajit Guha)* Colonial impact on Indian society,** Nationalist perspective (Swamy Vivekananda and Sri Aurobindo).</p> <p><b>Chapter 2: Political values and Ideals during freedom struggle:</b> Non Violence, Tolerance, Satyagraha and Swadeshi (Gandhi), Swarajya (Tilak), Integral Humanism (Deen Dayal Upadhyay) and Voluntarism (Vinoba Bhave).</p> <p><b>Chapter 3: Political Contribution of Regional freedom struggle:</b> Kittur Rani Chennamma, Hardekar Manjappa, Madikeri Peasants, Halagali Bedas.</p>	<p><b>6 Hours</b></p> <p><b>5 Hours</b></p> <p><b>4 Hours</b></p>
<b>Unit-II</b>	<p><b>Constitutional Development and its Philosophy</b></p> <p><b>Chapter- 4: Historical background of Constitutional development in India</b> - Developments between 1857 to 1952 (only Acts during this period must be taught), Composition and debates of Constituent Assembly (in brief), working of committees.</p> <p><b>Chapter 5: Philosophy and features of Indian Constitution</b> - Preamble*, Salient features**, Constitutionalism, Dr B.R. Ambedkar and Nehru's contribution in the making of the Constitution.</p> <p><b>Chapter- 6: Working of the Constitution</b> - Fundamental Rights, Union-State and Inter-State Relations (Art. 263, Inter-State disputes and trade and commerce), important Amendments to the Constitution**, Parliamentary Committees* (Standing, Ad hoc and Departmental).</p>	<p><b>5 Hours</b></p> <p><b>5 Hours</b></p> <p><b>5 Hours</b></p>



<b>Unit-III</b>	<p><b>Constitutional Institutions and Citizen's role</b></p> <p><b>Chapter 7: Parliamentary and Constitutional Institutions:</b> Legislature* (Upper and Lower house), Executive (composition and powers), Judiciary (High Court and Supreme Court, its composition and jurisdiction), Comptroller and Auditor General, Inter-State Council, Election Commission.</p> <p><b>Chapter 8: Role and Responsibilities of Citizens under Indian Constitution:</b> Concept of Citizenship, Citizenship Amendment Act, Fundamental Duties, Right to Information Act, Civil Society.*</p> <p><b>Chapter 9: Goals and Policies of National Development enshrined in the Constitution:</b> Concept of National Development, Unity and Integrity of the nation, Goals of Educational Policies*, Role of teachers and students in Nation Building**.</p>	<p><b>6 Hours</b></p> <p><b>4 Hours</b></p> <p><b>5 Hours</b></p>
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(\*\*Note-This is a compulsory, foundational and value additional course to be taught to students at the graduate level under NEP 2020. The paper is expected to impart the structure and functional aspects of constitution while giving them the background of a diverse country like India and the nuances of its social fabric and the why of such an elaborate constitution. The introductory chapter therefore is designed to familiarise students about their country and culture before they understand their constitution).

(Please note: The question paper pattern is indicative of the way a teacher needs to teach this paper. The pedagogical choice of a teacher helps to make an impact of his/her teaching on the student. Activity based and experiential teaching methods help student centric learning process - these are tips to make this paper more meaningful- the ultimate choice is left to the teacher)

#### **Exercise:**

- Department can debate on the role of Constitution in the development of India.
- Students can empirically evidence the effectiveness of concepts like Freedom, Equality, Justice, Rights and Duties by conducting empirical studies.
- Can invite expert to deliver special lectures on various provisions and amendments of the Constitution like the functioning of Election Commission, Article 246, 356 etc.

#### **Important Notes:**

##### **Chapter 1:**

\* These are introductory courses. Teachers should give a brief introduction to these for a better understanding of the philosophical and political foundations of Indian society taking suggested thinkers as examples (Max 2hrs).

\*\* Here teachers should briefly teach about the contributions and impact of British and Arabs as invaders, Mughals as settlers (Max 2hrs).

**Chapter2:**

\*These are to be taught briefly as concepts against the backdrop of freedom struggle

**Chapter3:**

\*BOS can alter this chapter to bring in the personalities and movements in their region who have made an impact on freedom struggle.

**Chapter5:**

\*While teaching the preamble please cover secularism and its criticism keeping in mind the neutrality of state in matters of religion and bring in the discussion regarding the differences in the usage of the terms like Religion, Dharma, Pantha(□□□), Matha(□□), Caste, Jatyathithate and the meaning of scientific secularism as expounded by Nehru.

\*\* In the salient features the teachers must teach at least 10 features of the constitution like Written constitution, Parliamentary form of government, Quasi federalism, Directive Principles of State Policy, Amendment procedure, Universal adult franchise, Integrated citizenship, Independent judiciary, Judicial Review, Emergency provisions and Three tier system of governance etc. The BOS has the discretion in selecting the salient features.

**Chapter6:**

\*In the committee they should teach the nature of these committees, their types, categories and subcategories.

\*\* In this the teacher should teach the amendments like 42nd, 73<sup>rd</sup>, 74th, 101st, etc which have major impact on the working of the Constitution. The BOS has the discretion in selecting the amendments but must ensure that they have a bearing on the working of the constitution.

**Chapter7:**

\*Here teachers are expected to teach the institutions in general and contextualise them to state and central governments.

**Chapter8:**

\*In this the teacher should discuss issues like paying taxes, exercising vote, discouraging corruption, Knowledge of laws that govern them.

**Chapter9:**

\*Teachers can touch upon Kothari Commission, NEP(1986 and 2020 while teaching Educational Policies)

\*\*Teachers can touch upon the teacher taught relations (vedantic tradition), teacher as a role model, student as future citizen, the need for ethical and moral responsibility among them etc.,

**Suggested Readings:**

1. Aiyangar K.R. 1941. "Ancient Indian Polity". Oriental Books Agency. Poona.

2. Altekar A.S. 1949. “*State and Government in Ancient India*”. Motilal Banarsidass Chowk, Banaras
3. Andre Beteille, 1965. *Caste, class, and Power*. Berkley: University of California Press.
4. Arora & Mukherji, *Federalism in India, Origin and Developments*, Vikas Publishing House, New Delhi, 1992.
5. Bhandarkar D.D. 1940. “*Some Aspects of Ancient Indian Culture*”. University of Madras.
6. Chandra Bipan. 1979. “*Nationalism and Colonialism in India*”. Orient, Lang.
7. Constitution of India (Full Text), India.gov.in., National Portal of India, [https://www.India.gov.in/sites/upload\\_files/npi/files/coi\\_part\\_full.pdf](https://www.India.gov.in/sites/upload_files/npi/files/coi_part_full.pdf)
8. D.C. Gupta, *Indian Government and Politics*, Vikas Publishing House, New Delhi, 1975.
9. Desai, A.R. 2016. *Social Background of Indian Nationalism*. Los Angeles: Popular Prakashan.
10. Durga Das Basu, *Introduction to the Constitution of India*, Gurgaon; Lexis Nexis, 2018 (23rd edn.)
11. Gandhi, M.K. "Hind Swaraj", [http://www.mkgandhi.org/ebks/hind\\_swaraj.pdf](http://www.mkgandhi.org/ebks/hind_swaraj.pdf)
12. Goshal U.N. 1923. “*History of Hindu Political Theory*”. Oxford University Press, Calcutta.
13. Granville Austin, 2000. *The Indian Constitution: Cornerstone of a Nation*. Melbourne: Oxford University Press.
14. Hanson and Douglas, 1972. *India's Democracy*. New York city: W.W. Norton & Co Inc.
15. Harish Ramaswamy and S. S. Patagundi (Ed.) 2007. *Karnataka- Government and Politics*. Delhi: Concept Publishing Company.
16. J.N. Pandey, *The Constitutional Law of India*, Allahabad; Central Law Agency, 2018 (55th edn.)
17. Jayaswal K.P. 1943. “*Hindu Polity*”. Bangalore Printing and Publishing Co. LTD, Bangalore.
18. Johari J.C. 1974. *Indian Government and Politics*. New Delhi: Vishal Publications.
19. K B Merunandan, *Bharatada Samvidhana Ondu Parichaya*, Bangalore, Meragu Publications, 2015.
20. K. Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, New Delhi, 2002.
21. Kapoor, Kapil (Ed), 2005, *Indian Knowledge System- Vol-1*, New Delhi: D>K Printworld LTD.

22. Kapoor, Kapil, 1994, *Texts of the Oral Tradition, Language, Linguistics and Literature: The Indian Perspective*. Delhi: Academic Foundation
23. Kosambi D.D. 1965. "*The Culture and Civilization of Ancient India and Historical Outline*". Vikas Publishing House pvt. ltd, Noida.
24. Krishana Rao, M. & G.S. Halappa. 1962. *History of Freedom Movement in Karnataka*. Mysore: Government of Mysore.
25. M.V. Pylee, *India's Constitution*, New Delhi; S. Chand Pub., 2017 (16th edn.)
26. Nagel, Stuart, 2017, *India's Development and Public Policy*. UK: Routledge.
27. P.M Bakshi, *Constitution of India*, Universal Law Publishing House, New Delhi, 1999.
28. Patham and Thomas Patham. 1986. "*Political Thought in Modern India*." Sage Publications, United State.
29. Rajni Kothari, 1995. *Caste in Indian Politics*. Telangana: Orient Blackswan.
30. Rghavendra Rao, K. 2000. *Imagining Unimaginable Communities*. Hampi: Prasranga, Kannada University.
31. Bhargava, Rajeev. ed. 1998. *Secularism and Its Critics*, New Delhi: Oxford University Press.
32. S.N. Jha, *Indian Political System, : Historical Developments*, Ganga Kaveri Publishing House, Varanasi, 2005.
33. Said Edarard. 1978. "*Orientalism*". Pantheon Books, USA.
34. Sharma, R.S. 1991. "*Early Indian Social and Political Thought and Institutions (Aspects of the Political Ideas and Institutions in Ancient India)*". Motilal Banarsidass, Delhi.

<b>FormativeAssessment</b>	
<b>AssessmentOccasion/type</b>	<b>WeightageinMarks</b>
AssessmentTest-1	10
Seminar/Presentation/GroupDiscussion	10
AssessmentTest-2	10
Assignment	10
<b>Total</b>	<b>40</b>

**I. Term End Examination for India and Indian Constitution (IIC)**

Paper will be for maximum of 60 marks. The minimum marks to pass the examination is 40% (24 marks).

**Note:** Duration of Examination for **India and Indian Constitution (IIC)** is **2 hours**.

Question paper pattern for **India and Indian Constitution**—

**Section A: Multiple Choice Questions**

**Section B: Short Answer Questions**

**Section C: Medium Answer Questions**

**Section D: Long Answer Questions**

**Section A: Multiple Choice Questions**

All Questions are Compulsory (10x1=10)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

**Section B: Short Answer Questions (5x5=25)**

Answer any Five questions. Answer the following questions in not more than 3-5 sentences.

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.

**SectionC:MediumAnswerQuestions (1x10=10)**

AnsweranyOnequestion.Answerthefollowingquestioninnotmorethan500words

18.

19.

**SectionD:LongAnswerQuestions (1x15=15)**

AnsweranyOnequestion.Answerthefollowingquestioninnotmorethan800words

20.

21.

**Department of Political science  
Pattern of Question Paper**

**1. International Assessment**

Each paper will have an internal assessment component for **40** marks out of the maximum **100** marks

**2. Theory Examination**

**Max.Marks 60**

Theory question paper pattern

Theory question paper for Itoiv Semester ( 2 papers) will have 1 parts

**Question Paper Pattern**

**Theory (3 Credits)**

**Time :2 Hours**

**Max.Marks:60**

**Anwer any five questions each question carries 10 marks**

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....
- 6.....
- 7.....
- 8.....
- 9.....

10.....

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
B.N. ROAD, MYSURU-570025**



**DEPARTMENT OF POLITICAL SCIENCE**

**UG Syllabus  
CHOICE BASED CREDIT SYSTEM  
For B.A.Programmes**

- History, Economics, Political science (HEP)
- Kannada, Economics, Political science (KEP)



## ➤ Journalisam,Politicalscience,English(JPE)

**2019-20****ELE26022/25/26**

**V Semester**  
**Discipline Specific Elective (DSE1A)**  
**Themes on Comparative Political Theory**

**Course Outcome:**

On completion of the Course, students will:

- CO1 Understand in details with application, if applicable, democracy and governance
- CO2 Understand in details with application, if applicable, Indian political thought
- CO3 Specify in depth Indian political thought
- CO4 Identify the classification and characteristics of western political thought
- CO5 Understand in details with examples western political thought
- CO6 Understand in depth local government
- CO7 Learn the details of regulatory institutions
- CO8 Identify the classification and characteristics of lobbying institutions

**Unit I**

- a. Distinctive features of Indian political thought
- b. Kautilya on State
- c. Tilak and Gandhi on Swaraj

**Unit II**

- a. Ambedkar and Lohia on Social Justice
- b. Nehru and Jayaprakash Narayan on Democracy
- c. John Locks on Rights

**Unit III**

- a. Distinctive features of western political thought
- b. Aristotle on citizenship
- c. plato –ideal state

**Unit IV**

- a. J.J. Rousseous on Inequality
- b. J.S. Mill on liberty and democracy

c. H.J.Laski- Rights,Liberty,Equality

**Reference:**

- Dallmayr F – Comparative Political Theory
- Sparks, Oh and Isaacs s – Political Theory its in context
- Zelliot E – Political Thought in Modern India

**ELE26222/25/26**

**V- SEMESTER**  
**Discipline Specific Elective (DSE1B)**  
**Legislative support**

**Course Outcome:**

On completion of the Course, students will:

- CO1 Understand in depth legislative support
- CO2 Write down the details of legislative process
- CO3 Write down the details of legislative committees
- CO4 Learn in details with examples legislative committees
- CO5 Identify in details with application, if applicable, budget process

**Unit I** a. Parliament, composition Power and functions,  
b.State legislature -composition Power and functions,  
.c.Rural and urban local self government from Zilla parishads / municipal corporation to panchayat

**Unit II** a. law making process in parliament  
b.Role of the Standing Committee in reviewing a Bill, Legislative Consultations, amendments to a Bill, the framing of Rules and Regulations.

**Unit III** a. meaning ,nature and scope financial administration  
b. Importance of financial administration  
c.Budget- preparation  
Enactment  
execution

**Unit IV.** a. Importance of Accounting Auditing

- b. The Comptroller and Auditor General of India - powers and functions
- c. Public Accounts Committee, Estimate Committee

### Essential Readings:

- Avasthi and Maheshwari - Public Administration
  - Madhavan, M R & N Wahi - Financing of Election Campaigns
  - Vanka, S - Primer on MPLADS - Centre for Policy Research
  - Karla, H - Public Engagement with the Legislative Process
  - Agerwal, P and T V Somanathan, "Public Policy Making in India: Issues"

ELF26022/25/26

## VI SEMESTER (DSE1A) MODERN GOVERNMENTS (U.K U.S.A. SWISS)

### Course Outcome:

On completion of the Course, students will:

CO1 Understanding the world politics

CO2 Enlightening the world governmental system

CO3 Develop comparative study on governmental systems

### Unit I UNITED KINGDOM

- a. Evolution, features of UK Constitution and role of conventions
- b. Parliament - Composition powers and functions
- c. Crown - prime minister - powers and functions

### Unit II

- a. Judiciary in UK - Composition and jurisdiction
- b. Role of political parties in UK

### Unit III : UNITED STATES OF AMERICA

- a. Features of USA Constitution
- b. Congress - Composition powers and functions
- c. President - Election, Role powers and functions

### Unit IV:

- a. Judiciary in USA - Composition and jurisdiction
- b. political parties in USA

### Unit IV: SWISS

- a. Features of Swiss Constitution

- b. Federal Assembly-Composition powers
- c. Federal Council-Composition powers
- d. Federal Tribunal-Composition powers
- e. Devices of Direct Democracy in Swiss

**Reference:**

- A.C Kapoor - Select constitution
- H.t.Ramakrishna - Adunikasarakaragalu
- U.Gurumurthy - Adunikasarakaragalu
- Vidyabhushan and- World Constitution
- Vishnu Bagavan

ELF26222/25/26

**VI Semester**  
**Skill Enhancement Course (DSE1B):**  
**Public Administration Concepts & Theories**

**Course Outcome:**

On completion of the Course, students will:

- CO1 Learn in depth Administration and Public Policy
- CO2 Specify the details of administrative theories
- CO3 Learn the classification and characteristics of administrative theories
- CO4 Deliberate the details of public policy
- CO5 Deliberate in details with examples public policy in India
- CO6 Identify the characteristics of public policy in India

**Unit I Public Administration**

- a. Meaning, Scope and Significance
- b. Public & Private Administration
- c. Approaches to Public Administration

**Unit II Administrative Theories**

- a. Classical Theory & Human Relations Theory
- b. Scientific Theory
- c. Rational decision making theory

**Unit III. Management**

- a. Meaning, importance and principles
- b. Features and functions of management
- c. Chief executive –functions and its role

**Unit IV. contemporary issues in administration**

- a. Meaning and modes of corruption
- b. Good governance
- c. E-governance

**Reference:**

- Awasthi A and Maheshwari - Public Administration
- BasuRumki, Public Administration - Concepts and Theories
- Henry N - Public Administration and Public Affairs
- Mouzelis N P - The Ideal type of Bureaucracy
- Mooney - The Principles of Organization
- Esman M T - Politics & Development Administration

ELE26242/25/26

**Generic Elective: Interdisciplinary Reading Gandhi****Course Outcome:**

On completion of the Course, students will:

- CO1 Specify the details of reading Gandhi
- CO2 Deliberate in depth Gandhi and hind swaraj
- CO3 Learn the details of Gandhi's views on nationalism
- CO4 Understand the details of Gandhi's views on communal unity
- CO5 Understand in details with examples Gandhi's views on women

**Unit I: Introduction**

- a. Biography (a brief)
- b. Commentaries on hind swaraj
  - c. Truth –non-violence
- d. Satyagraha
  - e. Modernity

**Unit II:**

- a. State and religion
  - b. Nationalism
  - c. Communal Unity
- d. Women's Question
  - e. Untouchability
  - f. Capt of ramarajya
  - g. Economical idias

**Reference:**

- A.J. Parel(1997)- Introduction, M.K Gandhi , Hinda swaraj and other writings
- B Parekh, -Gandhi(1997)
- D.hardiman, -Gandhi in his time and ours(2003)

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(Autonomous)**

**OOTY ROAD, MYSURU- 570 025**

***DEPARTMENT OF ZOOLOGY***

**Syllabus for**

**B.Sc. Hons ZOOLOGY**

**(UG) I,II,III,IV,V&VI**

**SEMESTERS**

**Framed According to the National Educational Policy (NEP 2020)**

**(2021-2022 AND 2022-2023 Batch Onwards)**



## Model Curriculum Structure for Degree Program

### B. Sc., Hons in Zoology

**Name of the Degree Program:** B. Sc., Hons

**Discipline Core:** Zoology Total Credits for the

**Program:** 50/100/142/184/268 Starting year of implementation: 2021-22

#### PROGRAM OBJECTIVES (POs)

**POs1-**The Programme offers both classical as well as modern concepts of Zoology in higher education.

**POs2-**It enables the students to study animal diversity in both local and global environments.

**POs3-**To make the study of animals more interesting and relevant to human studies more emphasis is given to branches like behavioural biology, evolutionary biology and economic zoology.

**POs4-**More of upcoming areas in cell biology, genetics, molecular biology, biochemistry, genetic engineering and bioinformatics have been also included.

**POs5-**Equal importance is given to practical learning and presentation skills of students.

**POs6-**The lab courses provide the students necessary skills required for their employability. **POs7-**Skill enhancement courses in classical and applied branches of Zoology enhance enterprising skills of students.

**POs8-**The global practices in terms of academic standards and evaluation strategies.

**POs9-** Provides opportunity for the mobility of the student both within and across the world.

**POs 10-**The uniform grading system will benefit the students to move across institutions within India to begin with and across countries.

**POs11-**It will also enable potential employers in assessing the performance of the candidates across the world.

**Semester I- Zoology Core Course I Content:**  
**Zoology: Paper-I: Cytology, Genetics & Infectious Diseases.**

<b>Course Title/Code:</b> Cytology, Genetics and Infectious Diseases	<b>Course Credits:</b> 4
<b>Course Code:</b> FSA470	<b>L-T-P per week:</b> 4-0-0
<b>Total Contact Hours:</b> 56	<b>Duration of ESA:</b> 3 Hours
<b>Formative Assessment Marks:</b> 40	<b>Summative Assessment Marks:</b> 60

**Course Outcomes (COs):**

At the end of the course the student should be able to understand:

- CO1. The structure and function of the cell organelles.
- CO2. The chromatin structure and its location.
- CO3. The basic principle of life, how a cell divides leading to the growth of an Organism and also reproduces to form a new organism.
- CO4. How a cell communicates with its neighboring cells.
- CO5. The principles of inheritance, Mendel's laws and the deviations.
- CO6. How environment plays an important role by interacting with genetic factors.
- CO7. Detect chromosomal aberrations in humans and study of pedigree analysis.

Content	Hours
<b>Unit -1</b>	14hrs
<p><b>Chapter 1:Structure and Function of Cell Organelles - I in Animal cell</b></p> <ul style="list-style-type: none"> <li>• Ultra structure of animal cell</li> <li>• <b>Plasma membrane:</b> Fluid mosaic model, Chemical structure – lipids, Proteins and their role in maintaining structural integrity. Functions of Plasma membrane - Cell permeability, diffusion, passive transport, active transport.</li> <li>• <b>Endomembrane system:</b> Protein targeting and sorting, transport, endocytosis and exocytosis.</li> </ul> <p><b>Chapter 2:Structure and Function of Cell Organelles - II in Animal cell.</b></p> <ul style="list-style-type: none"> <li>• <b>Endoplasmic reticulum-</b> Types, Structure and functions.</li> <li>• <b>Peroxisome &amp;Ribosome:</b> Types – (Prokaryotic &amp; Eukaryotic), Structure and functions.</li> <li>• <b>Golgi apparatus</b> - Structure and functions.</li> <li>• <b>Lysosomes</b> - Structure and functions.</li> <li>• <b>Mitochondria:</b> Structure and functions. Oxidative phosphorylation; electron transport system</li> <li>• <b>Cytoskeleton:</b> Structure and functions of - Microtubules, microfilament intermediate filaments.</li> </ul>	
<b>Unit -2</b>	14hrs
<p><b>Chapter 3:Nucleus and Chromatin Structure.</b></p> <ul style="list-style-type: none"> <li>• <b>Ultra structure of Nucleus and Functions</b> - Nuclear envelop, Nuclear pore complex, Nucleoplasm.</li> <li>• Ultrastructure of nucleolus and functions.</li> <li>• <b>Chemical structure</b> and base composition of DNA and RNA.</li> <li>• <b>Nucleosome model</b>, DNA super coiling, Chromatin organization, Structure of chromosomes (Fine structure). Types of DNA and RNA.</li> </ul> <p><b>Chapter 4: Cell cycle, Cell Division and Cell Signalling.</b></p> <ul style="list-style-type: none"> <li>• Introduction to Cell cycle and its regulation<b>Cell division:</b> Mitosis stages and its Significance and Meiosis Stages and its Significance, Apoptosis.</li> <li>• <b>Signal transduction:</b> Intracellular signalling and Cell surface receptors, via G-protein linked receptors.</li> <li>• <b>Cell-cell interaction:</b> Cell adhesion molecules, Cellular junctions.</li> </ul>	
<b>Unit -3</b>	14hrs
<p><b>Chapter 5: Mendelism and Sex Determination.</b></p> <ul style="list-style-type: none"> <li>• <b>Basic principles of heredity:</b> Mendel’s laws - Monohybrid cross and Dihybrid cross. Complete and Incomplete Dominance (Ex. <i>Mirabilis jalapa</i>). Penetrance and Expressivity.</li> <li>• <b>Genetic Sex Determining Systems</b> (XX- XY, XX – XO, ZZ – ZW), Environmental Sex Determination (<i>Bonelia viridis</i>), Sex Determination and Mechanism in <i>Drosophila melanogaster</i> (<i>Genic balance theory</i>).</li> <li>• <b>Dosage Compensation</b> - Barr body, Lyon’s hypothesis.</li> </ul>	

<p><b>Chapter 6: Extensions of Mendelism, Genes and Environment.</b></p> <ul style="list-style-type: none"> <li>• <b>Extensions of Mendelism:</b> Multiple Alleles (Inheritance of ABO blood group in Humans and Rh factor), Gene Interaction (Supplementary, Complementary and Epistasis).</li> <li>• <b>The Interaction between Sex and Heredity:</b> Sex-Influenced characteristics (Male pattern baldness in humans, horns in sheep) and Sex-Limited Characteristics (Plumage pattern, milk production and Moustache and Beard in Males)</li> <li>• <b>Cytoplasmic Inheritance</b> (Kappa particles in <i>Paramecium</i>), Genetic Maternal Effects (Shell coiling in <i>Limnaea</i>).</li> <li>• <b>Interaction between Genes and Environment</b> -Himalayan albino rabbit Environmental Effects on Gene Expression (Norm of reaction), Inheritance of Continuous Characteristics (Polygenic Inheritance - Skin colour in Man).</li> </ul>	
<b>Unit -4</b>	14hrs
<p><b>Chapter 7: Human Chromosomes and Patterns of Inheritance.</b></p> <ul style="list-style-type: none"> <li>• <b>Patterns of Inheritance:</b> Autosomal dominance (Huntington's chorea, PTC), Autosomal recessive (Sickle cell anemia, Albinism), X-linked recessive (Colour blindness, Hemophilia), X-linked dominant (Vitamin D resistance Ricketts, Coffin Lowry syndrome).</li> <li>• <b>Chromosomal Anomalies:</b> Structural (Deletion, Duplication, Inversion, Translocation with examples) and Numerical aberrations (Turner's syndrome, Klinefelter's syndrome). Autosomal anomalies - Down syndrome and Cri-du-chat syndrome.</li> <li>• <b>Human Karyotyping</b> and Pedigree analysis (Autosomal dominant, Autosomal recessive, X – linked dominant, X – linked recessive).</li> </ul> <p><b>Chapter 8: Infectious Diseases.</b></p> <ul style="list-style-type: none"> <li>• <b>Introduction to Pathogenic Organisms:</b> Viruses, Bacteria, Fungi, Protozoa and Worms. Structure, Life cycle, Pathogenicity, including diseases, causes, symptoms and control of common parasites: <i>Trypanosoma</i>, <i>Giardia</i> and <i>Wuchereria</i>.</li> </ul>	

**Suggested Readings :**

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA(2004).
2. Alberts et al: Molecular Biology of the Cell: Garland(2002).
3. Cooper: Cell: A Molecular Approach: ASM Press(2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman(2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson(2004).
7. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W H Freeman(2007).
8. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13<sup>th</sup> Edition. Wiley Blackwell(2017).
9. Principles of Genetics by B. D. Singh
10. Cell-Biology by C. B. Pawar, Kalyani Publications
11. Economic Zoology by Shukla and Upadhyaya

**Semester I- Zoology Core Course I**  
**Content: Zoology: Paper-I: Cytology, Genetics & Infectious Diseases.**

**Semester I**

<b>Course Title:</b> Cytology, Genetics and Infectious Diseases	<b>Course Credits:</b> 2
<b>Course Code:</b> FSA470	<b>L-T-P per week:</b> 0-0-4
<b>Total Contact Hours:</b> 56	<b>Duration of ESA:</b> 3 Hours
<b>Formative Assessment Marks:</b> 25	<b>Summative Assessment Marks:</b> 25

**Course Outcomes (COs):**

At the end of the course the student should be able to:

1. To use simple and compound microscopes.
2. To prepare stained slides to observe the cell organelles.
3. To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.
4. The chromosomal aberrations by preparing karyotypes.
5. How chromosomal aberrations are inherited in humans by pedigree analysis in families. The antigen-antibody reaction.

## Lab Course Content

List of labs to be conducted	56hrs
1. Understanding of simple and compound microscopes.	
2. To study different cell types such as buccal epithelial cells, neurons, striated muscle cells using Methylene blue/any suitable stain (virtual/ slaughtered tissue).	
3. To study the different stages of Mitosis in root tip of <i>Allium cepa</i> .	
4. To study the different stages of Meiosis in grasshopper testis (virtual).	
5. To check the permeability of cells using salt solution of different concentrations.	
6. Study of parasites in humans (e.g. Protozoans, Helminthes in compliance with examples being studied in theory) permanent microslides.	
7. To learn the procedures of preparation of temporary (spicules) or permanent stained slides (Fish scales), with available mounting material.	
8. Study of wild <i>Drosophila melanogaster</i> (male & female) and Mutant Phenotypes of <i>Drosophila</i> sp, –White eye, bar eye, sepia eye, vestigial wing & yellow body. (From Cultures or Photographs).	
9. Study of Polytene chromosomes (Chironomus larva or <i>Drosophila</i> larva).	
10. Preparation of <i>Drosophila</i> and human Karyotype and study (identification) of the chromosomal structural (Chriduchat syndrome (Deletion), Fragile X syndrome (duplication) , walker-warburg syndrome (Inversion) and leukemia (translocation) and numerical aberrations (Turner's, Klinefelter's and Down's syndrome) from the pictures provided. (Virtual / Optional).	
11. To prepare family pedigrees.	
12. <a href="https://www.vlab.co.in">https://www.vlab.co.in</a>	
13. <a href="https://zoologysan.blogspot.com">https://zoologysan.blogspot.com</a>	
14. <a href="http://www.vlab.iitb.ac.in/vlab">www.vlab.iitb.ac.in/vlab</a>	
15. <a href="http://www.onlinelabs.in">www.onlinelabs.in</a>	
16. <a href="http://www.powershow.com">www.powershow.com</a>	
17. <a href="https://vlab.amrita.edu">https://vlab.amrita.edu</a> <a href="https://sites.dartmouth.edu/">https://sites.dartmouth.edu/</a>	

**Suggested Readings:**

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1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA(2004).
2. Alberts et al: Molecular Biology of the Cell: Garland(2002).
3. Cooper: Cell: A Molecular Approach: ASM Press(2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman(2004).
5. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby  
Immunology. W HFreeman(2007).
6. Kesar, Saroj and Vasishta N.2007 Experimental Physiology: Comprehensive Manual.  
Heritage Publishers,NewDelhi.

**Scheme of Practical ExaminationI**  
**Semester BSc. Zoology**  
**Cytology, Genetics and Infectious diseases**  
**Course Code: FSA470**

**Duration: 3 hours**

**Max. Marks: 25**

- |  |     |
|--|-----|
| 1. Identify the spots A, B and C, giving suitable reasons with diagram<br>(Experiment no 1, 2, 3, 4, 6, 8, 9&10) | 12M |
| 2. Prepare a whole mount of the given material   | 03M |
| 3. Preparation of Karyotype  | 05M |
| 4. Preparation of Pedigree analysis  | 05M |

(The candidate has to submit the duly certified record at the time of practical examination. The record is for the reference of the examiners, but not for assessment (since it is already assessed for IA))



**Assessment:****Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25

**Pedagogy: Written Assignment/Presentation/Seminar**

Formative Assessment - Theory	
Assessment Occasion	Weightage in Marks
House Examination/Test	$C1+C2=10+10=20$
Written Assignment/Presentation/Seminar	$10+10=20$
Total	40

**Pedagogy: Written Assignment/Presentation/Record/Seminar**

Formative Assessment- Practical	
Assessment Occasion	Weightage in Marks
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

## Open Elective Course Content

### Semester: I

<b>Course Title:</b> Economic Zoology <b>Course Code:</b> FSA920	<b>Course Credits:</b> 3
<b>Total Contact Hours:</b> 42	<b>Duration of ESA:</b> 3 Hours
<b>Formative AssessmentMarks:</b> 40	<b>Summative AssessmentMarks:</b> 60

### Course Outcomes (COs):

At the end of the course the student will be able to:

**COs1-** Gain knowledge about silkworms rearing and their products.

**COs2-** Gain knowledge in Bee keeping equipment and apiary management.

**COs3-** Acquaint knowledge on dairy animal management, the breeds and diseases of cattle and learn the testing of egg and milk quality.

**COs4-** Acquaint knowledge about the culture techniques of fish and poultry.

**COs5-** Acquaint the knowledge about basic procedure and methodology of vermiculture.

**COs6-** Learn various concepts of lac cultivation.

**COs7-** Students can start their own business i.e. self-employments.

**COs8-** Get employment in different applied sectors

## Course Content

Content	Hrs
<b>Unit I</b>	<b>14</b>
<p><b>Chapter 1. Sericulture:</b></p> <ul style="list-style-type: none"> <li>• History and present status of sericulture in India</li> <li>• Mulberry and non-mulberry species in Karnataka and India</li> <li>• Mulberry cultivation</li> <li>• Morphology and life cycle of <i>Bombyxmori</i></li> <li>• Silkworm rearing techniques: Processing of cocoon, reeling</li> <li>• Silkworm diseases and pest control</li> </ul> <p><b>Chapter 2. Apiculture:</b></p> <ul style="list-style-type: none"> <li>• Introduction and present status of apiculture</li> <li>• Species of honey bees in India, life cycle of <i>Apisindica</i></li> <li>• Colony organization, division of labour and communication</li> <li>• Bee keeping as an agro based industry; methods and equipments: indigenous methods,extraction appliances, extraction of honey from the comb and processing</li> <li>• Bee pasturage, honey and bees wax and their uses</li> <li>• Pests and diseases of bees and their management</li> </ul>	
<b>Unit II</b>	<b>14</b>
<p><b>Chapter 3. Live Stock Management:</b></p> <ul style="list-style-type: none"> <li>• <b>Dairy:</b>Introduction to common dairy animals and techniques of dairy management</li> <li>• Types, loose housing system and conventional barn system; advantages and limitationsof dairy farming</li> <li>• Establishment of dairy farm and choosing suitable dairy animals-cattle</li> <li>• Cattle feeds, milk and milk products</li> <li>• Cattle diseases</li> <li>• <b>Poultry:</b> Types of breeds and their rearing methods</li> <li>• Feed formulations for chicks</li> <li>• Nutritive value of egg and meat</li> <li>• Disease of poultry and control measures</li> </ul> <p><b>Chapter 4. Aquaculture:</b></p> <ul style="list-style-type: none"> <li>• Aquaculture in India: An overview and present status and scope of aquaculture</li> <li>• Types of aquaculture: Pond culture: Construction, maintenance and management; carpculture, shrimp culture, shellfish culture, composite fish culture and pearl culture</li> </ul>	
<b>Unit - III</b>	<b>14</b>

<p><b>Chapter 5. Fish culture:</b></p> <ul style="list-style-type: none"> <li>• Common fishes used for culture.</li> <li>• Fishing crafts and gears.</li> <li>• Ornamental fish culture: Fresh water ornamental fishes- biology, breeding techniques</li> <li>• Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality. control of snail and algal growth.</li> <li>• Modern techniques of fish seed production</li> </ul> <p><b>Chapter 6. Prawn culture:</b></p> <ul style="list-style-type: none"> <li>• Culture of fresh and marine water prawns.</li> <li>• Preparation of farm.</li> <li>• Preservation and processing of prawn, export of prawn.</li> </ul> <p><b>Chapter 7. Vermiculture:</b></p> <ul style="list-style-type: none"> <li>• Scope of vermiculture.</li> <li>• Types of earthworms.</li> <li>• Habit categories - epigeic, endogeic and anecic; indigenous and exotic species.</li> <li>• Methodology of vermicomposting: containers for culturing, raw materials</li> </ul>	
<p>required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of vermicompost.</p> <ul style="list-style-type: none"> <li>• Advantages of vermicomposting.</li> <li>• Diseases and pests of earthworms.</li> </ul> <p><b>Chapter 8. Lac Culture:</b></p> <ul style="list-style-type: none"> <li>• History of lac and its organization, lac production in India.</li> <li>• Life cycle, host plants and strains of lac insect.</li> <li>• Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculation period, harvesting of lac.</li> <li>• Lac composition, processing, products, uses and their pests.</li> </ul>	

### Suggested Readings:

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, Kindle Edition.
6. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
7. Yadav Manju (2003). Economic Zoology, Discovery Publishing House.
8. Jabde Pradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
9. Cherian & Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
10. Sathe, T.V. Vermiculture and Organic farming.
11. Bard. J (1986). Handbook of Tropical Aquaculture.
12. Santhanam, R. A. Manual of Aquaculture.
13. Zuka. R.1 and Hamiyn (1971). Aquarium fishes and plants
14. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lacculture.
15. Animal Disease- Bairagi K. N. Anmol Publications Pvt.Ltd 2014



17. Economics Of Aquaculture - Singh(R.K.P) - Danika Publishing Company 2003
18. Applied and Economic Zoology (SWAYAM) web  
[https://swayam.gov.in/nd2\\_cec20\\_ge23/previe](https://swayam.gov.in/nd2_cec20_ge23/previe)  
w

### Assessment

**Pedagogy:** Chalk and Talk, PPT, Group discussion, Seminar, Field visit

<b>Formative Assessment - Theory</b>	
<b>Assessment Occasion</b>	<b>Weightage in Marks</b>
House Examination/Test	$C1+C2=10+10=20$
Written Assignment/Presentation/Seminar	$10+10=20$
Total	40

## Skill Enhancement Course in Zoology

### Course Content

#### Semester:I

<b>Course Title:</b> Vermiculture <b>Course Code:</b> VEC5ZOO1	<b>Course Credits:</b> 2
<b>Total Contact Hours:</b> 56 Hours	<b>Duration of ESA:</b> 3 Hrs
<b>Formative Assessment Marks:</b> 20	<b>Summative Assessment Marks:</b> 30

#### Course Outcomes (COs):

At the end of the course the student:

**COs1-** Understands the importance of earthworms in maintaining soil quality. **COs2-** Learns that the vermicomposting is an effective organic solid wastemanagementmethod.

**COs3-** Gets acquainted with the importance of earthworms in agro-based economic activity.

**COs4-** Vermicomposting leads to organic farming and healthy food production. **COs5-** Vermicomposting may be taken up as a small scale industry bythe farmers andunemployed youth.

**COs6-** Get jobs in teaching institutions or vermiculture units as technicians.

**COs7-** Learn the concept of vermicomposting as bio fertilizers thus student can become and entrepreneur after completion of the course.

### Course Content

List of labs to be conducted		56Hrs
1	Collection of native earth worm species to study habit and habitat.	
2	Keys to identify different species of earth worm.	
3	Externals and Life cycle of <i>Eiseniafetida</i> and <i>Eudriluseugeniae</i> .	
4	Dissection of digestive and reproductive system.	
5	Study of vermicomposting equipments and devices.	
6	Preparation of vermibeds and their maintenance.	
7	Study of different vermicomposting methods.	
8	Harvesting, separation of worms, packaging, transport and storage of vermicompost.	
9	Vermi-wash collection and processing.	
10	Small scale earth worm farming for home gardens and studying the effect of vermicompost on garden plants.	
11	Budget and cost scenario of vermiculture (Project).	
12	Diseases and natural enemies of earth worms and their control measures.	
13	Role of vermitechnology in environmental protection.	
14	Economics and Marketing of vermicompost and vermi wash.	
15	Visit to vermiculture farm to acquaint with latest techniques.	

#### Text Books and references

1. Bhatt J.V. & S.R. Khambata (1959) -Role of Earthworms in Agriculture|| Indian Council of Agricultural Research, New Delhi
2. Edwards, C.A. and J.R. Lofty (1977) -Biology of Earthworms|| Chapman and Hall Ltd., London.
3. Lee, K.E. (1985) -Earthworms: Their ecology and Relationship with Soils and Land Use| Academic Press, Sydney.
4. Dash, M.C., B.K.Senapati, P.C. Mishra (1980) — Vermisand Vermicomposting|| Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, JyotiVihar, Orissa.
5. Kevin, A and K.E.Lee (1989) — Earthworm for Gardeners and Fisherman| (CSIRO,Australia, Division of Soils)
6. Satchel, J.E. (1983) -Earthworm Ecology|| Chapman Hall, London.
7. Wallwork, J.A. (1983) -Earthworm Biology|| Edward Arnold (Publishers) Ltd. London.



**Pedagogy**

1. Demonstration
2. Assignment
3. Group discussion
4. Field visit
5. Use of Audio-Visual aids.

<b>Formative Assessment</b>	
<b>Assessment Occasion</b>	<b>Weightage in Marks</b>
Class Test	10
Attendance and Assignments	05
Visit to vermicompost unit and report	05
<b>Total</b>	<b>20</b>

**Scheme of Practical ExaminationI**  
**Semester BSc. Zoology**

Skill Enhancement course: Vermiculture

**Duration: 3 hours**

**Max. marks: 30**

1. Identify and describe the given system of the given specimen/chart 'A' given, with neat labelled diagram. (05 marks)
2. Identify and comment on the spotters B to E (Life cycle/Externals/Devices used in vermicomposting/ Vermicompost types) (5x5=25 marks)

## Semester II- Zoology Core Course I

### Content: Paper-II: Biochemistry and Physiology

<b>Course Title:</b> Biochemistry and Physiology	<b>Course Credits:</b> 4
<b>Course Code:</b> FSB470	<b>L-T-P per week:</b> 4-0-0
<b>Total Contact Hours:</b> 56	<b>Duration of ESA:</b> 3 Hours
<b>Formative Assessment Marks:</b> 40	<b>Summative Assessment Marks:</b> 60

#### Course outcomes:

The student at the completion of the course will learn:

**COs1-** To develop a deep understanding of structure of biomolecules like proteins, lipids and carbohydrates.

**COs2-** How simple molecules together form complex macromolecules.

**COs3-** To understand the thermodynamics of enzyme catalyzed

reactions. **COs4-** Mechanisms of energy production at cellular and

molecular levels. **COs5-** To understand various functional components of an organism.

**COs6-** To explore the complex network of these functional components.

**COs7-** To comprehend the regulatory mechanisms for maintenance of function in the body.

<b>Content</b>	<b>Hours</b>
<b>Unit I</b>	<b>14</b>
<p><b>Chapter 1. Structure and Function of Biomolecules:</b></p> <ul style="list-style-type: none"> <li>• Structure and Biological importance of carbohydrates (Classification with examples Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates).</li> <li>• Lipids Classification and Biological importance- (saturated and unsaturated Fatty acids, Tri-acylglycerols, Phospho lipids, Glycolipids and Steroids) Clinical importance of Lipids, HDL &amp; LDL, TG and Cholesterol</li> <li>• Proteins Structure, Classification and General Properties of <math>\alpha</math>-amino acids; Essential and non-essential amino acids, Levels of organization in proteins (Primary, secondary, tertiary and quaternary structure with Haemoglobin as an example) Simple and conjugate proteins.</li> </ul>	
<p><b>Chapter 2. Enzyme Action and Regulation</b></p> <ul style="list-style-type: none"> <li>• Nomenclature and classification of enzymes; Cofactors; Specificity of enzyme action.</li> <li>• Isozymes; Mechanism of enzyme action</li> <li>• Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Equation of Michaelis-Menten, Concept of <math>K_m</math> and <math>V_{max}</math>, Enzyme inhibition</li> <li>• Allosteric enzymes and their kinetics; Regulation of enzyme action.</li> </ul>	
<b>Unit 2</b>	<b>14</b>
<p><b>Chapter 3. Metabolism of Carbohydrates and Lipids</b></p> <ul style="list-style-type: none"> <li>• Metabolism of Carbohydrates: glycolysis, citric acid cycle, gluconeogenesis, phosphate pentose pathway, Glycogenolysis and Glycogenesis</li> <li>• Lipids- Biosynthesis of palmitic acid; Ketogenesis, <math>\beta</math>-oxidation and <math>\omega</math>-oxidation of saturated fatty acids with even and odd number of carbon atoms</li> </ul>	
<p><b>Chapter 4. Metabolism of Proteins and Nucleotides</b></p> <ul style="list-style-type: none"> <li>• <b>Catabolism of amino acids:</b> Transamination, Deamination, Urea cycle, Nucleotides and vitamins</li> <li>• <b>Anabolism</b> -Peptide linkages</li> </ul>	
<b>Unit 3</b>	<b>14</b>

<p><b>Chapter 5. Digestion and Respiration in humans</b></p> <ul style="list-style-type: none"> <li>• <b>Digestion</b>- Structural organization and functions of gastrointestinal tract and associated glands.</li> <li>• Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Physiology of trachea and Lung.</li> <li>• <b>Respiration</b> -Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood, Respiratory pigments, Dissociation curves and the factors influencing it; Control of respiration.</li> </ul>	
<p><b>Chapter 6. Circulation and Excretion in humans</b></p> <ul style="list-style-type: none"> <li>• Components of blood and their functions; hemopoiesis</li> <li>• <b>Blood clotting</b>: Blood clotting system, Blood groups: Rh-factor, ABO and MN</li> <li>• Structure of mammalian heart</li> <li>• Cardiac cycle; Cardiac output and its regulation, Electrocardiogram, Blood pressure and its regulation</li> <li>• Structure of kidney and its functional unit; Mechanism of urine formation</li> </ul>	
<p><b>Unit IV</b></p>	<p><b>14</b></p>
<p><b>Chapter 7. Nervous System and Endocrinology in humans</b></p> <ul style="list-style-type: none"> <li>• Structure of neuron, resting membrane potential(RMP)</li> <li>• Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers. Types of synapse</li> <li>• <b>Endocrine glands</b> - pineal, pituitary, thyroid, parathyroid, pancreas and adrenal; hormones secreted by them.</li> <li>• Classification of hormones; Mechanism of Hormone action.</li> </ul>	
<p><b>Chapter 8. Muscular System in humans</b></p> <ul style="list-style-type: none"> <li>• Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus</li> </ul>	

### **Suggested Readings:**

1. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols I & 2: Wiley (2004)
4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, XI Edition, Hecourt Asia PTE Ltd. /W.B.Saunders Company. (2006).
6. Tortora, G.J. & Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume I & 2, 11th edition, CBS Publishers (2016).

### Zoology Semester II Core Course Lab Content

<b>Course Title/Code:</b> Biochemistry and Physiology	<b>Course Credits:</b> 2
<b>Course Code:</b> FSB470	<b>L-T-P per week:</b> 0-0-4
<b>Total Contact Hours:</b> 56	<b>Duration of ESA:</b> 3 Hours
<b>Formative AssessmentMarks:</b> 25	<b>Summative AssessmentMarks:</b> 25

#### Course Outcomes (COs):

- COs1-** At the end of the course the student should be able to understand:Basic structure ofbiomolecules through model making. **COs2-** Develop the skills to identify different types of blood cells.
- COs3-** Enhance basic laboratory skill like keen observation, analysis and discussion.
- COs4-** Learn the functional attributes of biomolecules in animal body.
- COs5-** Know uniqueness of enzymes in animal body and their importance through enzyme kinetics

## Course Content

<b>List of labs to be conducted</b>	<b>56Hours</b>
1. Preparation of models of nitrogenous bases- nucleosides and nucleotides.	
2. Preparation of models of amino acids and dipeptides.	
3. Preparation of models of DNA and RNA.	
4. Qualitative analysis of Carbohydrates, Proteins and Lipids.	
5. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid.	
6. Separation of amino acids or proteins by paper chromatography.	
7. Determination of the activity of enzyme (Urease)-Effect of [S] and determination of $K_m$ and $V_{max}$ .	
8. Determination of the activity of enzyme (Urease) - Effect of temperature and time.	
9. Action of salivary amylase under optimum conditions.	
10. Quantitative estimation of Oxygen consumption by fresh water Crab.	
11. Quantitative estimation of salt gain and salt loss by fresh water.	
12. Estimation of Hemoglobin in human blood using Sahli's haemoglobinometer	
12. Counting of RBC in blood using Hemocytometer	
13. Counting of WBC in blood using Hemocytometer	
14. Differential staining of human blood corpuscles using Leishman stain	
15. Recording of blood glucose level by using glucometer	
<b>Virtual Labs (Suggestive sites)</b>	
<a href="https://www.vlab.co.in">https://www.vlab.co.in</a> <a href="https://zoologysan.blogspot.com">https://zoologysan.blogspot.com</a> <a href="http://www.vlab.iitb.ac.in/vlab">www.vlab.iitb.ac.in/vlab</a> <a href="http://www.onlinelabs.in">www.onlinelabs.in</a> <a href="http://www.powershow.com">www.powershow.com</a> <a href="https://vlab.amrita.edu">https://vlab.amrita.edu</a> <a href="https://sites.dartmouth.edu">https://sites.dartmouth.edu</a>	

### **Text Books**

1. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols I & 2: Wiley (2004)
4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, XI Edition, Hecourt Asia PTE Ltd. /W.B.Saunders Company. (2006).
6. Tortora, G.J. & Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume I & 2, 11th edition, CBS Publishers (2016).

### **Web References:**

- Mammalian Physiology– [www.biopac.com](http://www.biopac.com)

### **TOPICS RECOMMENDED FOR SEMINAR/PROJECT REPORT**

1. Biochemical pathways, their evolutionary background and regulation.
2. Blood groups and their importance.
3. Vital enzymes for human body.
4. Essential and nonessential amino acids.
5. Important body lipids.
6. Significance of animal proteins.
7. Role of carbohydrates in animal body.
8. Nature of proteins and nurture of animal body.
9. Role of lipids in structural and functional organization of body.



**Scheme of Practical Examination**  
**II Semester BSc. Zoology**  
**Biochemistry and Physiology**  
**Course Code: FSB470**

**Time: 3 hours**

**Maximum marks:25M**

1. Biochemistry experiments by lots  
(Carbohydrates, Proteins & Lipids) **6 Marks**
2. Physiology experiments by lots  
(Nitrogenous wastes/ salivary amylase/ activity of urease enzyme). **6 Marks**
3. Differential staining of human blood corpuscles OR Estimation of blood glucose level **5 Marks**
4. Identify the spots A(Haemoglobinometer/ Haemocytometer/ Paper chromatography) **3Marks**
5. Model submission. **5Marks**

The candidate has to submit the duly certified record at the time of practical examination. The record is for the reference of the examiners, but not for assessment (since it is already assessed for IA)

**Assessment:****Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25

**Pedagogy: Written Assignment/Presentation/Seminar**

Formative Assessment - Theory	
Assessment Occasion	Weightage in Marks
House Examination/Test	$C1+C2=10+10=20$
Written Assignment/Presentation/Seminar	$10+10=20$
Total	40

**Pedagogy: Written Assignment/Presentation/Record/Seminar**

Formative Assessment- Practical	
Assessment Occasion	Weightage in Marks
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

## Open Elective Course Content

Semester: **II Zoology**

Course Title: <b>Parasitology</b>	Course Credits: <b>3</b>
Course Code: <b>FSB920</b>	
Total Contact Hours: <b>42</b>	Duration of ESA: 3 Hours
Formative Assessment Marks: <b>40</b>	Summative Assessment Marks: <b>60</b>

### Course Outcomes (COs):

At the end of the course the students will be able to:

**COs1-** Know the stages of the life cycles of the parasites and infective stages.

**COs2-** Develop ecological model to know population dynamics of parasite, establishment of parasite population in host body, adaptive radiations and methods adopted by parasite to combat with the host immune system.

**COs3-** Develop skills and realize significance of diagnosis of parasitic infection and treatment.

**COs4-** Understand about diseases caused by Protozoa, Helminthes, Nematodes and Arthropods at molecular level.

**COs5-** Develop their future career in medical sciences and related administrative services.

## Course Content

Content	42Hrs
<b>Unit – 1</b>	
<p><b>Chapter 1. General Concepts</b></p> <ul style="list-style-type: none"> <li>• Introduction, Parasites, parasitoids, host, zoonosis</li> <li>• Origin and evolution of parasites</li> <li>• Basic concept of Parasitism, symbiosis, phoresis, commensalisms and mutualism</li> <li>• Host-parasite interactions and adaptations</li> <li>• Life cycle of human parasites</li> <li>• Occurance, mode of infection and prophylaxis</li> </ul> <p><b>Chapter 2. Parasitic Platyhelminthes</b></p> <ul style="list-style-type: none"> <li>• Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of               <ul style="list-style-type: none"> <li>• <i>Fasciolopsisbuski</i></li> <li>• <i>Schistosomahaematobium</i></li> <li>• <i>Taeniasolium</i></li> <li>• <i>Hymenolepis nana</i></li> </ul> </li> </ul> <p><b>Chapter 3. Parasitic Protists</b></p> <ul style="list-style-type: none"> <li>• Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of               <ul style="list-style-type: none"> <li>• <i>Entamoebahistolytica</i></li> <li>• <i>Giardia intestinalis</i></li> </ul> </li> </ul>	<b>14</b>
<ul style="list-style-type: none"> <li>• <i>Trypanosomagambiense</i></li> <li>• <i>Plasmodium vivax</i></li> </ul>	
<b>Unit – 2</b>	
<p><b>Chapter 4. Parasitic Nematodes</b></p> <ul style="list-style-type: none"> <li>• Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of               <ul style="list-style-type: none"> <li>• <i>Ascarislumbricoides</i></li> <li>• <i>Ancylostomaduodenale</i></li> <li>• <i>Wuchereriabancrofti</i></li> <li>• <i>Trichinellaspiralis</i></li> </ul> </li> <li>• Nematode plant interaction ; Gall formation</li> </ul> <p><b>Chapter 5. Parasitic Arthropods</b></p> <ul style="list-style-type: none"> <li>• Biology, importance and control of               <ul style="list-style-type: none"> <li>• Ticks (Soft tick <i>Ornithodoros</i>, Hard tick <i>Ixodes</i>)</li> <li>• Mites(<i>Sarcoptes</i>)</li> <li>• Lice (<i>Pediculus</i>)</li> <li>• Flea (<i>Xenopsylla</i>)</li> </ul> </li> <li>• Bug (<i>Cimex</i>)</li> <li>• Parasitoid (Beetles)</li> </ul> <p><b>Chapter 6. Parasitic Vertebrates</b></p> <ul style="list-style-type: none"> <li>• Cookicutter Shark</li> <li>• Hood Mocking bird and Vampire bat and their parasitic behavior and effect on host</li> </ul>	<b>14</b>
<b>Unit – 3</b>	
	<b>14</b>

### **Chapter 7. Molecular diagnosis & clinical parasitology**

- General concept of molecular diagnosis for parasitic infection
- Advantages and disadvantages of molecular diagnosis
- Fundamental techniques used in molecular diagnosis of endoparasites
- Immunoassay or serological techniques for laboratory diagnosis of endoparasites on the basis of marker molecules like *G.intestinalis*, *B. coli*, *E. histolytica*, *L. donovani*, Malarial parasite using
  - ELISA, RIA
  - Counter Current Immunoelectrophoresis (CCI)
  - Complement Fixation Test (CFT) PCR, DNA, RNA probe

### **Suggested Readings:**

19. Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributors.
20. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea & Febiger.
21. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group.
22. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi.
23. Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers.
24. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS Publishers & Distributors (P) Ltd.
25. Gunn, A. and Pitt, S.J. (2012). Parasitology: an Integrated Approach. Wiley Blackwell.
26. Noble, E. R. and G.A. Noble (1982) Parasitology: The biology of animal parasites. V th Edition, Lea & Febiger.
27. Paniker, C.K.J., Ghosh, S. [Ed] (2013). Paniker's Text Book of Medical Parasitology. Jaypee, New Delhi.
28. Parija, S.C. Textbook of medical parasitology, protozoology & helminthology (Text and color Atlas), II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi.
29. Roberts, L.S and Janovy, J. (2009). Smith & Robert's Foundation of Parasitology. 8th. Edn. McGraw Hill.
30. Bogitsh, B. J. and Cheng, T. C. (2000). Human Parasitology. 2nd Ed. Academic Press, New York.
31. Chandler, A. C. and Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wiley and Sons Inc.
32. Cheng, T. C. (1986). General Parasitology. 2nd ed. Academic Press, Inc. Orlando. U.S.A.
33. Schmidt, G. D. and Roberts, L. S. (2001). Foundation of Parasitology. 3rd ed. McGraw Hill Publishers.
34. Schmidt, G. D. (1989). Essentials of Parasitology. Wm. C. Brown Publishers (Indian print 1990, Universal Book Stall).
35. John Hyde (1996) Molecular Parasitology Open University Press.
36. J Joseph Marr and Miklos Muller (1995) Biochemistry and Molecular Biology of Parasites 2 nd Edn Academic Press.

**Pedagogy:** Chalk and Talk, PPT, Group discussion, Seminar, Interaction, virtual lab, Lab visit

<b>Formative Assessment</b>	
<b>Assessment Occasion</b>	<b>Weightage in Marks</b>
<b>House Examination/Test</b>	<b>20</b>
<b>Written Assignment/Presentation/Project / Term Papers/Seminar</b>	<b>20</b>
<b>Total</b>	<b>40</b>

## Skill Enhancement Course Content

Semester: II Zoology

<b>Course Title:</b> Sericulture <b>Course Code:</b> VEC5ZOOP2	<b>Course Credits:</b> 2
<b>Total Contact Hours:</b> 56 Hours	<b>Duration of ESA:</b> 3 Hrs.
<b>Formative Assessment Marks:</b> 20	<b>Summative Assessment Marks:</b> 30

### Course Outcomes (COs):

At the end of the course the student acquires the following knowledge:

**COs1-** Sericulture is an agro-based industry which gives economic empowerment to the students.

**COs2-** Sericulture may be taken up as a small scale industry by the small farmers and unemployed youth.

**COs3-** Get jobs in teaching profession, silk board and other Govt. institutions as technicians. Student can be self-employed after successful completion of the course

### Course Content

<b>List of Lab to be conducted</b>		<b>42 Hrs</b>
<b>1</b>	Morphology and taxonomy of mulberry.	
<b>2</b>	Raising of saplings – cutting preparation, planting and maintenance of nursery.	
<b>3</b>	Agronomical practices in mulberry cultivation-weeding, manuring, irrigation and harvesting.	
<b>4</b>	Diseases and pests of mulberry.	
<b>5</b>	Silk producing insects – non mulberry and mulberry silk worms.	
<b>6</b>	Life cycle and morphology of <i>Bombyxmori</i> .	
<b>7</b>	Dissection of digestive system and silk glands of <i>Bombyxmori</i> .	
<b>8</b>	Silk worm rearing equipments.	
<b>9</b>	Rearing process – incubation, chawki rearing, late age worm rearing, mounting and harvesting of cocoons.	
<b>10</b>	Silk worm diseases and pests – Grasserie, Flacherie, Muscardine, Pebrine, Uzi fly and Beetles.	
<b>11</b>	Grainages – production of silk worm eggs.	
<b>12</b>	Physical and commercial characteristics of cocoons.	
<b>13</b>	Reeling and weaving process – stiffling , cooking , brushing, reeling and re-reeling, different types of looms.	
<b>14</b>	Visit to mulberry farm and sericulture centre.	
<b>15</b>	Economics of silk production (Project)	



### Text Books and References

1. Govindan , R.,Narayanswami,T.K and Devaiah, M.C.1998,Principles of silk worm pathology.Ser Publishers ,Banglore.
2. Tazima, Y.1964 -The genetics of the silk worm|| Logos Press Ltd.London .
3. Tazima Y 1978 The silk worm an important laboratory tool Kodnasha Ltd. Tokyo.
4. Ganga G ,SulochanaChetty J An introduction to sericulture Oxford and IBH Publishing Co.Pvt. Ltd. New Delhi.
5. Ullal and Narasimhanna Hand book of practice sericulture .
6. FAO Manuals on sericulture vol . 1-4.
7. Tazima Y 1958 Silkworm egg CSB Publication ,Bombay .
8. Yashimoro Tanaka 1964 Sericology CSB Publication , Bombay.

### Pedagogy

1. Demonstration
2. Assignment
3. Group discussion
4. Field Visit.
5. Use of Audio-Visual aids.

<b>Formative Assessment</b>	
<b>Assessment Occasion</b>	<b>Weightage in Marks</b>
Class Test	10
Attendance and Assignments	05
Visit to Mulberry Farm and Sericulture centre.	05
<b>Total</b>	<b>20</b>

# **Model Curriculum Structure for Degree Program B.Sc., Hons in Zoology**

**Name of the Degree Program:** B. Sc., Hons

**Discipline Core:** Zoology

**Total Credits for the Program:** 50/100/142/184/268

**Starting year of implementation:** 2021-22 (I & II sem) ,2022-23 (III & IV sem)

## **PROGRAM OBJECTIVES (POs)**

**POs1-** The Program offers both classical as well as modern concepts of Zoology in higher education.

**POs2-** It enables the students to study animal diversity in both local and global environments.

**POs3-** To make the study of animals more interesting and relevant to human studies more emphasis is given to branches like behavioral biology, evolutionary biology and economic Zoology.

**POs4-** More of upcoming areas in cell biology, genetics, molecular biology, biochemistry, genetic engineering and bioinformatics have also been included.

**POs5-** Equal importance is given to practical learning and presentation skills of students.

**POs6-** The lab courses provide the students necessary skills required for their employability.

**POs7-** Skill enhancement courses in classical and applied branches of Zoology enhance enterprising skills of students.

**POs8-** The global practices in terms of academic standards and evaluation strategies.

**POs9-** Provides opportunity for the mobility of the student both within and across the world.

**POs10-** The uniform grading system will benefit the students to move across institutions within India to begin with and across countries.

**POs11-** It will also enable potential employers in assessing the performance of the candidates across the world.

**Semester III- Zoology Core Course Content**  
**Zoology: Paper-III: Molecular Biology,**  
**Bioinstrumentation & Techniques in Biology**

<b>Course Title/Code: Molecular Biology, Bioinstrumentation &amp; Techniques in Biology</b>	<b>Course Credits: 4</b>
<b>Course Code: FSC470</b>	<b>L-T-P per week: 4-0-0</b>
<b>Total Contact Hours: 56</b>	<b>Duration of ESA: 3 Hours</b>
<b>Formative Assessment Marks: 40</b>	<b>Summative Assessment Marks: 60</b>

**Course Outcomes (COs):**

At the end of the course the student should be able to understand:

**CO1-** After successful accomplishment of the course, the learners will be able to acquire better understanding and comprehensive knowledge regarding most of the essential aspects of Molecular Biology subject which in turn will provide a fantastic opportunity to develop professional skill related to the field of molecular biology.

**CO2-** The course will mainly focus on the study of principal molecular events of cell incorporating DNA Replication, Transcription and Translation in prokaryotic as well as eukaryotic organisms.

**CO3-** Acquiring knowledge on instrumentation and techniques in biology.

Content	Hours
<b>Unit I</b>	<b>14</b>
<b>Chapter 1: Process of Replication and Transcription</b> <ul style="list-style-type: none"> <li>• Fine structure of gene (Cistron, Recon, Muton)</li> <li>• DNA polymerase types and function.</li> <li>• Semiconservative model of replication.</li> <li>• Replication in Prokaryotes (Initiation, Elongation, Termination)</li> <li>• RNA polymerases - types and functions</li> <li>• Transcription in prokaryotes and eukaryotes</li> </ul>	8
<b>Chapter 2: Process of Translation</b> <ul style="list-style-type: none"> <li>• Genetic code and its salient features</li> <li>• Translation in prokaryotes and eukaryotes</li> </ul>	6
<b>Unit II</b>	<b>14</b>
<b>Chapter 3. Regulation of gene expression-I</b> <ul style="list-style-type: none"> <li>• Regulation of gene expression in prokaryotes- lac operon (inducible) and trp operon(repressible) in <i>E. coli</i></li> <li>• Regulation of gene expression in eukaryotes - Role of chromatin (euchromatin andheterochromatin) in gene expression</li> <li>• Post-transcriptional modification: capping, splicing, polyadenylation</li> <li>• Concept of RNA editing (mRNA), gene silencing, and, RNAi</li> </ul>	9
<b>Chapter 4. Regulation of gene expression-II</b> <ul style="list-style-type: none"> <li>• Post-translational modifications: purpose, advantages, and significance; glycosylation, methylation, phosphorylation, and acetylation.</li> <li>• Intracellular protein degradation (lysosomal autophagy and ubiquitin proteosome pathway).</li> </ul>	5
<b>Unit III</b>	<b>14</b>
<b>Chapter 5: Microscopy</b> <ul style="list-style-type: none"> <li>• Principles and applications of Light microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Confocal microscopy and Electron microscopy (SEM and TEM).</li> </ul>	9
<b>Chapter 6: Centrifugation and Chromatography</b> <ul style="list-style-type: none"> <li>• Centrifugation: Principles, types, and applications (High speed and Ultracentrifugation)</li> <li>• Chromatography : Principle and applications of: TLC, HPLC and GC</li> </ul>	5
<b>Unit IV</b>	<b>14</b>
<b>Chapter 7: Biochemical Instrumentation</b> <ul style="list-style-type: none"> <li>• Colorimetry and Spectrophotometry: Beer-Lambert's law, Absorption spectrum, UV-VL Spectrophotometer.</li> <li>• pH meter, measurement of pH</li> <li>• Principle, applications and safety measures of Radio-tracer techniques - Autoradiography.</li> </ul>	6

<p><b>Chapter 8: Molecular Techniques</b></p> <ul style="list-style-type: none"> <li>• Principle and applications of Agarose gel-electrophoresis, SDS-PAGE, DNA Sequencing (Sanger's Dideoxy method)</li> <li>• PCR, DNA Fingerprinting, ELISA, Southern &amp; Northern Blotting and Western Blotting.</li> </ul>	8
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**Suggested Readings:**

1. Griffiths A J F, H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart 2000. An introduction to genetic analysis. W. H. Greeman. New York.
2. Lewin, B 2003 Genes VIII. Oxford University Press. Oxford
3. Dale, Jeremy W and Schantz, Malcom V. 2002. From Gene to Genomes. John Wiley and Sons Ltd, NY, USA
4. Das, H.K. 2007. Text book of Biotechnology. Wiley India Pvt. Ltd. New Delhi
5. Freshney, Ian, R. 2006. Culture of Animal Cell (5th edn). Wiley- Liss publications
6. Pandian, T.T. and Kandavel, D. 2008. Text Book of Biotechnology. I.K International Publishing House, New Delhi. 47
7. Primrose, S.B., Twyman, R.M., and Old, R.W. 2001. Principle of Gene Manipulation (6th edn). Blackwell Science Ltd, London
8. Singh .B.D. 2006. Biotechnology. Kalyani Publishers, New Delhi
9. Sobti, R. C. and Pachauri, Suparna S. 2009. Essentials of Biotechnology. Ane Books Pvt. Ltd. New Delhi

**Semester III- Zoology Core Course I Content:**  
**Zoology: Paper-III: Molecular Biology, Bioinstrumentation and Techniques in Biology**

<b>Course Title: Molecular Biology, Bioinstrumentation and Techniques in Biology</b>	<b>Course Credits: 2</b>
<b>Course Code: FSC470</b>	<b>L-T-P per week: 0-0-4</b>
<b>Total Contact Hours: 56</b>	<b>Duration of ESA: 3 Hours</b>
<b>Formative Assessment Marks: 25</b>	<b>Summative Assessment Marks: 25</b>

**Course Outcomes (COs):**

At the end of the course the student should be able to:

**COs1-**At the end of the course, students will be able to understand the applications of biophysics and principle involved in bio-instruments.

**COs2-**Understand the methodology involved in bio techniques.

**COs3-** Students can demonstrate knowledge and practical skills of using instruments in biology and medical field.

**COs4-** They can perform techniques involved in molecular biology and diagnosis of diseases.

## Lab Course Content

List of experiments	14 units (1unit- 4hrs)
1. To study the principle and applications of simple, compound and binocular microscopes.	1
2. To study the principle and applications of various lab equipments- Ph meter Electronic balance, Vortex mixer, use of glass pipette and micropipettes, Laminar air flow Incubator, shaker, Water bath and centrifuge	2
3. To prepare Buffer solutions (Phosphate, Citrate, Tris-HCl buffer)	1
4. To estimate amount of RNA by Orcinol method.	2
5. Demonstration of differential centrifugation to fractionate components in a given mixture.	1
6. To estimate amount of protein by Lowry's method.	2
7. To identify different unknown amino acids using ascending paper chromatography.	1
8. Extraction of DNA from the given animal tissue sample.	2
9. To estimate amount of DNA by di-phenyl amine (DPA) method.	2

### Suggested Readings:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. *Molecular Biology of the Cell*, 4th edition. New York: Garland Science (2002).
2. Daniel L. Hartl and Maryellen Ruvolo. *Genetics: Analysis of Genes and Genomes*, 8th Edition. Burlington, Mass.: Jones & Bartlett Learning (2012).
3. Gerald Karp. *Cell and Molecular Biology: Concepts and Experiments*, 5th Edition. Wiley Publication (2008).
4. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Freeman. *Molecular Cell Biology*, 5th edition. W. H. & Company (2003).
5. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick. *Molecular Biology of the Gene*, 5th edition. Cold Spring Harbor Laboratory Press (2003).
6. Stryer, Lubert. *Biochemistry*, 2nd Edition. W. H. Freeman and Company, New York (1981)

**Scheme of Practical Examination BSc.  
Zoology III Semester**

**Core Subject: Molecular Biology, Bioinstrumentation and Techniques in Biology**

**Duration: 3 hours**

**Max. marks: 25**

- |   |        |
|---|--------|
| 1. Extraction of DNA from the given animal tissue<br>OR<br>Estimation of DNA / RNA / Proteins     | 10M    |
| 2. Separate and Identify the given unknown amino acids by using ascending<br>paper Chromatography | 07M    |
| 3. Identify and give the working principle of the s spotters A and B                              | 4X2-8M |



**Assessment:**

**Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25

**Pedagogy: Written Assignment/Presentation/Seminar**

Formative Assessment – Theory	
Assessment Occasion	Weightage in Marks
House Examination/Test	$C1+C2=10+10=20$
Written Assignment/Presentation/Seminar	$10+10=20$
Total	40

**Pedagogy: Written Assignment/Presentation/Record/Seminar**

Formative Assessment- Practical	
Assessment Occasion	Weightage in Marks
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

## Open Elective Course Content

### Semester: III

Course Title: <b>ENDOCRINOLOGY</b> Course Code: FSC920	Course Credits: <b>3</b>
Total Contact Hours: <b>42</b>	Duration of ESA: 3 Hours
Formative Assessment Marks: <b>40</b>	Summative Assessment Marks: <b>60</b>

#### Course Outcomes (Cos):

##### At the end of the course the student should be able to:

Differentiate among endocrine, paracrine and autocrine systems.

**COs 1-** Describe the different classes and chemical structures of hormones.

**COs 2-** Identify the glands, organs, tissues and cells that synthesize and secrete hormones, hormone precursors and ass

**COs 3-** Identify and discuss the integration of the endocrine system in general with focus on specific interactions.

**COs 4-** Explain the consequences of under- and overproduction of hormones.

## Course Content

Content	Hrs.
<b>Unit I</b>	<b>14</b>
<p><b>Chapter 1. About Endocrine glands</b></p> <ul style="list-style-type: none"> <li>• Endocrine glands and classifications of hormones.</li> <li>• Characteristics and Transport of Hormones.</li> </ul> <p><b>Chapter 2. Hypothalamus-Hypophysis</b></p> <ul style="list-style-type: none"> <li>• Hypothalamus as a neuroendocrine organ</li> <li>• Pituitary – Structure and functions</li> <li>• Chemical nature, mode of action, and functions of pituitary hormones.</li> <li>• Pituitary disorders</li> </ul> <p><b>Chapter 3. Pineal gland</b></p> <ul style="list-style-type: none"> <li>• Structure and functions of Pineal gland.</li> <li>• Hypo- and hyperactive states of the gland.</li> </ul>	
<b>Unit II</b>	<b>14</b>
<p><b>Chapter 4. Thyroid and parathyroid</b></p> <ul style="list-style-type: none"> <li>• Histological structure of the glands.</li> <li>• Chemical nature, mode of action, and functions of the hormones.</li> <li>• Hypo- and hyperactive states of the glands.</li> </ul> <p><b>Chapter 5.: Adrenal cortex and medulla –</b></p> <ul style="list-style-type: none"> <li>• Histological structure of the gland. Chemical nature, and functions of hormones</li> <li>• Hypo- and hyperactive states of the gland.</li> </ul> <p><b>Chapter 6. Prostaglandins and their function</b></p>	
<b>Unit – III</b>	<b>14</b>
<p><b>Chapter 7: Pancreas:</b></p> <ul style="list-style-type: none"> <li>• Pancreatic islets - histological structure.</li> <li>• Chemical nature, and function of pancreatic hormones. Hormonal control of blood sugar.</li> <li>• Hyperinsulinism and diabetes mellitus.</li> </ul> <p><b>Chapter 8: Gastro-intestinal hormones –</b> Functions and regulation of secretion.</p> <p><b>Chapter 9: Different types of Rhythms –</b></p> <ul style="list-style-type: none"> <li>• Ultradian, circadian, infradian. different zeitgebers and their relation with circadian clock</li> <li>• Neural basis of biological clock and role of suprachiasmatic nuclei. Sleep- wakefulness cycle. Time keeping genes. Jet-lag and shift work.</li> </ul>	

### Text Books & Suggested Readings:

1. William's Text Book of Endocrinology Larsen et al.: An Imprint of Elsevier.
2. Endocrinology, Mac E. Hadley, Pearson Education.
3. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
4. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
5. Concise Medical Physiology by S.K. Chaudhuri, New Central Book Agency.
6. Endocrinology. Vols.I, II and III by L.O. DeGroot. W.B. Saunders Co.
7. The Physiology of Reproduction, Vols.I & II, by E. Knobil and J.D. Neil. Raven Press.
8. Guyton and Hall. Textbook of Medical Physiology. 13th Edition.
9. Histology: A Text and Atlas. Sixth Edition. Ross & Pawlina. Lippincott Williams & Wilkins.
10. Vertebrate Endocrinology by David O. Norris.

**Course Books published in English and Kannada may be prescribed by the Universities and**

**Colleges.Pedagogy:** Chalk and Talk, PPT, Group discussion, Seminar.

<b>Formative Assessment</b>	
<b>Assessment Occasion</b>	<b>Weightage in Marks</b>
Class Test	10
Attendance and Assignments	05
Visit to Mulberry Farm and Sericulture centre.	05
<b>Total</b>	<b>20</b>

**Semester IV- Zoology Core Course IV  
Content:**

**Paper : IV Gene Technology Immunology and Computational Biology**

<b>Course Title:</b> Gene Technology Immunology and Computational Biology	<b>Course Credits:</b> 4
<b>Course Code:</b> FSD470	<b>L-T-P per week:</b> 4-0-0
<b>Total Contact Hours:</b> 56	<b>Duration of ESA:</b> 3 Hrs.
<b>Formative Assessment Marks:</b> 40	<b>Summative Assessment Marks:</b> 60

**Course Outcomes (COs):**

**At the end of the course the student should be able to:**

**COs1-** Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA techn

**COs2-** An understanding on application of genetic engineering techniques in basic and applied experimental biology.

**COs3-** To acquire a fundamental working knowledge of the basic principles of immunology.

**COs4-** To understand how these principles, apply to the process of immune function.

**COs5-** Use, and interpret results of, the principal methods of statistical inference and design; helps to communicate the res

<b>Course Content</b>	<b>Hours</b>
<b>Unit I</b>	<b>14</b>
<b>Chapter 1: Principles of Gene Manipulation</b> <ul style="list-style-type: none"> <li>● Recombinant DNA Technology: Introduction, steps involved.</li> <li>● Restriction Enzymes and Ligases and Nucleic acid modifying enzyme.</li> <li>● Gene cloning Vector: Concept of plasmids-pBR322, Lamda phage vectors,cosmids</li> <li>● Gene transfer techniques (Direct and indirect : Transformation, Transfection, Electroporation).</li> <li>● Screening and selection of recombinant colonies</li> </ul>	07
<b>Chapter 2: Applications of Genetic Engineering</b> <ul style="list-style-type: none"> <li>● Transgenic animals (Transgenic cow, Transgenic Fish); Transgenic plants(cry protein); Gene silencing (Knock out and Knock in mouse).</li> <li>● Production of Human Recombinant insulin and</li> <li>● Hybridoma technology: Synthesis and applications of Monoclonalantibodies</li> <li>● Gene Therapy (SCID)</li> <li>● Biosensors and its applications</li> </ul>	07
<b>Unit II</b>	<b>14</b>
<b>Chapter 3: Introduction to the Immune System</b> <ul style="list-style-type: none"> <li>● Defence against diseases: Introduction, First and second line of defense,</li> <li>● Types of Ummunity: Innate and acquired immunity; Humoral immunity and cell mediated immunity</li> <li>● Antigen presenting cells (APC's), Role of Band T-lymphocytes (), primary and secondary immune response.</li> <li>● Functional aspects of organs of the Immune system - Thymus and bone marrow, spleen, Lymph Node.</li> </ul>	07
<b>Chapter 4: Antigens and Antibodies</b> <ul style="list-style-type: none"> <li>● Antigens and haptens: Properties (foreignness, molecular size, heterogeneity).</li> <li>● B and T cell epitopes.</li> <li>● Structure of IgG and functions of different classes of immunoglobulins.</li> <li>● Major histocompatibility complex - Structure of MHC I &amp; II.</li> </ul>	07
<b>Unit III</b>	<b>14</b>
<b>Chapter 5: Clinical Immunology</b> <ul style="list-style-type: none"> <li>● Immunity against diseases of viral, bacterial and protozoan infections.</li> <li>● Vaccines: Types and Uses - Immunization schedule for children.</li> <li>● Transplantation immunology: Transplantation of organ- Types, graft rejection and Immuno-suppressors.</li> </ul>	07
<b>Chapter 6: Bioinformatics</b> <ul style="list-style-type: none"> <li>● Databases: Sequence and structural</li> </ul>	07

<ul style="list-style-type: none"> <li>Sequence analysis (homology): Pairwise and Multiple Sequence alignment- BLAST, CLUSTALW, Sequence alignment-FASTA.</li> <li>Scope and applications of Bioinformatics.</li> </ul>	
<b>Unit IV</b>	<b>14</b>
<b>Chapter 7: Biostatistics I</b> <ul style="list-style-type: none"> <li>Measures of central tendency: Mean, Median, Mode.</li> <li>Data summarizing: Frequency distribution, Graphical presentation - bar diagram, pie diagram, histogram.</li> <li>Elementary idea of probability and its applications.</li> </ul>	<b>07</b>
<b>Chapter 8: Biostatistics II</b> <ul style="list-style-type: none"> <li>Measures of dispersion: Range, Standard Deviation, Variance.</li> <li>Correlation and Regression.</li> <li>Tests of significance: F-test, ANOVA, t-test and Chi square test.</li> </ul>	<b>07</b>

**Topics Suggested for Assignment/ Formative Assessment:**

1. Q/A, Short Question, Quiz, MCQ, Assignment etc.

**Recommended Books:**

1. Primrose & Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl & Jones. Genetics: principles & Analysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook et al. Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. Clark & Switzer. Experimental Biochemistry. Freeman (2000)
6. Sudbery. Human Molecular Genetics. Prentice-Hall (2002).
7. Wilson. Clinical Genetics-A Short Course, Wiley (2000).
8. Pasternak. An Introduction to Molecular Human Genetics. Fritzgerald (2000).
9. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc., Delhi
10. Statistical Methods (Eighth Edition) by G. W. Snecdecor and W. G. Cochran, Willey Blackwell
11. Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley
12. Introductory Biological Statistics (Fourth Edition) by John E. Havel, Raymond E. Hampton and Scott J. Meiners
13. Westhead et al Bioinformatics: Instant Notes. Viva Books (2003)
14. Genetic engineering: Sandhya Mitra BITS, Pilani
15. Principles of Biostatistics Khan and Khanam
16. Transgenic animals: Ranga

### Zoology Semester IV Core Course Lab Content

<b>Course Title:</b> Gene Technology Immunology and Computational Biology	<b>Course Credits:</b> 2
<b>Course Code:</b> FSD470	<b>L-T-P per week:</b> 0-0-4
<b>Total Contact Hours:</b> 56	<b>Duration of ESA:</b> 3 Hrs.
<b>Formative Assessment Marks:</b> 40	<b>Summative Assessment Marks:</b> 60

#### Course Outcomes (COs):

At the end of the course the student should be able to:

**COs1-** Accurately, safely and appropriately use all the equipment regularly used in Molecular Biology(DNA manipulation, inclusion

**COs2-** Prepare chemical solution and reagents to the precision appropriate to the task.

**COs3-** Demonstrate knowledge of the biochemical basis underpinning the molecular biology techniques.



### Lab IV Course Content

List of labs to be conducted	Hours
<ol style="list-style-type: none"><li>1. Calculate the mean, median, mode and standard deviation (with suitable examples).</li><li>2. Measure the height and weight of all students in the class and apply statistical measures (Frequency distribution, Bar diagram, pie diagram, histogram)</li><li>3. With Suitable data, apply tests of significance : Chi-square test and student t-test</li><li>4. Determination of ABO Blood group and Rh factor.</li><li>5. Demonstration of agarose gel electrophoresis for detection of DNA.</li><li>6. To study Restriction enzyme digestion using teaching kits (Demonstration only).</li><li>7. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits (Demonstration only).</li><li>8. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins.</li><li>9. To calculate molecular weight of unknown DNA and protein fragments from gel pictures. (<a href="https://youtube/mCiCiO0cfbg">https://youtube/mCiCiO0cfbg</a>)</li><li>10. To learn nucleotide sequence database.</li><li>11. To learn sequence alignment: Pairwise alignment (Protein/ DNA).</li></ol>	

**Scheme of Practical  
Examination BSc. Zoology  
IV Semester  
Zoology Core Subject: Gene Technology**

**Duration: 3 hours**

**Max. marks: 25**

- |   |     |
|---|-----|
| 1. Determine the blood group of the given sample and comment  | 05M |
| 2. Problem on practical 1&2   | 06M |
| 3. Problem on practical 3   | 06M |
| 4. Identify and comment on the given spotters A and B<br>(PCR/PAGE/Restriction enzyme kit/FASTA/BLAST/Database) | 08M |

**Assessment:**

**Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25

**Pedagogy: Written Assignment/Presentation/Seminar**

Formative Assessment - Theory	
Assessment Occasion	Weightage in Marks
House Examination/Test	$C1+C2=10+10=20$
Written Assignment/Presentation/Seminar	$10+10=20$
Total	40

**Pedagogy: Written Assignment/Presentation/Record/Seminar**

Formative Assessment- Practical	
Assessment Occasion	Weightage in Marks
Internal assessment C1	10
Internal assessment C2	10
Class record	05
Total	25

**Open Elective Course Content**  
Semester: IV Zoology

Course Title: <b>Animal Behaviour</b> Course Code: FSD920	Course Credits: <b>3</b>
Total Contact Hours: <b>42</b>	Duration of ESA: 3 Hours
Formative Assessment Marks: <b>40</b>	Summative Assessment Marks: <b>60</b>
Model Syllabus Authors:	

**Course Outcomes (COs):**

At the end of the course the students will be able to:

**COs1-** Examine and critically to evaluate the emergence of ideas that have shaped how we observe and collect data on

**COs2-** Understand the main historical ideas that underpin animal behaviour theory

**COs3-** Critically review hypotheses to explain animal behavior

**COs4-** Understand different methods for collecting data on animal behavior

**COs5-** Have advanced their written and oral presentation skills.

## Course Content

Content	42Hrs
<b>Unit – 1</b>	
<p><b>Chapter 1.: Introduction to Animal Behaviour</b></p> <ul style="list-style-type: none"> <li>• Brief contributions of Karl Von Frisch, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.</li> <li>• Proximate and ultimate causes of behaviour.</li> </ul> <p><b>Chapter 2. Patterns of Behaviour</b></p> <ul style="list-style-type: none"> <li>• Stereotyped Behaviors - Orientation and Reflex.</li> <li>• Individual Behavioural patterns: Instinct and Learned Behaviour</li> <li>• Associative learning, classical and operant conditioning, Habituation, Imprinting.</li> </ul>	<b>14</b>
<b>Unit – 2</b>	
<p><b>Chapter 3. Social Behaviour:</b></p> <ul style="list-style-type: none"> <li>• Social organization in termites and honey bees.</li> <li>• Social behaviour: Altruism.</li> <li>• Conflict behaviour.</li> </ul> <p><b>Chapter 4. Sexual Behaviour</b></p> <ul style="list-style-type: none"> <li>• Sexual dimorphism, Mate choice in peacock.</li> <li>• Intra-sexual selection (male rivalry in red deer).</li> <li>• Kinship theory: Relatedness &amp; inclusive fitness.</li> <li>• Parental care in fishes (Nest Building &amp; cost benefit)</li> </ul>	<b>14</b>
<b>Unit – 3</b>	
<p><b>Chapter 5. Chronobiology</b></p> <ul style="list-style-type: none"> <li>• Brief historical developments in chronobiology.</li> <li>• Adaptive significance of biological clocks.</li> <li>• Biological Rhythms</li> </ul> <p><b>Chapter 6: Communications in animals</b></p> <ul style="list-style-type: none"> <li>• Bioluminescence in deep sea fishes and insects</li> <li>• Territoriality in Monkeys and Dogs</li> <li>• Role of pheromones in animal communication- Insects and Vertebrates,</li> <li>• Communication in Honey bees (Waggle Dance)</li> </ul>	<b>14</b>

### Suggested Readings:

1. Animal Behaviour by Drickamar.
2. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
3. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
4. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey(ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
5. Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barends and Noble Inc. New York, USA
6. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

**Pedagogy:** Chalk and Talk, PPT, Group discussion, Seminar, Interaction, virtual lab, Lab visit

<b>Formative Assessment</b>	
<b>Assessment Occasion</b>	<b>Weightage in Marks</b>
Class Test	10
Attendance and Assignments	05
Visit to Mulberry Farm and Sericulture centre.	05
<b>Total</b>	<b>20</b>

# Choice Based Credit System (CBCS) Syllabus for Undergraduate Zoology subject 2022-23

## DISCIPLINE CENTRIC ELECTIVE COURSE

### V SEMESTER ZOOLOGY

#### APPLIED ZOOLOGY

##### THEORY

(CREDITS 4)

#### Unit I

12 hrs

##### Introduction to Host-parasite Relationship

Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis

##### Epidemiology of Diseases

Transmission, Prevention and control of diseases: Tuberculosis, typhoid

##### Rickettsiae and Spirochaetes

Brief account of *Rickettsia prowazekii*, *Borrelia recurrentis* and *Treponema pallidum*

#### Unit II

12 hrs

##### Parasitic Protozoa

Life history, pathogenicity and preventive measures of *Entamoeba histolytica*, *Plasmodium vivax*, *Trypanosoma gambiense* and *Leishmania donovani*

##### Parasitic Helminthes

Life history and pathogenicity of *Ancylostoma duodenale*, *Wuchereria bancrofti*, Tape worm and *Liver fluke*.

#### Unit III

12 hrs

##### Insects of Economic Importance

Biology, Control and damage caused by *Helicoverpa armigera* (cotton boll worm), *Pyrilla perpusilla* (sugar cane leaf hopper), *Papilio demoleus* (lime butterfly), *Callosobruchus chinensis* (beetle), and *Tribolium castaneum* (red flour beetle) Lac insect.

**Sericulture**- Types of silks and distribution.

**Apiculture**- Types of honey bees, products, byproducts and their usage. Pollination and insects with examples.

#### Unit IV

12 hrs

##### Animal Husbandry

Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle

##### Poultry Farming

Principles of poultry breeding, Management of breeding stock and broilers, processing and preservation of eggs

##### Fish Technology

Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed.

#### Unit V

12 hrs

##### A. Insect Vector Biology

Introduction to vector biology, economic importance and control of fleas, lice, bugs, mosquitoes, flies and parasitoids. Vector-parasite interaction; host-pathogen interaction.

**B. Medical Zoology:**

Infectious/ communicable diseases: small pox, hepatitis, AIDS, influenza, SARS, Ebola, tuberculosis, plague, cholera, amoebiasis, malaria, dengue, chikungunya, trypanosomiasis, and elephantiasis.(pathogen. Vector, transmission, symptoms and prevention)



## V SEMESTER ZOOLOGY

### PRACTICAL –V

### APPLIED ZOOLOGY

#### PRACTICAL

(CREDITS 2)

1. Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*, *Aedes* and *Xenopsylla*.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of *Helicoverpa (Heliothis) armigera*, *Papilio demoleus*
5. Demonstration of Plastination techniques by using some dead insects.
6. Maintenance of freshwater aquarium.
7. Collection and mounting of Ants.
8. Animal associations: - Mutualism – Termites and *Trichonympha*.
9. Commensalism – Echenies and shark.  
Protocooperation – Hermit crab and Sea anemone.
10. Predation – Snake and Frog. Parasitism – Head louse, Bed bug, Mosquito, Ticks, Mites.
11. Identification of mulberry and non mulberry silkworms. Identification of different larvae of silk worm- Using specimens / pictures
12. Identification of food fishes of Karnataka.
13. Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm- submission of any 1 Report.
14. Repetition.

#### SUGGESTED READINGS

1. Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications
2. Atwal, A.S. (1986). Agricultural Pests of India and South East Asia, Kalyani  
CBCS Undergraduate Program in Zoology
4. Dennis, H. (2009). Agricultural Entomology. Timber Press (OR).
5. Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic  
Approaches.CABI publications, U.K.
6. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
7. Kumar and Corton. Pathological Basis of Diseases.
8. Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers.
9. Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.

## **V SEMESTER ZOOLOGY**

### **PRACTICAL –V**

### **APPLIED ZOOLOGY**

#### **Scheme of Practical Examination**

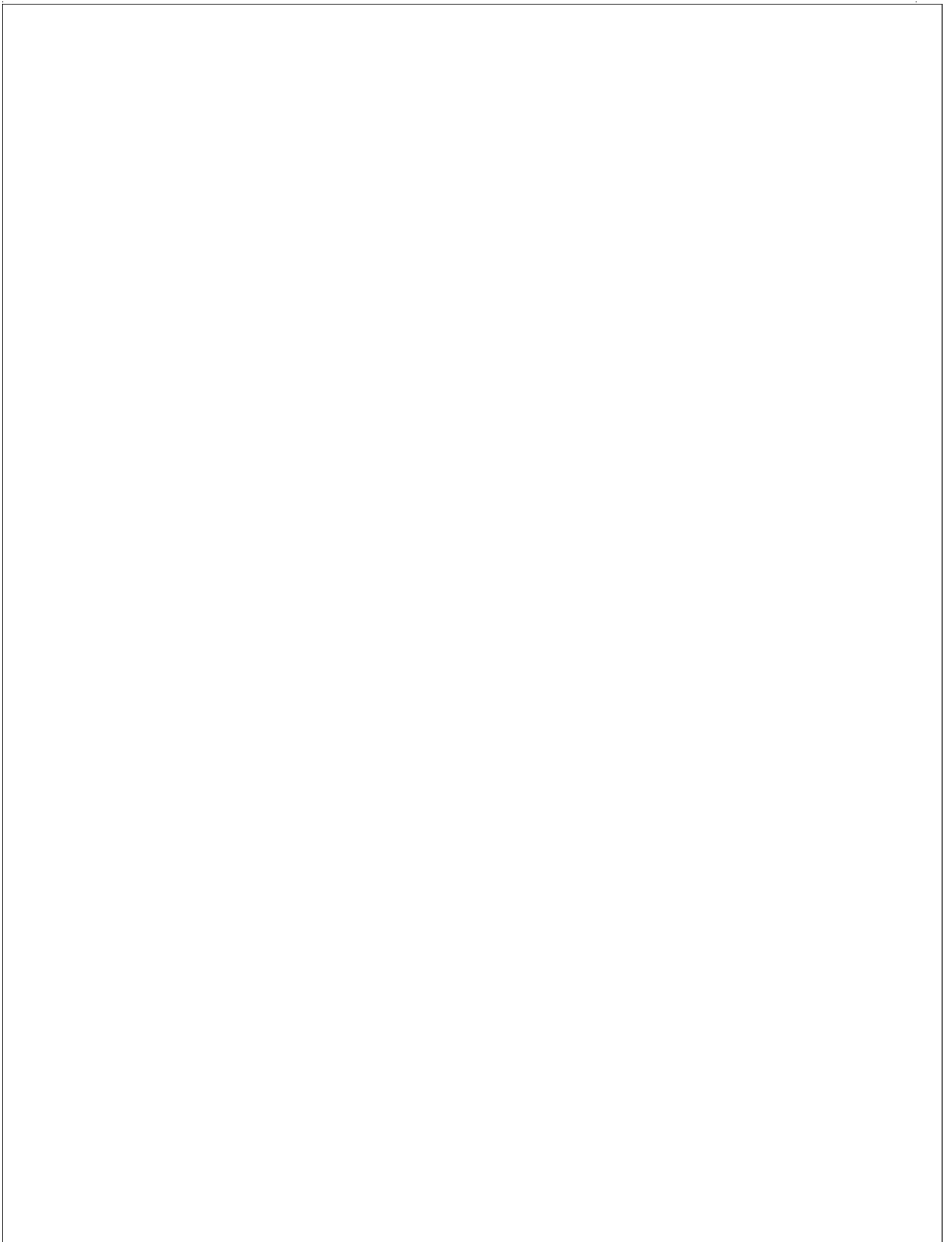
Duration 3 Hours

Max Marks: 70

- |   |          |
|---|----------|
| 1. Identification of parasites A to F (6x4)<br>(3 from I and II, 3 from III and IV) | 24 Marks |
| 2. Identify and comment upon animal association G & H(5X2)                          | 10 Marks |
| 3. Identification of mulberry and non mulberry silkworms I&J(3X2)                   | 06 Marks |
| 4. Identification of food fishes of Karnataka K&L(3X2)                              | 06 Marks |
| 5. Identification of different larvae of silk worm-<br>Using specimens / pictures   | 04 Marks |
| 1. Report submission  | 10 Marks |
| 2. Class record.  | 10 Marks |

#### **SCHEME OF VALUATION FOR PRACTICAL -V**

1. Identification –01, Classification-01,Diagram – 01,Comment–01
2. Identification – 01,Diagram – 02, Comment-02
3. Identification –01, Diagram – 01, Comment- 01
4. Identification – 01, Diagram – 01, Comment- 01
5. Identification – 01, Diagram – 01, Comment- 02



# DISCIPLINE SPECIFIC ELECTIVE COURSE

## V SEMESTER ZOOLOGY

### INSECT, VECTORS AND DISEASES

**THEORY**

**(Credits 4)**

#### **Unit I**

##### **Introduction to Insects**

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

**Concept of Vectors :** Brief introduction of Carrier and Vectors (mechanical and biological vector),

Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

#### **Unit II**

##### **Insects as Vectors**

Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

#### **Unit III**

##### **Dipteran as Disease Vectors**

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies;

Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes

Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly

Study of house fly as important mechanical vector, Myiasis, Control of house fly

#### **Unit IV**

##### **Siphonaptera as Disease Vectors**

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases –Plague, Typhus fever; Control of fleas

#### **Unit V**

##### **Siphunculata as Disease Vectors**

Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

#### **Unit VI**

##### **Hemiptera as Disease Vectors**

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

## V SEMESTER ZOOLOGY

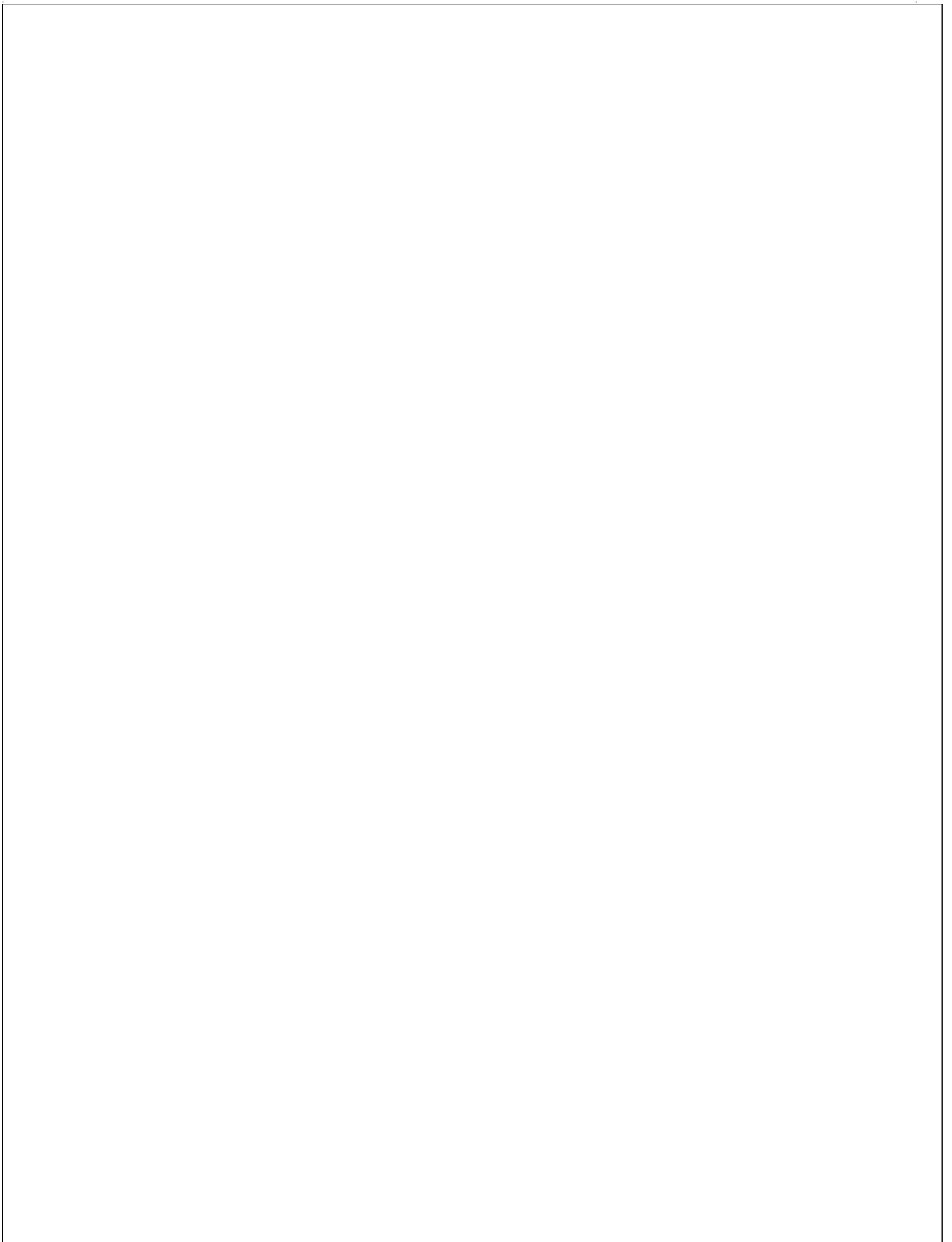
### PRACTICAL –V

#### INSECT VECTORS AND DISEASES PRACTICAL (CREDITS 2)

1. Study of different kinds of mouth parts of insects
  2. Study of following insect vectors through permanent slides/ photographs:  
*Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phthirus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica*, through permanent slides/ photographs
  3. Study of different diseases transmitted by above insect vectors
- Submission of a project report on any one of the insect vectors and disease transmitted**

#### SUGGESTED READINGS

1. Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
2. Chapman, R.F. (1998). *The Insects: Structure and Function*. IV Edition, Cambridge University Press, UK
3. Pedigo L.P. (2002). *Entomology and Pest Management*. Prentice Hall Publication
4. Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell



# DISCIPLINE SPECIFIC ELECTIVE COURSE

## VI SEMESTER ZOOLOGY

### AQUATIC BIOLOGY

**THEORY**

**(Credits 4)**

#### **UNIT I**

**12 hrs**

##### **Aquatic Biomes**

**Ecosystems:** Concept, types and structure of ecosystem

**Hydrosphere :** (Water) Physical and chemical properties.

**Brief**

**introduction of the aquatic biomes:** Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs

#### **UNIT II**

**12 hrs**

##### **Freshwater Biology**

**Physico-**

**chemical Characteristics:** Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide).

**Pond:** The pond as an ecosystem – Origin and classification, flora and fauna of pond ecosystem. Freshwater adaptations.

**Lakes:** Origin and

classification, Lake as an Ecosystem.

#### **UNIT III**

**12hrs**

##### **Marine Biology**

**Physico-chemical Characteristics:** Light, Temperature, pressure, stratification, Salinity and density of Sea water, biotic community of Continental shelf open sea, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

#### **UNIT IV**

**12 hrs**

##### **Management of Aquatic Resources**

**Water pollution:** Definition, sources Types and classification of pollutants. Effects of Water Pollution, Oxygen sag curves and Eutrophication Drinking water: Collection, purification and distribution. Wastewater treatment: Primary, secondary and tertiary treatment

**Causes of pollution:** Agricultural, Industrial, Sewage, Thermal and Oil spills, Management and conservation (legislations), Sewage treatment, Water quality assessment- BOD and COD.

#### **UNIT V: Aquaculture**

**12 hrs**

**Aquaculture in India:** an overview – nutritional value and food security - Site selection and preparation of culture ponds

**Fish**

**culture:** carps, marine fishes and ornamental fishes.

**Prawn culture:** Freshwater prawns and marine shrimps. Fattening of crabs. Crayfish and Lobster

**Pearl culture:** Types of pearls, composition, Biology of pearl oyster, pearl formation, culture of pearls .

## **SUGGESTED READINGS**

1. B. Das, (2012). Parasitology, Books & Allied Pvt. Ltd-II
2. S.Bhattacharya (2011). Environmental toxicology, Books & Allied Pvt. Ltd
3. S.Bhattacharya (2011). Environmental toxicology, Books & Allied Pvt. Ltd
4. T. K. Saha. (2012). Ecology and Environmental Biology. Books & Allied Pvt.

## **PRACTICAL VI**

### **AQUATIC BIOLOGY**

#### **PRACTICAL**

**(Credits 2)**

- 1&2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem/ photographs.
- 3 Estimation of dissolved oxygen in different water samples.
- 4 Estimation of dissolved carbon dioxide in different water samples.
- 5 Estimation of chlorides in different water samples.
- 6 Estimation of hardness in different water samples.
- 7 Measurement of pH, using pH-meter, pH paper.
- 8 Study of pond ecosystem.
- 9 Study of aquarium ecosystem.
- 10 Morphometric measurement of locally available freshwater fish and marine water fish.
- 11 Identification of fish(any six).
- 12&13. Fish by products.
- 14 . Project Report on a visit to a Sewage treatment plant/Marine bioreserve/  
Fisheries Institutes.
15. Repetition.

## **PRACTICAL VI**



# AQUATIC BIOLOGY

## Scheme of Practical Examination

Duration 3 Hours

Max Marks: 70 Marks

1.	Estimation of any 2 parameters – by lots	10Marks
2.	Estimation of any 2 parameters – by lots	10Marks
3.	Morphometric measurement of freshwater fish and marine water fish.	10Marks
4.	Identification of fish. (A&B)	08 Marks
5.	Identification of phyto and zooplanktons (C&D)	08 Marks
6.	Fish by products	04 Marks
7.	Report	10 Marks
8.	Record	10 Marks

## SCHEME OF VALUATION FOR PRACTICAL -V

1. Procedure - 04, Experiment- 04, Result - 02
2. Procedure - 04, Experiment- 04, Result - 02,
3. Procedure - 04, Experiment- 04 , Result - 02,
4. Identification -01, Classification-01,Diagram –01,Comment- 01
5. Identification -01, Classification-01,Diagram –01,Comment- 01
6. Identification -01, Classification-01,Diagram –01,Comment- 01

## DISCIPLINE SPECIFIC ELECTIVE COURSE

### VI SEMESTER ZOOLOGY

#### IMMUNOLOGY

##### THEORY

(CREDITS 4)

##### Unit 1: Overview of the Immune System 12Hrs

Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

##### Unit 2: Cells and Organs of the Immune System 12Hrs

Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid

organs) of the immune system

**Antigens:** Basic properties of antigens, B and T cell epitopes, haptens and adjuvants

**Unit 3: Antibodies** **12Hrs**

Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis

**Unit 4: Working of the immune system** **12Hrs**

Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.

**Unit 5: Immune system in health and disease** **12Hrs**

Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

**Unit 6: Vaccines** **12Hrs**

General introduction to vaccines, Various types of vaccines

*CBCS Undergraduate Program in Zoology*

## **PRACTICAL VI**

### **IMMUNOLOGY**

#### **PRACTICAL**

**(CREDITS 2)**

1. Demonstration of lymphoid organs
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immuno-diffusion method.
5. ABO blood group determination.
6. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of
  - a) ELISA
  - b) Immunoelectrophoresis

#### **SUGGESTED READINGS**

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
- 2, David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
3. Abbas, K. Abul and Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

## **SKILL ENHANCEMENT COURSE**

## MEDICAL DIAGNOSTICS

THEORY

(Credits 2)

### Unit I

10 hrs

#### Introduction to Medical Diagnostics and its Importance

#### Diagnostics Methods Used for Analysis of Blood

Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

### Unit II

10 hrs

#### Non-infectious Diseases

Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

#### Infectious Diseases

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

### Unit III:

10 hrs

#### Diagnostic Methods Used for Urine Analysis

Urine Analysis: Physical characteristics; Abnormal constituents

#### Tumours

Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

### SUGGESTED READINGS

1. Asis. Das. (2012). Medical Physiology, Books & Allied Pvt. Ltd
2. Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses.
3. Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House.
4. Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders
5. Park, K. (2007), and Social Medicine, B.B. Publishers.
6. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S.Chand and Co.
7. Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders.



# **JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

**Ooty Road, Mysore-570025, Karnataka**

## **SYLLABUS**

**Programme: B.Voc.(Software Development)**

**(2022-2023)**

## B.Voc.(SD)Scheme:

Year	Sem	Course Code	Title	L:T:P	Theory Hours	Practical Hours	Total Hours	Total Credits
1 Year	Sem 1	SDA010A	UdyogaSiri-I	3:00:00	45	0	45	3
		SDA020A	Reverberations-I	3:00:00	45	0	45	3
		SDA030A	KahaniSahetyaAurVyakarna -I	3:00:00	45	0	45	3
		SDA040A	SpecialEnglish	3:00:00	45	0	45	3
		SDA050A	EnvironmentScience	3:00:00	45	0	45	3
		SDA060A	BusinessOrganization	3:00:00	45	0	45	3
		SDA070A	Mathematics-I	2:00:00	30	0	30	2
		SDA070AP	Mathematics-I-Practical	0:00:01	15	15	15	1
		SDA080A	BasicsofIT	1:00:00	30	0	30	1
		SDA080AP	BasicsofIT- Practical	0:00:02	00	15	15	2
		SDA090A	Problem-SolvingandProgram Design	1:00:00	30	0	30	1
		SDA090AP	Problem-SolvingandProgram Design- Practical	0:00:02	00	15	15	2
		SDA100A	WorkEfficiency	1:00:00	30	0	30	1
	SDA100AP	WorkEfficiency-Practical	0:00:02	00	15	15	2	
	SDA110A	Maintain a Healthy, Safe and SecureWorkingEnvironment	1:00:00	30	0	30	1	
	SDA110AP	Maintaina Healthy, Safeand SecureWorkingEnvironment- Practical	0:00:02	00	15	15	2	
	SDA120A	JuniorsoftwareDeveloper	0:00:03	15	30	45	3	
	SDA130A	Health,Wellness& Yoga	0:00:02	00	45	45	2	
							32	
Sem2	16210	Vignanasiri-II	3:00:00	45	0	45	3	
	16211	Reverberations-II	3:00:00	45	0	45	3	
	16212	LaguupanyasaOur prayojanmulak-II	3:00:00	45	0	45	3	
	16224	SpecialEnglish	3:00:00	45	0	45	3	
	16214	DigitalFluency	1:00:00	15	0	15	1	

		16214P	DigitalFluency-Practical	0:00:01	0	30	30	1
		16215	PeopleManagement	3:00:00	45	0	45	3
		16216	DiscreteMathematics	2:00:00	30	0	30	2
		16216P	DiscreteMathematics -Practical	0:00:01	0	15	15	1
		16217	CProgramming	2:00:00	30	0	30	2
		16217P	CProgramming-Practical	0:00:01	0	15	15	1
		16218	FundamentalsofComputer	2:00:00	30	0	30	2
		16218P	FundamentalsofComputer-Practical	0:00:01	0	15	15	1
		16219	BasicsofOperatingSystem	1:00:00	30	0	30	1
		16219P	BasicsofOperatingSystem-Practical	0:00:02	0	15	15	2
		16220	DataManagementinWorkplace	1:00:00	30	0	30	1
		16220P	DataManagementinWorkplace-Practical	0:00:02	0	15	15	2
		16221P	SoftwareDeveloper(Skill Component)	0:00:03	15	30	45	3
		16223	RoversandRangers	0:00:02	0	30	30	2
								31
2 Year		SDC510	Advancedcalculus	3:0:0	45	0	45	3
		SDC520	Differential equation	3:0:0	45	0	45	3
		SDC530	Software ArchitectureandSDLC & Process	2:0:1	30	15	45	3
		SDC550	IndianConstitution	3:0:0	45	0	45	3
	Sem 4	SDD 510	NumericalAnalysis& Statistics	3:0:0	45	0	45	3
		SDD 520	OperationResearch	3:0:0	45	0	45	3
		SDD 530	Software Modeling &Software QualityAssurance	2:0:1	30	15	45	3
		SDD560	Environmental Studies	3:0:0	45	0	45	3
							<b>24</b>	
Sem 5	SDE510	ProjectManagement	2:0:2	30	30	60	4	
	SDE520	Configuration Management	3:0:1	45	15	60	4	







### Semester-III:

Sl. no	Course Code	CourseName	Credits		Marks					HoursPerWeek		
			L:T:P	Total	Th	C1	C2	P	Total	T	P	Total
1	SDC 510	Advanced Calculus	4:0:0	04	70	15	15	-	100	04	-	04
2	SDC 520	Differential Equation	2:0:0	02	70	15	15	-	100	02	-	02
3	SDC 530	Software Architecture and SDLC & Process	2:0:1	03	70	15	15	70	170	02	01	03
4	SDC 550	Indian Constitution	3:0:0	03	70	15	15	-	100	03	-	03

### Semester-IV:

Sl. no	Course Code	CourseName	Credits		Marks					HoursPerWeek		
			L:T:P	Total	Th	C1	C2	P	Total	T	P	Total
1	SDD510	Numerical Analysis & Statistics	4:0:0	04	70	15	15	-	100	04	-	04
2	SDD520	Operation Research	2:0:0	02	70	15	15	-	100	02	-	02
3	SDD530	Software Modelling & QA	2:0:1	03	70	15	15	70	170	02	01	03
4	SDD560	Environmental Science	3:0:0	03	70	15	15	-	100	03	-	03

## Semester-V:

Sl. no	Course Code	CourseName	Credits		Marks					HoursPer Week		
			L:T:P	Total	Th	C1	C2	P	Total	T	P	Total
1	SDE510	Project Management	2:0:2	04	70	15	15	70	170	02	02	04
2	SDE520	Configuration Management	3:0:1	04	70	15	15	70	170	03	01	04
3	SDE530	Human Computer Interaction	3:0:1	04	70	15	15	70	170	03	01	04

## Semester-VI:

Sl. no	Course Code	CourseName	Credits		Marks					HoursPerWeek		
			L:T:P	Total	Th	C1	C2	P	Total	T	P	Total
1	SDF510	Operating System	3:0:1	04	70	15	15	70	170	03	01	04
2	SDF550	DatabaseDesign	3:0:1	04	70	15	15	70	170	03	01	04
3	SDF520	Computer Networks & Security Fundamentals	3:0:1	04	70	15	15	70	170	03	01	04

## **Program Outcome:**

After completing the graduation in Software Development, the students are able to:

- PO1. Contribute to the design of software products and applications
- PO2. Develop software code to specification
- PO3. Provide data/information in standard formats
- PO4. Develop their knowledge, skills and competence
- PO5. Create documents for Knowledge Sharing
- PO6. Develop media content and graphic designs for software products and applications
- PO7. Appreciate the engineering nature of software development
- PO8. Describe key activities in software development and the role of modelling
- PO9. Explain key concepts in software development such as risk and quality
- PO10. Explain the basics of an object-oriented approach to software development

## **Program Specific Outcome:**

After completing the graduation in Software Development, the students are able to:

- PSO1. Apply standard Software Engineering practices and strategies in real-time software project development
- PSO2. Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems
- PSO3. Understand, analyze and develop computer programs of varying complexity
- PSO4. Apply standard Software Engineering practices and strategies in software project development
- PSO5. Acquaint with the contemporary issues, latest trends in technological development
- PSO6. Develop software code to specification
- PSO7. Manage their work to meet requirements
- PSO8. Develop their skills and competence

# **GeneralComponentSyllabus**

SL no.	<b>BASICSOFT (PRACTICAL)</b>	Hrs
	<b>UNIT1:INTRODUCTIONTOSOFTWARECONSTRUCTIONANDTESTING</b>	
1.	Settingupadevelopmentenvironment(e.g.,IDE) Writing and running a simple program Exploring basic programming concepts (variables, loops) Introductiontosoftwaretestingandexecutingtestcases	8
	<b>UNIT2:SOFTWAREDEVELOPMENTPROCESS</b>	
2.	Understandingsoftwarerequirements Creating a simple software design Implementingandintegratingsoftwarecomponents Basictroubleshootinganddebuggingtechniques	6
	<b>UNIT3:PROGRAMMINGFUNDAMENTALSANDSOFTWARECONSTRUCTION TECHNIQUES</b>	
3.	Fundamentalsofprogramminglanguages(e.g.,variables,conditions) Organizing code and using functions Errorhandlingandexception handlingbasics Applyingcodingstandardsandbestpractices	8
	<b>UNIT 4:SOFTWARETESTINGFUNDAMENTALSANDTESTAUTOMATION</b>	
4.	Introduction to software testing and its importance Creating and executing manual test cases Introductiontotestautomationtools(e.g.,Selenium) Basic automation script creation and execution	8
	<b>TotalPractical</b>	<b>30</b>
SL.no.	<b>(THEORY)</b>	Hrs
1.	Overviewofsoftwareconstructionandtesting Importanceofsoftwarequalityandtestinginthedevelopmentprocess	9
2.	Softwaredevelopmentlifecycle(SDLC) Agile vs. Waterfall methodologies	7
3.	Introductiontoobject-orientedprogramming Basic software quality assurance concepts Unit4:SoftwareTestingFundamentalsandTestAutomation	8
4.	Fundamentalsofsoftwaretesting Typesoftesting(e.g.,unittesting,integrationtesting)	6
	<b>TotalTheory</b>	<b>30</b>
<b>TotalPracticalHours: 30 hoursTotalTheoryHours: 30 hoursL:T:P=2:0:2</b>		

## ReferenceBooks

### 1. Title:"SoftwareConstructionandTesting:AnIntroduction"

Author:JenniferJohnson

Publisher: OpenStax

Year: 2021

URL:OpenStax

### 2. Title:"IntroductiontoSoftwareConstructionandTesting:ABeginner'sGuide"

Author:JohnSmith

Publisher:OpenBookPublishers

Year: 2022

URL:OpenBookPublishers

### 3. Title:"IntroductiontoSoftwareDevelopmentandTesting"

Author:MaryThompson

SLno.	<b>WORK EFFICIENCY (PRACTICAL)</b>	Hrs
<b>UNIT 1: INTRODUCTION TO WORK EFFICIENCY</b>		
1.	Conducting a self-assessment of current work habits and identifying areas for improvement. Setting personal goals for enhancing work efficiency. Practicing time management techniques, such as prioritization and scheduling.	8
<b>UNIT 2: ORGANIZATION AND PLANNING</b>		
2.	Creating a clutter-free and ergonomic workspace. Developing a personal organization system for files, documents, and digital resources. Practicing effective planning techniques, such as creating to-do lists and setting deadlines.	6
<b>UNIT 3: TIME MANAGEMENT</b>		
3.	Applying time-blocking techniques to allocate specific time slots for different tasks. Using productivity apps or tools to track and manage time effectively. Practicing strategies for minimizing distractions and maintaining focus during work hours.	8
<b>UNIT 4: COMMUNICATION AND COLLABORATION</b>		
4.	Practicing active listening and clear communication in professional interactions. Exploring collaboration tools and techniques to streamline teamwork and project management. Participating in group exercises or projects to enhance communication and collaboration skills.	8
<b>Total Practical</b>		<b>30</b>
SL.no.	<b>(THEORY)</b>	Hrs
1.	Understanding the concept of work efficiency and its importance in productivity. Exploring the benefits of improving work efficiency. Identifying common productivity challenges faced in the workplace.	9
2.	Learning effective organizational strategies for the workspace. Understanding the importance of planning and goal-setting for work efficiency. Exploring different tools and technologies to aid in organization and planning.	7
3.	Understanding the principles of time management and its impact on work efficiency. Exploring different time management frameworks and methodologies. Learning to identify and eliminate time-wasting activities.	8
4.	Understanding the role of communication in enhancing work efficiency. Exploring effective communication techniques for different modes (e.g., email, meetings, phone calls). Learning collaborative strategies to improve teamwork and productivity.	6
<b>Total Theory</b>		<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 30 hours L:T:P=2:0:2</b>		

**Reference Books:**

1. "Getting Things Done" by David Allen
2. "Deep Work: Rules for Focused Success in a Distracted World" by Cal Newport
3. "Atomic Habits" by James Clear
4. "The 7 Habits of Highly Effective People" by Stephen R. Covey
5. "Make Time: How to Focus on What Matters Every Day" by Jake Knapp and John Zeratsky
6. "Essentialism: The Disciplined Pursuit of Less" by Greg McKeown
7. "Mindset: The New Psychology of Success" by Carol S. Dweck
8. "The Power of Habit: Why We Do What We Do in Life and Business" by Charles Duhigg

SL no.	MAINTAIN A HEALTHY, SAFE, AND SECURE WORKING ENVIRONMENT (PRACTICAL)	Hrs
<b>UNIT 1: INTRODUCTION TO WORKPLACE HEALTH AND SAFETY</b>		
1.	Conducting a workplace hazard assessment Identifying and reporting potential hazards to supervisors Participating in safety training and drills Understanding emergency evacuation procedures Demonstrating basic first aid skills and knowledge	8
<b>UNIT 2: MAINTAINING PHYSICAL HEALTH IN THE WORKPLACE</b>		
2.	Practicing proper posture and body mechanics during work tasks Setting up an ergonomic workstation Implementing strategies to manage stress in the workplace Incorporating physical activity and stretching exercises into daily routine Promoting healthy eating and hydration habits at work Unit 3: Ensuring a Safe and Secure Work Environment	6
<b>UNIT 3: ENSURING A SAFE AND SECURE WORK ENVIRONMENT</b>		
3.	Reporting suspicious activities or security breaches Familiarizing with access control systems and procedures Participating in emergency response drills Handling and protecting sensitive information appropriately Implementing cybersecurity best practices (e.g., strong passwords, secure browsing)	8
<b>UNIT 4: PROMOTING MENTAL HEALTH AND WELL-BEING</b>		
4.	Encouraging open communication and promoting a stigma-free environment Identifying and addressing signs of mental health issues in oneself and others Utilizing available mental health resources and support services Implementing strategies for work-life balance and stress reduction Promoting team-building activities and positive relationships in the workplace	8
<b>Total Practical</b>		<b>30</b>
SL.no.	(THEORY)	Hrs
1.	Overview of workplace health, safety, and security Importance of maintaining a healthy, safe, and secure working environment Legal and regulatory frameworks related to workplace safety Identifying common workplace hazards and risks Understanding the roles and responsibilities of employees and employers in ensuring a safe workplace	9
2.	Importance of physical health in the workplace Ergonomics and proper body mechanics for injury prevention Promoting a healthy work-life balance Preventing and managing stress in the workplace Proper nutrition and hydration for optimal productivity	7

3.	Importance of maintaining security in the workplace Identifying potential security threats and risks Implementing access control measures Responding to emergencies and security incidents Maintaining data privacy and information security	8
4	Understanding mental health in the workplace Identifying signs of mental health issues Creating a supportive work environment Accessing available mental health resources and support Promoting work-life balance and stress management	6
	<b>Total Theory</b>	<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 30 hours L:T:P=2:0:2</b>		

## Reference Books

“Introduction to health and Safety at work: The Handbook for students on NEBOSH and Other Introductory H&S Courses” by Phil Huges and Ed Ferrett.

SL no.	PROBLEMSOLVING AND PROGRAM DESIGN FOR BEGINNERS (PRACTICAL)	Hrs
	<b>UNIT 1: INTRODUCTION TO PROBLEMSOLVING AND PROGRAMMING BASICS</b>	
1.	Setting up the development environment (e.g., installing a programming IDE) Writing and executing simple programs in a chosen programming language Performing basic arithmetic and logical operations in programs Handling user input and displaying output	8
	<b>UNIT 2: CONTROL FLOW AND DECISION MAKING</b>	
2.	Writing programs using conditional statements to make decisions Implementing loops to solve repetitive tasks and iterate over data Applying Boolean expressions for decision-making in programs Creating and calling user-defined functions	6
	<b>UNIT 3: ARRAYS AND PROBLEMSOLVING TECHNIQUES</b>	
3.	Implementing arrays and manipulating array elements in programs Applying problem-solving strategies to break down problems into manageable steps Implementing searching and sorting algorithms for arrays Solving small-scale problems using arrays and problem decomposition	8
	<b>UNIT 4: MODULAR PROGRAMMING AND BASIC SOFTWARE DEVELOPMENT</b>	
4.	Designing modular programs using functions to organize code Applying coding conventions for improved readability and maintainability Reusing code through function libraries in programs Identifying and fixing common errors using basic debugging techniques	8
	<b>Total Practical</b>	<b>30</b>
SL.no.	(THEORY)	Hrs
1.	Introduction to problem-solving methodologies Overview of algorithms and their role in programming Understanding variables, data types, and operators Basic input/output operations in programming	9
2.	Conditional statements (e.g., if-else) Looping statements (e.g., for, while) Understanding Boolean logic and expressions Introduction to functions and their usage in programs	7



3.	Introduction to arrays and their significance in programming Overview of problem-solving strategies (e.g., step-by-step approach) Searching and sorting algorithms for arrays (e.g., linear search, selection sort) Introduction to problem decomposition and solving small-scale problems	8
4	Introduction to modular programming and its benefits Basics of code organization and readability Understanding the importance of code reusability Introduction to basic debugging techniques	6
	<b>Total Theory</b>	<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 30 hours L:T:P=2:0:2</b>		

**Reference Books** "Clean Code: A Handbook of Agile Software Craftsmanship" by Robert C.

## Semester II

SL no.	<b>DATAMANAGEMENTINWORKPLACE (PRACTICAL)</b>	Hrs
<b>UNIT1:INTRODUCTIONTODATAMANAGEMENT</b>		
1.	Introduction to common data management tools and software Data entry and validation techniques Data cleaning and pre-processing exercises Creating basic data visualizations using spreadsheet software	8
<b>UNIT2:DATABASE FUNDAMENTALS</b>		
2.	Installing and setting up a DBMS (e.g., MySQL, Microsoft Access) Creating a simple relational database schema Writing SQL queries to retrieve and modify data Importing and exporting data into/from a database	6
<b>UNIT3: DATASECURITYAND PRIVACY</b>		
3.	Setting up user access controls and permissions in a database Encrypting sensitive data and backups Implementing data anonymization techniques Conducting a basic data security audit	8
<b>UNIT4: DATAANALYSISANDVISUALIZATION</b>		
4.	Performing basic data analysis using spreadsheet software Creating various data visualizations (e.g., bar charts, pie charts, line graphs) Using data visualization tools (e.g., Tableau, Power BI) for interactive visuals Preparing a data-driven presentation using analyzed data	8
	<b>Total Practical</b>	<b>30</b>
<b>SL.no.</b>	<b>(THEORY)</b>	<b>Hrs</b>

1.	What is data management and its importance in the workplace? Types of data: structured, semi-structured, and unstructured Data lifecycle: data collection, storage, processing, analysis, and archiving Data quality and data governance principles	9
2.	Understanding databases and database management systems (DBMS) relational database concepts: tables, records, fields, and keys Database design principles: entity-relationship model Database basics: querying and manipulating data	7
3.	Importance of data security in the workplace Common data security threats and vulnerabilities Data privacy regulations (e.g., GDPR, HIPAA) and compliance Best practices for securing sensitive data	8
4.	Introduction to data analysis and its significance in decision-making Descriptive vs. inferential statistics Data visualization techniques and best practices Interpreting and presenting data analysis results	6
<b>Total Theory</b>		<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 30 hours L:T:P=2:0:2</b>		

## Reference Books

- "Data Science for Business" by Foster Provost and Tom Fawcett
- "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball and Margy Ross
- "Information Architecture: For the Web and Beyond" by Louis Rosenfeld, Peter Morville, and Jorge Arango
- "Data Management for Researchers: Organize, Maintain and Share Your Data for Research Success" by Kristin Briney
- "Data Management and Analysis for Researchers" by Matthew Brett
- "The DAMA Guide to the Data Management Body of Knowledge (DAMA-DMBOK)" by DAMA International
- "Data-Driven: Creating a Data Culture" by Hilary Mason and DJ Patil
- "Data Management and File Structures" by Mary E. S. Loomis

SL no.	BASICS OF OPERATING SYSTEM (PRACTICAL)	Hrs
<b>UNIT 1: INTRODUCTION TO OPERATING SYSTEMS</b>		
1.	Familiarization with different operating systems (Windows, macOS, or Linux) Basic navigation of the operating system interface Working with files and directories using the file manager or command-line interface Customizing system settings (e.g., desktop background, screen resolution)	8
<b>UNIT 2: PROCESSES AND MEMORY MANAGEMENT</b>		
2.	Task Manager/Activity Monitor usage for process monitoring Starting, managing, and terminating processes Implementing simple multithreading programs Investigating memory usage and monitoring with system tools	6
<b>UNIT 3: FILE SYSTEMS AND STORAGE MANAGEMENT</b>		
3.	Creating, modifying, and deleting files and directories File permissions and access control Disk management using disk utility tools Working with external storage devices (e.g., USB drives)	8
<b>UNIT 4: SYSTEM SECURITY AND MAINTENANCE</b>		

4.	Managing user accounts and access rights Configuring password policies and authentication methods Backup and restoration using built-in tools Applying system updates and software installations	8
	<b>Total Practical</b>	<b>30</b>
<b>SL.no.</b>	<b>(THEORY)</b>	<b>Hrs</b>
1.	Definition and purpose of an operating system History and evolution of operating systems Types of operating systems (e.g., Windows, macOS, Linux) Functions and responsibilities of an operating system Operating system architecture: kernel, shell, and user space	9
2.	Understanding processes and threads Process states: running, ready, blocked Process scheduling algorithms Memory management techniques: segmentation and paging Virtual memory and its importance	7
3.	File system concepts and organization File operations: create, read, write, delete Directory structure and path handling Disk management: partitioning and formatting Storage types: HDD, SSD, and others	8
4.	Overview of computer security principles User accounts and privileges Password management and authentication Basic principles of data backup and recovery System updates and software patches	6
	<b>Total Theory</b>	<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 30 hours L:T:P=2:0:2</b>		

### Reference Books

1. "Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne.
2. "Modern Operating Systems" by Andrew S. Tanenbaum.
3. "Operating Systems: Internals and Design Principles" by William Stallings.
4. "Operating Systems: Three Easy Pieces" by Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau.
5. "Operating System Design and Implementation" by Andrew S. Tanenbaum and Albert S. Woodhull.

**SDB520**

## **ALGORITHMS AND DATA STRUCTURES**

**Credits: 3(45Hours)**

(2HoursofTheoryand1HourofPracticalperWeek)

### **Course Outcome:**

After completion of the course, the students are able to:

CO1. Deliberate in details with examples Algorithms and Data Structures CO2.

Learn in depth Arrays

CO3. Learn in details with examples Binary Search Trees CO4.

Deliberate the characteristics of Heaps

CO5. Specify the characteristics of Sorting Algorithms

CO6. Learn the details of Shortest Path

### **Unit1:**

**15Hours**

Algorithms and Data Structures: Asymptotic and Algorithm Analysis, Properties of data, Asymptotic Analysis, Algorithm Analysis.

Abstract Lists and Implementations: Linked lists and arrays, Stacks, Queues, De-queues.

Abstract Sorted Lists and Implementations: General trees, binary (including binary and complete trees), N-array trees and tree traversals, Abstract Sorted Lists, Binary search trees, Balanced search trees, AVL trees, B-Trees.

### **Unit2:**

**15Hours**

Abstract Priority Queues: Heaps.

Abstract Sets/Maps: Chained Hash Tables, Linear Probing, Double Hashing.

Sorting Algorithms: Insertion and bubble sort, Heap, merge and quick sort, Bucket and radix sort

Graph and Direct Acyclic Graph Algorithms: Topological sort, Minimum spanning trees and shortest path.

### **Reference:**

1. T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, Introduction to Algorithms, 2nd Ed., Prentice-Hall of India, 2006.
2. Robert L. Kruse and A.J. Ryba, Data Structures and Program Design in C++, Prentice Hall, Inc., NJ, 1998.

### **Practicals**

(1 Hour per week X 15 Weeks = 15Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**

## **SDB 550**

### **INTRODUCTION TO MICROCONTROLLERS AND EMBEDDED SYSTEMS**

**Credits: 3(45Hours)**

(2Hours of Theory and 1Hour of Practical per Week)

#### **Course Outcome:**

After completion of the course, the students are able to:

- CO1. Understand the architecture of 8051 microcontroller
- CO2. Write down the instruction set and simple programs of 8051 microcontroller
- CO3. Learn the details of 8051 microcontrollers
- CO4. Specify the characteristics of embedded system

#### **Unit 1: Microcontrollers**

**15Hours**

Microcontroller 8051 - Introduction, block diagram of microprocessor, block diagram of microcontroller, comparison between microprocessor & microcontroller, Architecture of 8051 and pin out diagram of 8051.

**Addressing modes** - Data moves, Types of addressing modes - register addressing, immediate addressing, direct addressing, indirect addressing mode.

**Instructions set** - Data transfer instructions, arithmetic instructions, jump and call instructions.

**PIC microcontroller**- Core feature and overview of series.

#### **Unit 2: Embedded Systems**

**15 Hours**

**Introduction to Embedded Systems** - Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

**Hardware Side** - introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers. An Instruction Set View, Embedded Systems- A Register View, Register View of a Microprocessor

**The Hardware Side:** Storage Elements and Finite-State Machines- Theoretical model.

#### **Reference:**

- Microcontroller– KJ Ayala.
- Introduction to Embedded Systems- Shibu K.V, McGraw Hill.
- Microcontroller– Mazadi.

#### **Practicals**

(1 Hour per week X 15 Weeks = 15Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**

**SEMESTER III**  
**ADVANCED CALCULUS**

**Credits: 3(45Hours)**  
(3HoursofTheoryperWeek)

**Course Outcome:**

After completion of the course, the students are able to:

- CO1. Learn in depth Sequences
- CO2. Specify the details of Series
- CO3. Understand in details with examples Rolle's Theorem
- CO4. Deliberate in details with examples Taylor's Theorem
- CO5. Identify the details of Partial derivatives

**Unit 1: Sequences and Series:**

**15 Hours**

Sequences- Bounded and monotonic sequences- convergent, divergent and oscillatory sequences- standard results and simple problems  
Infinite series- nth partial sum- geometric series- convergence of  $\sum_{n=1}^{\infty} \frac{1}{n^p}$ - comparison test and ratio test- simple problems- alternating series

**Unit 2: Calculus**

**15 Hours**

Mean value theorems- Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorems (Statements and Geometrical interpretations)- Taylor's theorem – Maclaurin's expansion (Statement) and problems.

**Unit 3: Partial derivatives**

**15 Hours**

Limit and continuity of functions of two and three variables, Partial differentiation, Change of variables, Partial derivation and differentiability of real-valued functions of two and three variables, Euler's theorem on homogeneous functions. Taylor's theorem for functions of two and three variables - Jacobians

**Reference:**

1. A First Course in Real Analysis – Asharani Singhal.
2. Real Analysis – S.C. Malik.
3. Principles of Mathematical Analysis – Shanthinarayan
4. Calculus, Volume-1 and Volume-2

SDC 520

## DIFFERENTIAL EQUATIONS

Credits: 3(45Hours)

(3HoursofTheoryperWeek)

### Course Outcome:

After completion of the course, the students are able to:

- CO1. Specify in details with examples linear differential equations
- CO2. Write down in details with examples nonlinear differential equations
- CO3. Understand in details with examples Homogeneous linear differential equations
- CO4. Learn the details of Non homogeneous linear differential equations
- CO5. Specify the details of Partial differential equations

### Unit 1: Linear and nonlinear differential equations

15 Hours

Elimination of arbitrary constant - solutions of linear differential equations - separation of variables - Homogeneous equations - exact equations - equations of the form  $\frac{dy}{dx} + Py = Q$  - Integrating factor, Equations solvable for x, y, p. Clairaut's form and singular solutions

### Unit 2: Homogeneous and non homogeneous linear differential equations 15 Hours

Homogeneous Linear differential equations with constant coefficients. - non homogeneous linear differential equations - inverse differential operators - Cauchy's homogeneous linear differential equations - Second order linear differential equations - variation of parameters and exact equations.

### Unit 3: Partial differential equations

15 Hours

Total differential equations - simultaneous equations - partial differential equations - Lagrange's form of linear partial differential equations - Charpit's method.

### Reference:

1. A short course in differential equations - Rainville and Bedient
2. Advanced Engineering Mathematics - Kreyszig
3. Higher Engineering Mathematics - Grewal
4. Laplace Transform - Murry R Spiegel
5. Applications of Differential equations - Martin Brown

**SDC530**

## **SOFTWARE ARCHITECTURE AND SDLC & PROCESSES**

**Credits: 3(45Hours)**

(2HoursofTheoryand1HourofPracticalperweek)

### **Course Outcome:**

After completion of the course, the students are able to: CO1.

Specify in depth Software Process

CO2. Deliberate in details with examples SDLC CO3.

Learn in depth Data Modeling

CO4. Understand the details of UML and ER Models CO5.

Specify the details of Loose Coupling

### **Unit1:**

**15 Hours**

**SDLC & Processes:** Software Process, Software Development Life Cycle, Object-Oriented Concepts: connections between design and implementation, Software Testing, Object-Oriented Architecture and Design, Requirements analysis, Safety Critical Software.

### **Unit2:**

**15 Hours**

**Software Architecture:** Introduction to enterprise software architecture, the role of middleware, Cloud computing = SaaS + Utility Computing, Data Modeling, UML and E-R models. XML, Schemas, XML Schemas, Data Processing. Strategies for data processing, introduction to XQuery. JSON and JAXB, Domain-Driven Architecture. Domain-driven, design (DDD), Object-relational mapping (ORM), Service-oriented Architecture (SOA), Standardized service contract, Loose coupling, Service abstraction, Service-oriented Architecture (SOA),

### **Reference:**

1. Designing Software Architectures: A Practical Approach (SEI Series in Software Engineering) 1st Edition, Kindle Edition by Humberto Cervantes
2. Just Enough Requirements and Sdlc: Requirements Documentation, Waterfall, and Agile Paperback – Import, 10 Mar 2017 by Ed Crook shanks

### **Practicals**

(1 Hour per week X 15 Weeks = 15 Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**



**SDC 550**

## **INDIAN CONSTITUTION**

**Credits: 3(45Hours)**

(3HoursofTheoryperweek)

### **Course Outcome:**

After completion of the course, the students are able to:

- CO1. Learn the details of Features of Indian Constitution
- CO2. Understand the details of Fundamentals Rights
- CO3. Identify the details of Role of Prime Minister
- CO4. Learn the details of Power and Functions of Lok Sabha
- CO5. Specify the details of Power and Functions of Chief Minister

### **Unit1** **08 Hours**

- a) Preamble of the Indian Constitution
- b) Salient features of Indian Constitution

### **Unit2** **10Hours**

- a) Fundamental Rights
- b) Fundamental Duties
- c) Directive principles of State Policy

### **Unit3** **14Hours**

- a) President – Election Method, Powers and Functions
- b) The Role of the Prime Minister
- c) The Parliament – Structure, Power and Functions (Lok Sabha and Rajya Sabha)
- d) Supreme Court – Organization and Jurisdiction

### **Unit4** **13 Hours**

- a) The Role of Governor in the Administration of State
- b) Powers and Functions of the Chief Minister
- c) Composition, Powers and Functions of both the Houses of State Legislature
- d) High Court – Organization and Jurisdiction

### **Reference:**

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
3. Latest Publications of Indian Institute of Human Rights, New Delhi.

**SDD510**

**SEMESTER IV**  
**NUMERICAL ANALYSIS AND STATISTICS**  
**Credits: 3(45Hours)**  
(3HoursofTheoryperWeek)

**Course Outcome:**

After completion of the course, the students are able to: CO1.

Understand the details of Bisection Method

CO2. Identify in details with examples Range Kutta IV Order Method CO3.

Learn the details of Finite differences

CO4. Understand in depth Numerical Integration

CO5. Identify in details with examples Linear programming

**Unit 1: Numerical techniques**

**15 Hours**

Numerical solutions of algebraic equations - Bisection method - Newton Raphson method, Regula Falsi method - iteration method - Euler method, Range kutta IV order methods

**Unit 2: Finite differences and Numerical integration**

**15 Hours**

Finite differences - Interpolation - Newton Gregory forward interpolation formula - Lagrange's interpolation formula - Numerical integration: Trapezoidal rule, Simpson's  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rule Weddle's rule.

**Unit 3: Linear programming**

**15 Hours**

Linear programming - Requirements for a linear programming problem, Examples on the Applications of linear programming, Formulation of a linear programming, Standardization, Solving LPP by Graphical Method, Simplex Method (up to two variables)

**Reference:**

1. Numerical methods: S.S. Sastry.
2. Probability and statistics for engineers and Scientists - Ronald E. Walpole and Raymond H Mayers.
3. Mathematical Statistics - John Freund (Prentice Hall India PVT. Ltd)

**OPERATIONRESEARCH**

**Credits: 3(45Hours)**  
(3HoursofTheoryperWeek)

**CourseOutcome:**

Aftercompletionofthecourse,thestudentsareableto:

- CO1.UnderstandthedetailsofDifferent phasesofoperationresearch
- CO2. Deliberate in depth Simplex method
- CO3.Identifyin depthDualitytheorems
- CO4.UnderstandthedetailsofSequencingproblems
- CO5. Learn in depth Transportation model problems
- CO6.UnderstandthedetailsofAssignmentproblems

**Unit1:**

**15 Hours**

Definition of the term Operation Research -Different phases of operation research  
Advantages and limitations of O.R. Linear programming –Requirements for a linear programming problem ,Examples ontheApplicationsoflinear programming  
,Formulation of a linear programming , Standardization ,SolvingLPPby GraphicalMethod  
,SimplexMethod(up to two variables)

**Unit2:**

**15 Hours**

Big M method revised simplex method, Dual simplex method, Duality theorems.  
**Sequencingproblems:**Processing ‘n’jobsthroughtwo machines–Travellingsalesman problems as an application of sequencing

**Unit3:**

**15 Hours**

**TransportationModelproblems**– Formulating, Solution–NorthWest Corner Rule, Least Cost method, Row Minima method, Column minima method and Vogel’s approximation.  
**Assignmentproblem:** formulating, methodoffinding initialbasic feasiblesolutionto Assignment problem using Hungarian method.

**Reference:**

1. ‘Operation Research‘ by Kanthiswarup, Gupta, Manmohan – Sultan chandand sons Educational publishers, New Delhi,1996
2. ‘OperationResearch‘byH.A.TahaPrentice HallofIndia Ltd 1998
3. ‘OperationResearch‘byS.DSharmaKedarnathRamnathandco(publishers)1997

## **SDD 530**

### **SOFTWARE MODELING AND SOFTWARE QUALITY ASSURANCE**

**Credits: 3(45Hours)**

(2HoursofTheoryand1HourofPracticalperweek)

#### **Course Outcome:**

After completion of the course, the students are able to:

CO1. Deliberate in details with examples Classes and Relationships CO2.

Specify the details of State diagrams

CO3. Identify in details with examples Events

CO4. Deliberate in details with examples Software quality assurance CO5.

Understand the details of Software quality assurance

#### **Unit1:**

**15Hours**

**Software Modeling:** What is Modeling?, Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams, Advanced Relationships, Instances, Object Diagrams, Use Cases, Interaction/Activity Diagrams, Events, State Machines, Time, Space, State Diagrams and Events

#### **Unit2:**

**15Hours**

**Software Quality Assurance:** Software Quality, Quality Assurance, Testing Concepts and Issues, Testing Activities, Testing Techniques. Other Techniques, Defect Prevention/Process Improvement, Inspection, Refactoring, CRC, Software Reliability Engineering, Quality Models and Measurements

#### **Reference:**

1. Modeling for Software Quality Assurance (English, Paperback, Srivyshnavi Pagadala)
2. Modeling for Software Quality Assurance Paperback – Import, 16 Nov 2013 by Srivyshnavi Pagadala

#### **Practicals**

(1 Hour per week X 15 Weeks = 15 Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**

**SDD560**

## **ENVIRONMENTAL STUDIES**

**Credits:3 (45Hours)**

(3HoursofTheoryperweek)

### **Course Outcome:**

After completion of the course, the students are able to:

CO1. Deliberate the details of Components of environment CO2.

Specify the details of Ecology and Ecosystems

CO3. Identify in details with examples Natural resources CO4.

Learn the details of Biodiversity

CO5. Specify in details with examples Environmental pollution CO6.

Identify the details of Environmental issues and policies

### **Unit 1: Environment and natural systems**

**4Hours**

- Introduction to Environment and Environmental Studies
- Definition and Components of Environment, Relationship between the different components of Environment
- Man and Environment relationship
- Impact of technology on Environment, Environmental Degradation
- Multidisciplinary nature of the Environment studies
- Its scope and importance in the present day Education System

### **Unit 2: Ecology and Ecosystems**

**5Hours**

- Introduction: Ecology- Objectives and Classification
- Concept of an ecosystem- structure and functions of ecosystem
- Components of ecosystem- Producers, Consumers, Decomposers
- Bio-Geo-Chemical Cycles- Hydrologic Cycle, Carbon cycle, Energy Flow in Ecosystem, Food Chains, Food webs, Ecological Pyramids
- Major Ecosystems: Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem, Estuarine Ecosystem.

### **Unit 3: Natural Resources**

**6 Hours**

Renewable and Non-renewable resources, exploitation and conservation,

- Water resources: Surface and Groundwater sources, Indian and Global scenario.
- Land as a resource, land use change and land degradation
- Forest resources: Definition and Classification of Forests  
Ecological and Economic importance and benefits of forest, Indian scenario  
Deforestation: causes and effects, case studies remedial measures
- Food resources: Sources of food, Global and Indian food demand scenario  
Limits of food production, Environmental effects of Agriculture
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies
- Mineral resources: Definition and Classification of minerals, mining issues  
Case studies
- Role of individual in conservation of natural resources.

**Unit4:Biodiversity and its Conservation****7 Hours**

- Biodiversity: Definition, Levels of biological diversity: genetic, species and ecosystem diversity
- Biogeographic zones of India
- Hotspots of biodiversity
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- Biodiversity patterns
- India as a mega-biodiversity nation
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**Unit5: Environmental pollution****6 Hours**

- Types of Environmental Pollution:
- Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution: Industrial Agricultural, Municipal; Classification of water pollutants, Effects of water pollutants, Eutrophication.
- Marine pollution: Causes, effects and control.
- Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO<sub>2</sub>, NO<sub>x</sub>, Natural & Anthropogenic Sources, Effects of common air pollutants
- Soil Pollution: causes, effects and control.
- Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects
- Thermal Pollution: Causes, effects and control.
- Nuclear hazards and human health risks.
- Solid waste management: Control measures of urban and industrial waste.
- Role of individual in the prevention of pollution, Pollution case studies.

**Unit6: Sustainable development and Environmental issues and Policies****7 Hours**

- Sustainable development: Meaning, changes in resource utilization.
- Water conservation: watershed management and Rainwater harvesting.
- Environmental issues: Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management: floods, drought, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act: Air, Water, Wildlife (Prevention and Control of Pollution)
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

**Unit 7: Human Population and the Environment****5 Hours**

- Population growth, Explosion, demographic variation among nations.
- Family welfare Program.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- HIV/AIDS
- Women and Child welfare.
- Role of information technology in Environment and human health

**Unit 8: Field visit****5 Hours**

- Field work Visit to an area to document environmental assets river/forest/ grassland/ hill/ mountain
- Visit to a local polluted site - Urban/Rural/Industrial/Agricultural.
- Visit to the solid waste treatment plant and water treatment plant.
- Video: The one degree (Equal to 5 lectures)

**Reference:**

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha Second edition, 2013 Publisher: Universities Press (India) Private Ltd, Hyderabad.
2. Basics of Environmental Studies by Prof Dr NS Varandani, 2013 Publisher: LAP – Lambert Academic Publishing, Germany.
3. Environmental Studies by Anindita Basak, 2009 Publisher: Driling Kindersley (India) Pvt. Ltd Pearson
4. Textbook of Environmental Studies by Deeksha Dave & SSKateva, Cengage Publishers.
5. Environmental Sciences by Daniel B Botkin & Edward A Keller Publisher: John Wiley & Sons.
6. Environmental Studies by R. Rajagopalan, Oxford University Press
7. Environmental Studies by Benny Joseph, TMH publishers
8. Environmental Studies by Dr. Suresh K Dhameja, 2007 Published by: SK Kataria & Sons New Delhi
9. Basics of Environmental Studies by UK Khare, 2011 Published by Tata McGraw Hill.
10. Environmental Studies by N. Arumugam & V. Kumaresan, Sara's publication.

**SDE 510**

**SEMESTER V**  
**PROJECTMANAGEMENT**

**Credits: 4(60Hours)**

(2HourofTheoryand2HoursofPracticalperWeek)

**CourseOutcome:**

Aftercompletionofthecourse,thestudentsareableto:

CO1.UnderstandindepthProjectplan

CO2.IdentifythedetailsofUsercontrolledscheduling

CO3. Deliberate the details of Adding tasks

CO4.UnderstandindetailswithexamplesAddingworkresources CO5.

Learn the details of Calendar

**Unit1:**

**15 Hours**

Creating a Project Plan

User-ControlledScheduling

Adding Tasks

ResolvingCommonSchedulingIssues

**Unit2:**

**15 Hours**

AddingWorkResources

AddingMaterialandCostResources Defining  
a Calendar

ViewingandTrackingProjectInformationGanttCharts

**Reference:**

1. ProjectManagementfor Dummies, 5edPaperback–2017byStanleyE. Portny
2. ProjectManagement3rdEdition(English,Paperback,Maylor)

**Practicals**

(2 Hoursperweek X15Weeks=30Hours)

**ExperimentsarebasedontopicsmentioninthePaperdesignedbyconcernedFaculty**



**SDE520**

## **CONFIGURATION MANAGEMENT**

**Credits: 4(60Hours)**

(3 Hour of Theory and 1 Hour of Practical per Week)

### **Course Outcome:**

After completion of the course, the students are able to: CO1.

Specify in depth Configuration management

CO2. Understand the details of Configuration management planning

CO3. Deliberate the details of Configuration control

CO4. Learn in details with examples Configuration status accounting

CO5. Identify the details of Configuration audits

### **Unit1:**

**15 Hours**

**DEFINING CONFIGURATION MANAGEMENT:** CM principles and standards, the recent growth of CM

**CM PLANNING:** Program phasing and milestones, Creating the CM organization, Defining CM system requirements, CM job classifications

**CONFIGURATION IDENTIFICATION:** First tasks of CM, Configurations & Baselines, Requirements traceability, Item identification and numbering

### **Unit2:**

**15 Hours**

**ENGINEERING RELEASE:** Control of technical data, the document control process, Development vs. formal release

**CONFIGURATION CONTROL:** Defining a closed-loop process, Change classifications, Review boards and CCBs, Processing changes and RDWs

**INTRODUCTION TO SOFTWARE CONFIGURATION MANAGEMENT:** Specific software CM tasks, SEI evaluation criteria

### **Unit3:**

**15 Hours**

**CONFIGURATION STATUS ACCOUNTING:** Defining CS A tasks and tailoring, Status accounting elements, Understanding the impact

**CM PLANS:** CMP preparation techniques, Software CMPs, Assessments and Plans

General procedures and work flow

**CONFIGURATION AUDITS:** Internal and informal audits, developing the audit plan, The Functional and Physical Audits

### **Reference:**

1. Jessica Keyes, Software Configuration Management, Auerbach Publications, 2004
2. Anne Hass, Configuration Management Principles and Practice, Addison Wesley, 2002

### **Practicals**

(1 Hour per week X 15 Weeks = 15 Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**

**SDE530**

## **HUMAN COMPUTER INTERACTION**

**Credits: 4(60Hours)**

(3 HoursofTheoryand1HourofPracticalperWeek)

### **Course Outcome:**

After completion of the course, the students are able to:

- CO1. Learn the details of Introduction of human computer interface
- CO2. Understand the details of Human consideration in screen design
- CO3. Identify in details with examples Windows
- CO4. Deliberate in depth Multimedia and coloring
- CO5. Specify in details with examples Hypermedia

### **Unit1:**

**20 Hours**

Introduction-Importance-Human-Computer interface-characteristics of graphics interface-Direct manipulation graphical system - web user interface-popularity-characteristic & principles. User interface design process- obstacles-usability-human characteristics in design -Human interaction speed-business functions-requirement analysis-Direct-Indirect methods-basic business functions-Design standards-system timings - Human consideration in screen design- structures of menus - functions of menus-content of menu-formatting -phrasing the menu - selecting menu choice-navigating menus-graphical menus.

### **Unit2:**

**13 Hours**

Windows-Characteristics-components-presentation-styles-types-managements-organizations-operations-web systems-device-based controls: characteristics-Screen -based controls: operate control- text boxes-selection control-combination control-custom control-presentation control.

### **Unit3:**

**12 Hours**

Text for web pages - effective feedback-guidance & assistance-Internationalization-accessibility-Icons-Image-Multimedia -coloring, Windows layout-test: prototypes - kinds of tests- retest - Information search - visualization - Hypermedia - www - Software tools.

### **Reference:**

1. Human-Computer Interaction, 3e Paperback-2004 by Dix
2. Human Computer Interaction Paperback-2014 by Meena K
3. Human-Computer Interaction Third Edition Paperback -Import, 24 Aug 2018 by Gerardus Blokdyk

### **Practicals**

(1 Hour per week X 15 Weeks = 15 Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**

**SDF510**

**SEMESTER VI**

**OPERATING SYSTEM**

**Credits: 4(60Hours)**

(3HoursofTheoryand1HourofPracticalperWeek)

**Course Outcome:**

After completion of the course, the students are able to:

- CO1. Identify the Characteristics of operating system
- CO2. Deliberate in depth Scheduling algorithms
- CO3. Learn in depth Semaphores
- CO4. Specify the details of Message passing
- CO5. Understand the details of Deadlock
- CO6. Identify in details with examples File organisation

**Unit1:**

**15 Hours**

Overview of operating systems, functionalities and characteristics of OS

Hardware concepts related to OS, CPU states, I/O channels, memory hierarchy and microprogramming

The concept of a process, operations on processes, process states, concurrent processes, process control block, process context

UNIX process control and management, PCB, signals, forks and pipes

Interrupt processing, operating system organisation, OS kernel FLI and dispatcher. Job and processor scheduling, scheduling algorithms, process hierarchies.

Problems of concurrent processes, critical sections, mutual exclusion, synchronisation, deadlock.

**Unit2:**

**15 Hours**

Mutual exclusion, process co-operation, producer and consumer processes.

Semaphores: definition, init, wait, signal operations.

Use of semaphores to implement mutex, process synchronisation etc., implementation of semaphores, Critical regions, Conditional Critical Regions, Monitors, Ada Tasks

Interprocess Communication (IPC), Message Passing, Direct and Indirect

**Unit3:**

**15 Hours**

Deadlock: prevention, detection, avoidance, banker's algorithm.

Memory organisation and management, storage allocation

Virtual memory concepts, paging and segmentation, address mapping.

Virtual storage management, page replacement strategies

File organisation: blocking and buffering, file descriptor, directory structure, File and Directory structures, blocks and fragments, directory tree, inodes, file descriptors, UNIX file structure.

**Reference:**

1. D.M Dhamdhere: Operatingsystems -A conceptbasedApproach,3rdEdition, Tata McGraw- Hill, 2012.
2. P.C.P.Bhatt: IntroductiontoOperatingSystemsConceptsandPractice,3rd Edition, PHI, 2010.
3. HarveyMDeital: Operatingsystems,3rdEdition, PearsonEducation,2011.

**Practicals**

(1 HourperweekX15Weeks= 15Hours)

**ExperimentsarebasedontopicsmentioninthePaperdesignedbyconcernedFaculty**

**SDF550**

**DATABASE DESIGN**

**Credits: 4(60Hours)**

(3HoursofTheoryand1HourofPracticalperWeek)

**CourseOutcome:**

Aftercompletionofthecourse,thestudentsareableto:

CO1.UnderstandthedetailsofDatabaseterminologyand informationtypes CO2.

Specify in depth Database planning and designing

CO3.LearnthedetailsofCloudcomputing

CO4.SpecifythedetailsofSetsandnormalization

CO5. Specify in depth Report writing

CO6.UnderstandindetailswithexamplesCustomerservicemanagement

**Unit1**

**15 Hours**

DatabaseBasics

IntroductiontoDeviseDigitalStorage

DatabaseTerminology&DatabaseInformationTypes

Microsoft Excel versus Microsoft Access

DatabasePlanning

DatabaseObjects–CreatingFieldsandTables

Planning and Designing a Database

**Unit2**

**15 Hours**

IntroductiontoCloudComputing

Database Relationships

Designing for the Business Case

IntroductiontoDataSecurity&DataArchives

Managing the Database

Database Relationship Development

IntroductiontoVisualDataAnalytics

IntroductiontoSets&Normalization

Database Extractions

**Unit3**

**15 Hours**

Database Queries and Basic SQL

EmergenceofSocialMediaDatabases

Database Distribution

Report Writing

IntroductiontoCustomerServiceManagement

Computing Databases

Database Inputs

FormDevelopment

**Reference:**

1. Korth, Sberchatz, Sudarshan: "Database System Concepts", 6th Edition, McGraw – Hill
2. Elmasri and Navathe: "Fundamentals of Database Systems", 5th Edition, PEARSON Education.
3. Peter Rob and Carlos Coronel: "Database Systems Design, Implementation and Management", Thomson Learning, 5th Edition.

**Practicals**

(1 Hour per week X 15 Weeks = 15 Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**

**SDF520**

## **COMPUTER NETWORKS & SECURITY FUNDAMENTALS**

**Credits: 4 (60 Hours)**

(3 Hours of Theory and 1 Hour of Practical per Week)

### **Course Outcome:**

After completion of the course, the students are able to:

CO1. Deliberate the details of OSI model

CO2. Learn the details of Switches

CO3. Understand the details of Protocols and services CO4.

Identify in depth Security

CO5. Learn in depth Encryption

CO6. Specify the details of E-mail and server protection

### **Unit1**

**15 Hours**

#### **COMPUTER NETWORKS**

Network Infrastructure- Internet, intranet, and extranet.

Understand the OSI model.

TCP/IP

Local area networks (LANs), Wide area networks (WANs).

Network topologies and access methods

Network Hardware- switches.

### **Unit2**

**15 Hours**

Routers, media types

Protocols and Services

Understand IPv4 & IPv6.

Addressing names resolution & networking services.

#### **SECURITY**

Understanding Security Layers Principles, Physical, Wireless, Internet & Operating System Security

### **Unit3**

**15 Hours**

User authentication, permissions, password, audit policies, encryption, malware,

Network Security & dedicated firewalls.

Network Access Protection (NAP), network isolation, Protocol security, client, e-mail & server protection

### **Reference:**

1. Fundamentals of Computer Networks Kindle Edition by SUDAKSHINA KUNDU
2. Introduction to Computer and Network Security Hardcover – 21 Aug 2013 by Richard R. Brooks

### **Practicals**

(1 Hour per week X 15 Weeks = 15 Hours)

**Experiments are based on topics mentioned in the Paper designed by concerned Faculty**

**QUESTIONPAPERScheme**

JSS MAHAVIDYAPEETHA  
JSS College of Arts, Commerce & Science (Autonomous)  
Ooty Road, Mysore - 570  
025 Title of the paper with code

**Time: 3 Hours**

**Max Marks: 70**

**Part- A**

- I Answer any five Questions (out of six) 2x5=10
- a)
  - b)
  - c)
  - d)
  - e)
  - f)

**Part- B**

Answer any two questions from each main

- II a) 2x5=10
- b)
  - c)
- III a) 2x5=10
- b)
  - c)
- IV a) 2x5=10
- b)
  - c)



### Part– C

Answer any one question from each main

V a) 1x10=10

Or

b)

VI a) 1x10=10

Or

b)

VII a) 1x10=10

Or

b)

Question numbers V, VI and VII internal split-up (5+5, 7+3, 2+8 etc.)

## QUESTIONPAPERScheme

**TIME:3Hrs**

**MAXMARKS:70**

InstructionstoStudents:Allsectionsarecompulsory.

### SECTION A

- I Fill in the blanks with correct form of verbs 5X1=05 a)  
b)  
c)  
d)  
e)
- II Change the voice of the following sentences 5X1=05 a)  
b)  
c)  
d)  
e)
- III Fill in the blanks with suitable article 5X1=05 a)  
b)  
c)  
d)  
e)
- IV Change the speech of the following 5X1=05 a)  
b)  
c)  
d)  
e)
- V Add question tag to the following 5X1=05 a)  
b)  
c)  
d)  
e)
- VI Framequestionsso astogettheunderlinedwordsasanswers 5X1=05 a)  
b)  
c)  
d)  
e)

## SECTION B

- VII 10X1=10
1. Write a letter of application
  - Or
  2. Prepare a Resume.
- VIII Read the following essay carefully and answer the questions. 10X1=10 a)
- b)
  - c)
  - d)
  - e)
- IX Write an essay on one of the following: 10X1=10 a)
- b)
  - c)
- X Answer the following (Dialogue writing) 5X2=10
- 1)
  - 2)

# QUESTIONPAPERPATTERN

## SectionA

Q1:Six questions of two marks each .Five questions to be answered  $5 \times 2 = 10$

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

## SectionB

Answeranyfour questionsfromeachmain.Eachmaincarries20marks3X 20=60

Q2: Five subquestions of5 marks each fromunit 1

Q3: Five sub questions of5 marks each fromunit 2

Q4:Fivesubquestionsof5markseach fromunit3

# **SkillComponentSyllabus**

# Model Curriculum

## JUNIOR SOFTWARE DEVELOPER

### JUNIOR SOFTWARE DEVELOPER

SECTO IT-ITeS  
R:SUB- IT Services Application  
SECTOR: Development  
OCCUPATIO SSC/Q0508, version 1.0  
N: 4  
REFERENCE  
ID: NSQF  
LEVEL:



Format:ModCur\_2015\_1\_0

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# Junior Software Developer

## CURRICULUM/SYLLABUS

This program is aimed at training candidates for the job of **Junior Software Developer** in the **IT-ITeS Sector/Industry** and aims at building the following key competencies in the learner.

<b>Program Name</b>	<b>Junior Software Developer</b>		
<b>Qualification Pack Name &amp; Reference ID.</b>	Junior Software Developer SSC/Q0508, version 1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	31/12/2015
<b>Pre-requisite to Training</b>	10 <sup>th</sup> Standard		
<b>Training Outcomes</b>	<p><b>After completing this programme, participants will be able to:</b></p> <ul style="list-style-type: none"> <li>• assist in performing software construction and software testing entry-level tasks in the IT Services industry</li> <li>• manage work to meet requirements</li> <li>• maintain a healthy, safe and secure working environment</li> </ul>		

The Course encompasses all six National Occupational Standards (NOS) of **Junior Software Developer SSC/Q0508**

Qualification Pack issued by **IT-ITeS Sector Skills Council NASSCOM**.

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
1	Basics of IT	05:00	15:00	Candidates will be able to: <ul style="list-style-type: none"> <li>• Demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media.</li> </ul>	SSC/N0506	Refer to Unique Equipment Required section
2	Problem Solving and Program Design	30:00	60:00	Candidates will be able to: <ul style="list-style-type: none"> <li>• Demonstrate aptitude for analysing information and making logical conclusions.</li> </ul>	SSC/N0506	Refer to Unique Equipment Required section



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>Demonstrate knowledge of the foundational mathematical concepts in computing.</li> </ul>		
3	Basic Algorithms and Application Development	30:00	60:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>Design algorithms to solve problems and convert them into code using the appropriate programming language constructs.</li> <li>Read and execute a test case and record the outcome in the appropriate template.</li> <li>Communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.</li> </ul>	SSC/N0506	Refer to Unique Equipment Required section
4	Self and work Management	30:00	70:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>Establish and agree work requirements with appropriate people</li> <li>Keep immediate work area clean and tidy</li> <li>Utilize time effectively</li> <li>Use resources correctly and efficiently</li> <li>Treat confidential information correctly</li> <li>Work in line with organization's policies and procedures</li> <li>Work within the limits of job role</li> <li>Obtain guidance from appropriate people, where necessary</li> <li>Ensure work meets the agreed requirements</li> </ul>	SSC/N9001	Refer to Unique Equipment Required section

5	Team Work and Communication	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Obtain guidance from appropriate people to agree the analysis to be performed on the data</li> <li>• Obtain advice and guidance from appropriate people on issues with data analysis</li> </ul>	SSC/N9002	Refer to Unique Equipment Required Section
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>outside their area of competence or</p> <ul style="list-style-type: none"> <li>• Review the results of their analysis with appropriate people</li> <li>• Undertake modifications to your analysis based on inputs from appropriate people</li> <li>• Communicate with colleagues clearly, concisely and accurately</li> <li>• Work with colleagues to integrate their work effectively with them</li> <li>• Pass on essential information to colleagues in line with organizational requirements</li> <li>• Work in ways that show respect for colleagues</li> <li>• Carry out commitments they have made to colleagues</li> <li>• Let colleagues know in good time if they cannot carry out your commitments, explaining the reasons</li> <li>• Identify any problems they have working with colleagues and take the initiative to solve these problems</li> <li>• Follow the organization's policies and procedures for working with colleagues</li> </ul>		
6	Managing Health and Safety	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Comply with organization's current health, safety and security policies and procedures</li> <li>• Report any identified breaches in health, safety, and security policies and procedures to the designated person</li> <li>• Identify and correct any hazards that can deal with</li> </ul>	SSC/N9003	Refer to Unique Equipment Required section



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				safely, competently and within the limits of authority <ul style="list-style-type: none"> <li>• Report any hazards that one is not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected</li> <li>• Follow their organization's emergency procedures promptly, calmly, and efficiently</li> <li>• Identify and recommend opportunities for improving health, safety, and security to the designated person</li> <li>• Complete any health and safety records legibly and accurately</li> </ul>		
7	Data and Information Management	15:00	35:00	Candidates will be able to: <ul style="list-style-type: none"> <li>• Establish and agree with appropriate people the data/information they need to provide, the formats in which you need to provide it, and when they need to provide it</li> <li>• Obtain the data/information from reliable sources</li> <li>• Check that the data/information is accurate, complete and up-to-date</li> <li>• Obtain advice or guidance from appropriate people where there are problems with the data/information</li> <li>• Carry out rule-based analysis of the data/information, if required</li> <li>• Insert the data/information into the agreed formats</li> <li>• Check the accuracy of work, involving colleagues where required</li> <li>• Report any unresolved anomalies in the</li> </ul>	SSC/N9004	Refer to Unique Equipment Required Section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>data/information to appropriate people</p> <ul style="list-style-type: none"> <li>• Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time</li> </ul>		
8	Learning and Self Development	05:00	20:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Obtain advice and guidance from appropriate people to develop your knowledge, skills and competence</li> <li>• Identify accurately the knowledge and skills they need for your job role</li> <li>• Identify accurately their current level of knowledge, skills and competence and any learning and development needs</li> <li>• Agree with appropriate people a plan of learning and development activities to address their learning needs</li> <li>• Undertake learning and development activities in line with their plan</li> <li>• Apply new knowledge and skills in the workplace, under supervision</li> <li>• Obtain feedback from appropriate people on their knowledge and skills and how effectively you apply them</li> <li>• Review their knowledge, skills and competence regularly and take appropriate action</li> </ul>	SSC/N9005	Refer to Unique Equipment Required Section

<b>Total Duration :</b>	<b><u>114:00</u></b>	<b><u>286:00</u></b>	<b>UniqueEquipmentRequired:</b> Training room should be fully furnished with the following equipment / tools / accessories. Additional / specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome.
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>For Domain NOS, For NOSSSC/N0506–HTML,C++/Java,IDE</p> <p>General:</p> <ul style="list-style-type: none"> <li>• Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning</li> <li>• WhiteBoard,MarkersandEraser</li> <li>• Projectorwithscreen</li> <li>• Flipchartwithmarkers</li> <li>• Faculty’sPC/Laptopwithlatestconfiguration andinternet connection</li> <li>• Supporting software/ applications for projecting audio, video, recording,</li> <li>• PresentationToolstosupportlearningactivities:</li> <li>• Intranet</li> <li>• Email</li> <li>• IMs</li> <li>• Learningmanagementsysteme.g.Moodle,Blackboardto enable blended learning</li> <li>• Microphone/voicesystemforlectureandclassactivities</li> <li>• HandyCamera</li> <li>• Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets</li> <li>• For IT Labsessions: Computer Lab with 1:1 PC : trainee ratio and having internet connection, MS Office / Open office, Browser, Outlook / Any other Email Client and chat tools.</li> <li>• Assessment and Test Tools for day to day online Tests and Assessments</li> <li>• For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition.</li> <li>• Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.</li> </ul>		

GrandTotalCourseDuration:**400 Hours 0 Minutes**

(ThisSyllabus/CurriculumhasbeenapprovedbyIT-ITeSSectorSkillsCouncilNASSCOM.)

Format:ModCur\_2015\_1\_0





### Notes from IT-ITeS Sector Skills Council NASSCOM

1. This document outlines the broad scope of coverage. This should be linked with OBF and training delivery plan. OBF (Outcome based framework) reflects the pedagogy used to ensure an expected outcome. Training delivery plan focuses on the sequence of delivery.
2. Though many NOS have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. For example, writing skills required to document program structure and code (in SSC/N0506) are different from the writing skills required to prepare a time plan (in SSC/N9001). Training providers are advised to,
  - a. Embed such skills development in the learning pedagogy for each expected outcome
  - b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
  - c. Run a diagnostic test to assess prior learning of students and help trainers/students identify the need for gap training, optimal duration and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.



Annexure 1: Assessment Criteria

<b>Assessment Criteria for Junior Software Developer</b>	
<b>Job Role</b>	<b>Junior Software Developer</b>
<b>Qualification Pack</b>	<b>SSC/Q0508</b>
<b>Sector Skill Council</b>	<b>IT-ITeS</b>

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit <a href="http://www.sscnasscom.com">www.sscnasscom.com</a> .

ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	Assessment criteria (PC)	Total Marks	Out Of	MARKS ALLOCATION	
				Theory	Skills Practical
<b>1.SSC/N0506(Deal remotely with customer queries- Domestic)</b>	PC1. greet customers and verify details, following your organization's procedures	<b>120</b>	12.5	2.5	10
	PC2. read carefully, summarize, and obtain customer confirmation of your understanding of queries		12.5	2.5	10
	PC3. express your concern for any difficulties caused and your commitment to resolving queries		15	0	15
	PC4. record and categorize queries accurately using your organization's query management tool		5	0	5
	PC5. refer queries outside your area of competence or authority promptly to appropriate people		2.5	0	2.5
	PC6. access your organization's knowledge base for solutions to queries, where available		2.5	0	2.5
	PC7. resolve queries within your area of competence or authority in line with organizational guidelines and service level agreements (SLAs)		15	0	15
	PC8. obtain advice and guidance from appropriate people, where necessary		2.5	0	2.5
	PC9. obtain confirmation from customers that queries have been resolved to satisfaction		10	0	10



	PC10. record the resolution of queries accurately using your organization's query management tool		35	15	20
	PC11. comply with relevant standards, policies, procedures and guidelines when dealing remotely with customer queries		7.5	0	7.5
		<b>NOS Total</b>	<b>120</b>	<b>20</b>	<b>100</b>
<b>2.SSC/N9001 (Manage your work to meet requirements)</b>	PC1. establish and agree your work requirements with appropriate people	<b>40</b>	10	5	5
	PC2. keep your immediate work area clean and tidy		5	0	5
	PC3. utilize your time effectively		5	5	0
	PC4. use resources correctly and efficiently		5	2.5	2.5
	PC5. treat confidential information correctly		5	0	5
	PC6. work in line with your organization's policies and procedures		2.5	0	2.5
	PC7. work within the limits of your job role		2.5	0	2.5
	PC8. obtain guidance from appropriate people, where necessary		2.5	0	2.5
	PC9. ensure your work meets the agreed requirements		2.5	0	2.5
		<b>NOS Total</b>	<b>40</b>	<b>12.5</b>	<b>27.5</b>
<b>3.SSC/N9003 (Maintain a healthy, safe and secure working environment)</b>	PC1. comply with your organization's current health, safety and security policies and procedures	<b>40</b>	10	5	5
	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		5	0	5
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority		10	5	5
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		5	0	5
	PC5. follow your organization's emergency procedures promptly, calmly, and efficiently		5	0	5
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		2.5	0	2.5
	PC7. complete any health and safety records legibly and accurately		2.5	0	2.5
		<b>NOS Total</b>	<b>40</b>	<b>10</b>	<b>30</b>



Annexure2:TrainerPrerequisitesforJobrole:JuniorSoftwareDeveloper mappedtoQualificationPack:SSC/Q0508

Sr. No.	Area	Details
1	<b>JobDescription</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0508.
2	<b>PersonalAttributes</b>	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in this field.
3	<b>Minimum Educational Qualifications</b>	Minimum 12 <sup>th</sup> Standard; Preferred Master's degree in any discipline
4a	<b>Domain Certification</b>	Minimum accepted score in SSC Assessment is 90% per NOS being taught in QP SSC/Q0508.  Additional certification in customer orientation, dealing with difficult customers, written communication etc. will be an added advantage.
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402".  Minimum accepted score is 70% per NOS.
5	<b>Experience</b>	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred



## Certificate

### CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

Issued by the NSC  
OF THE SECTOR SKILL COUNCILS ASSOCIATION

#### MODEL CURRICULUM

This curriculum is prepared for compliance with the  
Qualification Pack for **Business Software Developer (Level 2)**

Name of the Candidate: \_\_\_\_\_  
Date of Issuance: \_\_\_\_\_

  
Name of the Official: \_\_\_\_\_



**4E-VandanaBuilding(4thFloor)**

11, Tolstoy Marg  
New Delhi-110001

Phone:91-11-41519230/60

Fax:91-11-41519240

Email:[ssc@nasscom.in](mailto:ssc@nasscom.in)

# Model Curriculum

## WEBDEVELOPER

### WEBDEVELOPER

SECTO IT-ITeS  
R:SUB- IT ServicesApplication  
SECTOR: Development  
OCCUPATIO SSC/Q0503,version1.0  
N: 5  
REFERENCE  
ID: NSQF  
LEVEL:



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# Web Developer

## CURRICULUM/SYLLABUS

This program is aimed at training candidates for the job of **Web Developer** in the **IT-ITeS Sector/Industry** and aims at building the following key competencies in the learner.

<b>Program Name</b>	<b>Web Developer</b>		
<b>Qualification Pack Name &amp; Reference ID.</b>	Web Developer SSC/Q0503, version 1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	31/12/2015
<b>Pre-requisites to Training</b>	Graduate degree/ diploma in web design/ media design or any other related field		
<b>Training Outcomes</b>	<p><b>After completing this programme, participants will be able to:</b></p> <ul style="list-style-type: none"> <li>• Contribute to the design of software products and applications</li> <li>• Develop media content and graphic designs for software products and Applications</li> <li>• Manage their work to meet requirements</li> <li>• Work effectively with colleagues</li> <li>• Maintain a healthy, safe and secure working environment</li> <li>• Provide data/information in standard formats</li> <li>• Develop their knowledge, skills and competence</li> </ul>		

The Course encompasses all seven National Occupational Standards (NOS) of **Web Developer SSC/Q0503** Qualification Pack issued by **IT-ITeS Sector Skills Council NASSCOM**.

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
1	Programming for the Web	20:00	30:00	Candidates will be able to: <ul style="list-style-type: none"> <li>• Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD</li> </ul>	SSC/N0501	Refer to Unique Equipment Required Section



2	Analysis and Design of Web based Applications	20:00	30:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Check their understanding of the Business Requirements Specification (BRS)/User</li> </ul>	SSC/N0501	Refer to Unique Equipment Required Section
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>Requirements Specification (URS) with appropriate people</p> <ul style="list-style-type: none"> <li>• Check their understanding of the Software Requirements Specification (SRS) with appropriate people</li> <li>• Check their understanding of High Level Design (HLD) with appropriate people</li> <li>• Review their designs with appropriate people</li> <li>• Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs</li> <li>• Document their designs using standard templates and tools</li> <li>• Comply with their organization's policies, procedures and guidelines when contributing to the design of software products and applications</li> </ul>		
3	Media Content and Graphics Design	20:00	80:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Check their understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people</li> <li>• Access reusable components, media and graphical packages and tools from their organization's knowledge base</li> </ul>	SSC/N0503	Refer to Unique Equipment Required Section



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>• Convert requirements into media content and graphic designs, leveraging reusable components where available</li> <li>• Review media content and graphic designs with appropriate people and analyze their feedback</li> <li>• Record any defects and corrective actions taken to inform future work</li> <li>• Rework media content and graphic designs, incorporating feedback</li> <li>• Submit media content timely and graphic designs for approval by appropriate people</li> <li>• Update their organization's knowledge base with their experiences of the media content and graphic designs developed</li> <li>• Comply with their organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications</li> </ul>		

4	Self and work Management	12:00	38:00	Candidates will be able to: <ul style="list-style-type: none"> <li>• Establish and agree their work requirements with appropriate people</li> <li>• Keep their immediate work area clean and tidy</li> <li>• utilize their time effectively</li> </ul>	SSC/N9001	Refer to Unique Equipment Required Section
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>• Use resources correctly and efficiently</li> <li>• Treat confidential information correctly</li> <li>• Work in line with organization's policies and procedures</li> <li>• Work within the limits of their job role</li> <li>• Obtain guidance from appropriate people, where necessary</li> <li>• Ensure their work meets the agreed requirements</li> </ul>		
5	Team Work and Communication	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Communicate with colleagues clearly, concisely and accurately</li> <li>• Work with colleagues to integrate their work effectively with them</li> <li>• Pass on essential information to colleagues in line with organizational requirements</li> <li>• Work in ways that show respect for colleagues</li> <li>• carry out commitments they have made to colleagues</li> <li>• Let colleagues know in good time if they cannot carry out their commitments, explaining the reasons</li> <li>• Identify any problems they have working with colleagues and take the initiative to solve these problems</li> <li>• Follow the organization's policies and procedures for working with colleagues</li> </ul>	SSC/N9002	Refer to Unique Equipment Required Section



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
6	Managing Health and Safety	05:00	20:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Comply with their organization's current health, safety and security policies and procedures</li> <li>• Report any identified breaches in health, safety, and security policies and procedures to the designated person</li> <li>• Identify and correct any hazards that they can deal with safely, competently and within the limits of their authority</li> <li>• Report any hazards that they are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected</li> <li>• Follow their organization's emergency procedures promptly, calmly, and efficiently</li> <li>• Identify and recommend opportunities for improving health, safety, and security to the designated person</li> <li>• Complete any health and safety</li> </ul>	SSC/ N9003	
7	Data and Information Management	15:00	35:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Establish and agree with appropriate people the data/information they need to provide, the formats in which they need to provide it, and when they need to provide it</li> </ul>	SSC/N9004	Refer to Unique Equipment Required Section



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>Obtain the data/information from reliable sources</li> <li>Check that the data/information is accurate, complete and up-to-date</li> <li>Obtain advice or guidance from appropriate people where there are problems with the data/information</li> <li>Carry out rule-based analysis of the data/information, if required</li> <li>Insert the data/information into the agreed formats</li> <li>Check the accuracy of their work, involving colleagues where required</li> <li>Report any unresolved anomalies in the data/information to appropriate people</li> <li>Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time</li> </ul>		
8	Learning and Self Development	5:00	20:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>Obtain advice and guidance from appropriate people to develop their knowledge, skills and competence</li> <li>Identify accurately the knowledge and skills they need for their job role</li> <li>Identify accurately their current level of knowledge, skills</li> </ul>	SSC/N9005	Refer to Unique Equipment Required Section

				and		
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>competence and any learning and development needs</p> <ul style="list-style-type: none"> <li>• Agree with appropriate people a plan of learning and development activities to address their learning needs</li> <li>• Undertake learning and development activities in line with their plan</li> <li>• Apply their new knowledge and skills in the workplace, under supervision</li> <li>• Obtain feedback from appropriate people on their knowledge and skills and how effectively they apply them</li> <li>• Review their knowledge, skills and competence regularly and take appropriate action</li> </ul>		

	<b>TotalDuration:</b>	<b><u>109:00</u></b>	<b><u>291:00</u></b>	<p><b>UniqueEquipmentRequired:</b>  Training room should be fully furnished with the following equipment / tools / accessories. Additional / specific resources, wherever applicable (e.g.Hardware, software) are indicated in the main text corresponding to relevant learning outcome.</p> <p>ForDomainNOSs:</p> <ul style="list-style-type: none"> <li>• NOS SSC/N0501: HTML5, Javascript, CSS, SQL, Web Builder, Word Press, Joomla and modelling tools suchas Visio, UML</li> <li>• NOS SSC/N0503: HTML5, CSS, Flash, Photoshop, Windows media player, Eclipse, XAMPP</li> </ul> <p>General:</p> <ul style="list-style-type: none"> <li>• Comfortable seats with adequate lighting,controlled temperature and acoustics for training and learning</li> </ul>
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>• WhiteBoard,MarkersandEraser</li> <li>• Projectorwithscreen</li> <li>• Flipchartwithmarkers</li> <li>• Faculty’sPC/Laptopwithlatest configurationandinternet connection</li> <li>• Supporting software / applications for projecting audio, video, recording,</li> <li>• PresentationToolstosupportlearningactivities:                             <ul style="list-style-type: none"> <li>○ Intranet</li> <li>○ Email</li> <li>○ IMs</li> <li>○ Learning management system e.g. Moodle, Blackboard to enable blended learning</li> </ul> </li> <li>• Microphone/voicesystemforlectureandclassactivities</li> <li>• HandyCamera</li> <li>• Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets</li> <li>• For IT Lab sessions: Computer Lab with 1:1 PC:trainee ratio and having internet connection, MS Office / Open office, Browser, Outlook/ other Email Clients</li> <li>• AssessmentandTestToolsfordaytodayonlineTestsand Assessments</li> <li>• For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition.</li> <li>• ReadingResources: Access torelevant sampleddocuments and learning forums to enable self-study before and after each training session.</li> </ul>		

GrandTotalCourseDuration:**400 Hours 0 Minutes**

*(ThisSyllabus/CurriculumhasbeenapprovedbyIT-ITESSectorSkillsCouncilNASSCOM.)*



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2. Though many NOSs have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. For example, writing skills required to write design specifications (in SSC/N0501) are different from the writing skills required to prepare a time plan (in SSC/N9001). Training providers are advised to,
  - a. Embed such skills development in the learning pedagogy for each expected outcome
  - b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
  - c. Run a diagnostic test to assess prior learning of students and help trainers / students identify the need for gap training, optimal duration, and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.



Annexure 1: Assessment Criteria

Assessment Criteria for Web Developer	
<b>Job Role</b>	<b>Web Developer</b>
<b>Qualification Pack</b>	<b>SSC/Q0503</b>
<b>Sector Skill Council</b>	<b>IT-ITeS</b>

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit <a href="http://www.sscnasscom.com">www.sscnasscom.com</a> .

ASSESSMENT OUTCOME (NOS  CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	MARKS ALLOCATION	
				THEORY	SKILLS PRACTICAL
<b>1. SSC/N0501 (Contribute to the design of software products and applications)</b>	PC1. check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	<b>100</b>	10	10	0
	PC2. check their understanding of the Software Requirements Specification (SRS) with appropriate people		10	10	0
	PC3. check their understanding of High Level Design (HLD) with appropriate people		10	10	0
	PC4. design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD		30	0	30
	PC5. review their designs with appropriate people		5	5	0
	PC6. analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs		15	5	10
	PC7. document their designs using standard templates and tools		10	0	10
	PC8. comply with their organization's policies, procedures and guidelines when contributing to the design of software products and applications		10	0	10

		<b>Total</b>	100	40	60
<b>2. SSC/N0503 (Develop media</b>	PC1. check their understanding of the Business RequirementsSpecification(BRS),Software	<b>100</b>	10	10	0



content an dgraphic designs for software products and Applications)	Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people				
	PC2.access reusable components, media and graphical packages and tools from their organization's knowledge base		10	0	10
	PC3.convert requirements into media content and graphic designs, leveraging reusable components where available		20	0	20
	PC4.review media content and graphic designs with appropriate people and analyze their feedback		10	5	5
	PC5. record any defects and corrective actions taken to inform future work		10	0	10
	PC6.rework media content and graphic designs, incorporating feedback		10	5	5
	PC7. submit media content and graphic designs for approval by appropriate people		10	0	10
	PC8.update their organization's knowledge base with their experiences of the media content and graphic designs developed		10	0	10
	PC9.comply with their organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications		10	0	10
	<b>Total</b>	100	20	80	
3.SSC/N9001 (Manage their work to meet requirements)	PC1. establish and agree their work requirements with appropriate people	<b>100</b>	7.5	0	7.5
	PC2. keep their immediate work area clean and tidy		15	7.5	7.5
	PC3. utilize their time effectively		15	7.5	7.5
	PC4. use resources correctly and efficiently		15	7.5	7.5
	PC5. treat confidential information correctly		7.5	0	7.5
	PC6. work in line with their organization's policies and procedures		15	0	15
	PC7. work within the limits of their job role		7.5	0	7.5
	PC8. obtain guidance from appropriate people, where necessary		7.5	0	7.5
	PC9. ensure their work meets the agreed requirements		10	0	10
	<b>Total</b>	100	22.5	77.5	
4.SSC/N9002 (Work effectively with colleagues)	PC1.communicate with colleagues clearly, concisely and accurately	<b>100</b>	20	0	20
	PC2. work with colleagues to integrate their work effectively with theirs		10	0	10



	PC3. pass on essential information to colleagues in line with organizational requirements		10	10	0
	PC4. work in ways that show respect for colleagues		20	0	20
	PC5. carry out commitments you have made to colleagues		10	0	10
	PC6. let colleagues know good time if you cannot carry out their commitments, explaining the reasons		10	10	0
	PC7. identify any problems you have working with colleagues and take the initiative to solve these problems		10	0	10
	PC8. follow the organization's policies and procedures for working with colleagues		10	0	10
		<b>Total</b>	100	20	80
<b>5.SSC/N9003 (Maintain a healthy, safe and secure working environment)</b>	PC1. comply with their organization's current health, safety and security policies and procedures		20	10	10
	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of their authority	<b>100</b>	20	10	10
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		10	0	10
	PC5. follow their organization's emergency procedures promptly, calmly, and efficiently		20	10	10
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		10	0	10
	PC7. complete any health and safety records legibly and accurately		10	0	10
		<b>Total</b>	100	30	70
<b>6.SSC/N9004 (Provide data/information in standard formats)</b>	PC1. establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it		15	15	0
	PC2. obtain the data/information from reliable sources	<b>100</b>	15	0	15
	PC3. check that the data/information is accurate, complete and up-to-date		15	5	10
	PC4. obtain advice or guidance from appropriate people where there are problems with the data/information		5	5	0



	PC5.carryoutrule-basedanalysisofthe data/information, if required	20	0	20
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	PC6.insertthedata/informationintotheagreed formats		10	0	10
	PC7. check theaccuracyof their work, involving colleagues where required		10	0	10
	PC8. reportanyunresolvedanomaliesinthe data/information to appropriate people		5	5	0
	PC9.providecomplete,accurateandup-to-date data/information to theappropriate people inthe required formats on time		5	0	5
		<b>Total</b>	100	30	70
<b>7.SSC/N9005 (Develop their knowledge, skill sandcompetence)</b>	PC1. obtain advice and guidance from appropriate people to develop their knowledge, skills and competence	<b>100</b>	20	7	13
	PC2.identifyaccuratelytheknowledgeandskills you need for their job role		14	7	7
	PC3. identify accurately their current level of knowledge,skillsandcompetence andany learning and development needs		14	0	14
	PC4. agree with appropriate people a plan of learning and development activities to address their learning needs		7	0	7
	PC5.undertakelearninganddevelopment activities in line with their plan		12	0	12
	PC6.applytheirnewknowledgeandskillsin the workplace, under supervision		12	0	12
	PC7.obtainfeedbackfromappropriate people ontheirknowledgeandskillsandhoweffectively you apply them		7	0	7
	PC8. review their knowledge, skills and competenceregularlyand takeappropriate action		14	7	7
			<b>Total</b>	100	21



Annexure 2: Trainer Prerequisites for Job role: Web Developer mapped to Qualification Pack: SSC/Q0503

Sr. No.	Area	Details
1	<b>Job Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0503.
2	<b>Personal Attributes</b>	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in this field.
3	<b>Minimum Educational Qualifications</b>	Minimum Graduated degree/ diploma in web design/ media design or any other related field; Preferred Master's Degree in Media Design
4a	<b>Domain Certification</b>	Minimum accepted score in SSC Assessment is 90% per NOS being taught in QP SSC/Q0503.  Certification in relevant software competencies: Software Development Certifications in C++, Embedded, C#, C, Java etc., is an added advantage.
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/1402".  Minimum accepted score is 70%.
5	<b>Experience</b>	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred



# Certificate

## CURRICULUM COMPLIANCE TO QUALIFICATION FRAME – NATIONAL OCCUPATIONAL STANDARDS

Issued on: \_\_\_\_\_

BY THE DIRECTOR GENERAL, NSC

### MODEL CURRICULUM

For the Sector Skills Council (SSC) \_\_\_\_\_  
at the \_\_\_\_\_ Level of the Qualification Framework (NQF)

Name of the Candidate: \_\_\_\_\_  
Address: \_\_\_\_\_

*(Signature)*  
Director General, NSC



**4E-VandanaBuilding(4thFloor)**  
11, Tolstoy Marg  
New Delhi-110001  
Phone:91-11-41519230/60  
Fax:91-11-41519240  
Email: [ssc@nasscom.in](mailto:ssc@nasscom.in)



# Model Curriculum

## Software Developer

**SECTOR:** IT-ITES  
**SUB-SECTOR:** IT SERVICES DATA  
**OCCUPATION:** SCIENTISTS  
**REF.ID:** SSC/Q0401, VERSION 1.0  
**NSQF** 7  
**LEVEL:**





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<b>2. Trainer Prerequisites</b>	<b>07</b>
<b>3. Annexure: Assessment Criteria</b>	<b>08</b>



# Software Developer

## CURRICULUM/SYLLABUS

This program is aimed at training candidates for the job of **Software Developer** in the **IT-ITeS** Sector/Industry and aims at building the following key competencies in the learner.

<b>Program Name</b>	<b>Software Developer</b>		
<b>Qualification Pack Name &amp; Reference ID.</b>	Software Developer SSC/Q0501, version 1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	31/12/2015
<b>Pre-requisites to Training</b>	BSc (Stat, Math, Physics, Chemistry, Geology) or BE/BTech		
<b>Training Outcomes</b>	<b>After completing this programme, participants will be able to:</b> <ul style="list-style-type: none"><li>• Contribute to the design of software products and applications</li><li>• Develop software code to specification</li><li>• Manage their work to meet requirements</li><li>• Work effectively with colleagues</li><li>• Maintain a healthy, safe and secure working environment</li><li>• Provide data/information in standard formats</li><li>• Develop their knowledge, skills and competence</li></ul>		





The Course encompasses all seven National Occupational Standards (NOS) of Software Developer SSC/Q0501 Qualification Pack issued by IT-ITeS Sector Skills Council NASSCOM.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<b>Programming and Algorithms</b>  <b>Theory Duration</b> (hh:mm) 20:00  <b>Practical Duration</b> (hh:mm) 30:00  <b>Corresponding NOS Code</b> SSC/N0501	Candidates will be able to: <ul style="list-style-type: none"><li>Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD</li></ul>	Refer to Unique Equipment Required Section
2	<b>Analysis and Design of Software Applications</b>  <b>Theory Duration</b> (hh:mm) 20:00  <b>Practical Duration</b> (hh:mm) 30:00  <b>Corresponding NOS Code</b> SSC/N0501	Candidates will be able to: <ul style="list-style-type: none"><li>Check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people</li><li>Check their understanding of the Software Requirements Specification (SRS) with appropriate people</li><li>Check their understanding of High Level Design (HLD) with appropriate people</li><li>Review their designs with appropriate people</li><li>Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs</li><li>Document designs using standard templates and tools</li><li>Comply with organization's policies, procedures and guidelines when contributing to the design of software products and applications</li></ul>	Refer to Unique Equipment Required Section
3	<b>Application Development</b>  <b>Theory Duration</b> (hh:mm) 20:00  <b>Practical Duration</b> (hh:mm) 80:00  <b>Corresponding NOS Code</b> SSC/N0502	Candidates will be able to: <ul style="list-style-type: none"><li>Check their understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people</li><li>Access reusable components, code generation tools and unit testing tools from their organization's knowledge base</li><li>Convert technical specifications into code to meet the requirements, leveraging reusable components, where available</li><li>Create appropriate unit test cases (UTCs)</li><li>Review codes and UTCs with appropriate people</li><li>Execute UTCs and document results</li><li>Rework the code and UTCs to fix identified defects</li></ul>	Refer to Unique Equipment Required Section



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"><li>Analyse inputs from appropriate people to inform future designs</li><li>Record corrective actions for identified defects to inform future designs</li><li>Submit tested code timely for approval by appropriate people</li><li>Update their organization's knowledge base with their experiences of the code developed</li><li>Comply with their organization's policies, procedures and guidelines when developing software code to specification</li></ul>	
4	<b>Self and work Management</b>  <b>Theory Duration</b> (hh:mm) 12:00  <b>Practical Duration</b> (hh:mm) 38:00  <b>Corresponding NOS Code</b> SSC/N9001	Candidates will be able to: <ul style="list-style-type: none"><li>Establish and agree their work requirements with appropriate people</li><li>Keep their immediate work area clean and tidy</li><li>utilize their time effectively</li><li>User resources correctly and efficiently</li><li>Treat confidential information correctly</li><li>Work in line with organization's policies and procedures</li><li>Work within the limits of their job role</li><li>Obtain guidance from appropriate people, where necessary</li><li>Ensure their work meets the agreed requirements</li></ul>	Refer to Unique Equipment Required Section
5	<b>Team Work and Communication</b>  <b>Theory Duration</b> (hh:mm) 12:00  <b>Practical Duration</b> (hh:mm) 38:00  <b>Corresponding NOS Code</b> SSC/N9002	Candidates will be able to: <ul style="list-style-type: none"><li>Communicate with colleagues clearly, concisely and accurately</li><li>Work with colleagues to integrate their work effectively with them</li><li>Pass on essential information to colleagues in line with organizational requirements</li><li>Work in ways that show respect for colleagues</li><li>carry out commitments they have made to colleagues</li><li>Let colleagues know in good time if they cannot carry out their commitments, explaining the reasons</li><li>Identify any problems they have working with colleagues and take the initiative to solve these problems</li><li>Follow the organization's policies and procedures for working with colleagues</li></ul>	Refer to Unique Equipment Required Section
6	<b>Managing Health and Safety</b> <b>Theory Duration</b> (hh:mm) 05:00	Candidates will be able to: <ul style="list-style-type: none"><li>Comply with their organization's current health, safety and security policies and procedures</li><li>Report any identified breaches in health, safety, and security policies and procedures to the designated person</li><li>Identify and correct any hazards that they can deal</li></ul>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Practical Duration</b> (hh:mm) 20:00  <b>Corresponding NOS Code</b> SSC/N9003	with safely, competently and within the limits of their authority <ul style="list-style-type: none"><li>• Report any hazards that they are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected</li><li>• Follow their organization's emergency procedures promptly, calmly, and efficiently</li><li>• Identify and recommend opportunities for improving health, safety, and security to the designated person</li><li>• Complete any health and safety</li></ul>	
7	<b>Data and Information Management</b>  <b>Theory Duration</b> (hh:mm) 15:00  <b>Practical Duration</b> (hh:mm) 35:00  <b>Corresponding NOS Code</b> SSC/N9004	Candidates will be able to: <ul style="list-style-type: none"><li>• Establish and agree with appropriate people the data/information they need to provide, the formats in which they need to provide it, and when they need to provide it</li><li>• Obtain the data/information from reliable sources</li><li>• Check that the data/information is accurate, complete and up-to-date</li><li>• Obtain advice or guidance from appropriate people where there are problems with the data/information</li><li>• Carry out rule-based analysis of the data/information, if required</li><li>• Insert the data/information into the agreed formats</li><li>• Check the accuracy of their work, involving colleagues where required</li><li>• Report any unresolved anomalies in the data/information to appropriate people</li><li>• Provide complete, accurate and up-to-date data/information to the appropriate people in the required format on time</li></ul>	Refer to Unique Equipment Required Section
8	<b>Learning and Self Development</b>  <b>Theory Duration</b> (hh:mm) 05:00  <b>Practical Duration</b> (hh:mm) 20:00  <b>Corresponding NOS Code</b> SSC/N9005	Candidates will be able to: <ul style="list-style-type: none"><li>• Obtain advice and guidance from appropriate people to develop their knowledge, skills and competence</li><li>• Identify accurately the knowledge and skills they need for their job role</li><li>• Identify accurately their current level of knowledge, skills and competence and any learning and development needs</li><li>• Agree with appropriate people a plan of learning and development activities to address their learning needs</li><li>• Undertake learning and development activities in line with their plan</li><li>• Apply their new knowledge and skills in the workplace, under supervision</li><li>• Obtain feedback from appropriate people on their</li></ul>	Refer to Unique Equipment Required Section



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		knowledge and skills and how effectively they apply them <ul style="list-style-type: none"> <li>Review their knowledge, skills and competence regularly and take appropriate action</li> </ul>	
	<b>Total Duration</b>  <b>Theory Duration</b> <b>109:00</b>  <b>Practical Duration</b> <b>291:00</b>	<b>Unique Equipment Required:</b> Training rooms should be fully furnished with the following equipment/tools/accessories. Additional/specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome.  <b>For Domain NOSs:</b> <ul style="list-style-type: none"> <li>For NOSSSC/N0501: C/C++, UML toolssuchas Rational suite</li> <li>For NOSSSC/N0502: JDK/Eclipse</li> </ul> <b>General:</b> <ul style="list-style-type: none"> <li>Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning</li> <li>White Board, Markers and Eraser</li> <li>Projector with screen</li> <li>Flipchart with markers</li> <li>Faculty's PC/Laptop with latest configuration and internet connection</li> <li>Supporting software/applications for projecting audio, video, recording,</li> <li><b>Presentation Tools to support learning activities:</b> <ul style="list-style-type: none"> <li>Intranet</li> <li>Email</li> <li>IMs</li> </ul> </li> <li>Learning management systems e.g. Moodle, Blackboard to enable blended learning</li> <li>Microphone/voice system for lecture and class activities</li> <li>Handy Camera</li> <li>Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets</li> <li>For IT Lab sessions: Computer Lab with 1:1 PC: trainee ratio and having internet connection, MS Office/Open office, Browser, Outlook/other Email Clients</li> <li>Assessment and Test Tools for day today online Tests and Assessments</li> <li>For team discussions: Adequate seating arrangement in full/half circle format for one or more teams as per planned team composition.</li> <li>Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.</li> </ul>	

**Grand Total Course Duration: 400 Hours 0 Minutes**

**(This Syllabus/Curriculum has been approved by IT-ITeS Sector Skills Council NASSCOM.)**



## Notes from IT-ITeS Sector Skills Council

1. This document outlines the broad scope of coverage. This should be linked with OBF and training delivery plan. OBF (Outcome based framework) reflects the pedagogy used to ensure an expected outcome. Training delivery plan focuses on the sequence of delivery.
2. Though many NOSs have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. For example, writing skills required to communicate results of testing (in SSC/N0501) are different from the writing skills required to prepare a time plan (in SSC/N9001). Training providers are advised to,
  - a. Embed such skills development in the learning pedagogy for each expected outcome
  - b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
  - c. Run a diagnostic test to assess prior learning of students and help trainers/students identify the need for gap training, optimal duration, and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.



## Trainer Prerequisites for Job role: Software Developer mapped to Qualification Pack: SSC/Q0501

Sr. No.	Area	Details
1	<b>Job Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0501.
2	<b>Personal Attributes</b>	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in this field.
3	<b>Minimum Educational Qualifications</b>	Minimum Bachelor's Degree in Computer Science or any related field; Preferred Master's Degree in Computer Science
4a	<b>Domain Certification</b>	Minimum accepted score in SSC Assessment is 90% per NOS being taught in QP SSC/Q0501.  Certification in relevant software competencies: Software Development Certifications in C++, Embedded, C#, C, Java etc., is an added advantage.
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402". Minimum accepted score is 70%.
5	<b>Experience</b>	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred



## Annexure: Assessment Criteria

<b>Assessment Criteria for Software Developer</b>	
<b>Job Role</b>	<b>Software Developer</b>
<b>Qualification Pack</b>	<b>SSC/Q0501</b>
<b>Sector Skill Council</b>	<b>IT-ITeS</b>

<b>Sr.No.</b>	<b>Guidelines for Assessment</b>
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit <a href="http://www.sscnasscom.com">www.sscnasscom.com</a> .



				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOCODE AND DESCRIPTION)	ASSESSMENT CRITERIA(PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
<b>1.SSC/N0501 (CONTRIBUTE TO THE DESIGN OF SOFTWARE PRODUCTS AND APPLICATIONS)</b>	PC1.checktheirunderstandingoftheBusiness RequirementsSpecification(BRS)/User Requirements Specification (URS)with appropriatepeople	<b>100</b>	10	10	0
	PC2.checktheirunderstandingoftheSoftware RequirementsSpecification(SRS)with appropriatepeople		10	10	0
	PC3.checktheirunderstandingofHighLevel Design(HLD)withappropriatepeople		10	10	0
	PC4.designbasicprogrammingstructuresto implementfunctionalityinlinewith requirementsdefinedinBRS/URS,SRSandHLD		30	0	30
	PC5.reviewtheirdesignswithappropriate people		5	5	0
	PC6.analyzeinputsfromappropriatepeople toidentify,resolveandrecorddesign defects andinformfuturedesigns		15	0	15
	PC7.documenttheirdesignsusingstandard templatesandtools		10	0	10
	PC8.complywiththeirorganization'spolicies, procedures andguidelines whencontributing tothedesignofsoftwareproductsand applications		10	0	10
	<b>Total</b>			100	35
<b>2.SSC/N0502 (DEVELOP SOFTWARE CODE TO SPECIFICATION)</b>	PC1.checktheirunderstandingoftheBusiness RequirementsSpecification(BRS),Software RequirementsSpecification(SRS),HighLevel Design(HLD)andLowLevelDesign(LLD)with appropriatepeople	<b>100</b>	5	5	0
	PC2.accessreusablecomponents,code generationtoolsandunittestingtoolsfrom theirorganization'sknowledgebase		5	0	5
	PC3.converttechnicalspecificationsintocode to meet the requirements, leveraging reusable components,whereavailable		30	0	30
	PC4.createappropriateunittestcases(UTCs)		10	0	10
	PC5.reviewcodesandUTCswithappropriatepeople		5	5	0
	PC6.executeUTCsanddocumentresults		5	0	5
	PC7.reworkthecodeandUTCstofixidentified defects		10	0	10
	PC8.analyzeinputsfromappropriatepeople toinformfuturedesigns		5	5	0
	PC9.recordcorrectiveactionsforidentified defectstoinformfuturedesigns		10	0	10
				5	5





				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
	PC10. submitted code for approval by appropriate people				
	PC11. update their organization's knowledge base with their experiences of the code developed		5	0	5
	PC12. comply with their organization's policies, procedures and guidelines when developing software code to specification		5	0	5
		<b>Total</b>	100	20	80
<b>3.NOS/N9001 (MANAGE THEIR WORK TO MEET REQUIREMENTS)</b>	PC1. establish and agree their work requirements with appropriate people	<b>100</b>	6.25	0	6.25
	PC2. keep their immediate work area clean and tidy		12.5	6.25	6.25
	PC3. utilize their time effectively		12.5	6.25	6.25
	PC4. use resources correctly and efficiently		18.75	6.25	12.5
	PC5. treat confidential information correctly		6.25	0	6.25
	PC6. work in line with their organization's policies and procedures		12.5	0	12.5
	PC7. work within the limits of their job role		6.25	0	6.25
	PC8. obtain guidance from appropriate people, where necessary		6.25	0	6.25
	PC9. ensure their work meets the agreed requirements		18.75	6.25	12.5
		<b>Total</b>	<b>100</b>	<b>25</b>	<b>75</b>
<b>4.SSC/N9002 (WORK EFFECTIVELY WITH COLLEAGUES)</b>	PC1. communicate with colleagues clearly, concisely and accurately	<b>100</b>	20	0	20
	PC2. work with colleagues to integrate their work effectively with theirs		10	0	10
	PC3. pass on essential information to colleagues in line with organizational requirements		10	10	0
	PC4. work in ways that show respect for colleagues		20	0	20
	PC5. carry out commitments you have made to colleagues		10	0	10
	PC6. let colleagues know in good time if you cannot carry out their commitments, explaining the reasons		10	10	0
	PC7. identify any problems you have working with colleagues and take the initiative to solve these problems		10	0	10
	PC8. follow the organization's policies and procedures for working with colleagues		10	0	10
			<b>Total</b>	<b>100</b>	<b>20</b>
<b>5.SSC/N9003 (MAINTAIN A</b>	PC1. comply with their organization's current health, safety and security policies and procedures	<b>100</b>	20	10	10



ASSESSMENT OUTCOME (NO CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	MARKS ALLOCATION			
		TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
HEALTHY, SAFE AND SECURE WORKING ENVIRONMENT)	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of their authority		20	10	10
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people whom may be affected		10	0	10
	PC5. follow their organization's emergency procedures promptly, calmly, and efficiently		20	10	10
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		10	0	10
	PC7. complete any health and safety records legibly and accurately		10	0	10
		<b>Total</b>	<b>100</b>	<b>30</b>	<b>70</b>
6.SSC/N9004 (PROVIDE DATA/INFORMATION IN STANDARD FORMATS)	PC1. establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it	<b>100</b>	12.5	12.5	0
	PC2. obtain the data/information from reliable sources		12.5	0	12.5
	PC3. check that the data/information is accurate, complete and up-to-date		12.5	6.25	6.25
	PC4. obtain advice or guidance from appropriate people where there are problems with the data/information		6.25	0	6.25
	PC5. carry out rule-based analysis of the data/information, if required		25	0	25
	PC6. insert the data/information into the agreed formats		12.5	0	12.5
	PC7. check the accuracy of their work, involving colleagues where required		6.25	0	6.25
	PC8. report any unresolved anomalies in the data/information to appropriate people		6.25	6.25	0
	PC9. provide complete, accurate and up-to-date data/information to the appropriate people in the required format on time		6.25	0	6.25
		<b>Total</b>	<b>100</b>	<b>25</b>	<b>75</b>
7.SSC/N9005 (DEVELOP THEIR KNOWLEDGE, SKILLS AND COMPETENCE)	PC1. obtain advice and guidance from appropriate people to develop their knowledge, skills and competence	<b>100</b>	10	0	10
	PC2. identify accurately the knowledge and skills you need for their job role		10	0	10
	PC3. identify accurately their current level of		20	10	10



				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA(PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
	knowledge, skills and competence and any learning and development needs				
	PC4. agree with appropriate people a plan of learning and development activities to address their learning needs		10	0	10
	PC5. undertake learning and development activities in line with their plan		20	10	10
	PC6. apply their new knowledge and skills in the workplace, under supervision		10	0	10
	PC7. obtain feedback from appropriate people on their knowledge and skills and how effectively you apply them		10	0	10
	PC8. review their knowledge, skills and competence regularly and take appropriate action		10	0	10
		<b>Total</b>	<b>100</b>	<b>20</b>	<b>80</b>



**IT-ITeS Sector Skill Council**

4E-Vandana Building(4th Floor)11,Tolstoy Marg,New Delhi-110001

# ModelCurriculum

## UserInterface(UI) Developer

### UserInterface(UI)Developer

SECTO IT-ITeS  
R:SUB- IT Services  
SECTOR: Application  
OCCUPATIO DevelopmentSSC/Q0502  
N: 7  
REFERENCE  
ID:NSQF  
LEVEL:



**Format:ModCur\_2015\_1\_0**

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# User Interface (UI) Developer

## Curriculum/Syllabus

This program is aimed at training candidates for the job of a User Interface (UI) Developer in the IT-ITeS Sector/Industry and aims at building the following key competencies amongst the learner.

<b>Program Name</b>	<b>User Interface (UI) Developer</b>		
<b>Qualification Pack Name &amp; Reference ID.</b>	User Interface (UI) Developer SSC/Q0502		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	31/01/2015
<b>Pre-requisites to Training</b>	Bachelor's Degree in Science/Technology/Computers or any graduate course		
<b>Training Outcomes</b>	<p><b>After completing this programme, participants will be able to:</b></p> <ul style="list-style-type: none"> <li>• Contribute to the design of software products and applications</li> <li>• Develop software code to specification</li> <li>• Develop media content and graphic designs for software products and applications</li> <li>• Manage your work to meet requirements</li> <li>• Work effectively with colleagues</li> <li>• Maintain a healthy, safe and secure working environment</li> <li>• Provide data/information in standard formats</li> <li>• Develop your knowledge, skills and competence</li> </ul>		

This course encompasses all Eight National Occupational Standards (NOS) of **User Interface (UI) Developer** Qualification Pack issued by **IT-ITeS Sector Skills Council NASSCOM**.

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
1.	Contribute to the design of software products and applications	17:00	33:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• check your understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people</li> <li>• check your understanding of the Software Requirements Specification (SRS) with appropriate people</li> <li>• check your understanding of High Level Design (HLD) with appropriate people</li> <li>• design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD</li> <li>• review your designs with appropriate people</li> </ul>	SSC/N0501	Refer to Unique Equipment Required





Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs</li> <li>document your designs using standard templates and tools</li> <li>comply with your organization's policies, procedures and guidelines when contributing to the design of software products and applications</li> </ul>		
2.	Develop software code to specification	20:00	80:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people</li> <li>access reusable components, code generation tools and unit testing tools from your organization's knowledgebase</li> <li>convert technical specifications into code to meet the requirements, leveraging reusable components, where available</li> <li>create appropriate unit test cases (UTCs)</li> <li>review codes and UTCs with appropriate people</li> <li>execute UTCs and document results</li> <li>rework the code and UTCs to fix identified defects</li> <li>analyze inputs from appropriate people to inform future designs</li> <li>record corrective actions for identified defects to inform future designs</li> <li>submit tested code for approval by appropriate people</li> <li>update your organization's knowledge base with your experiences of the code developed</li> <li>comply with your organization's policies, procedures and guidelines when developing software code to specification</li> </ul>	SSC/N0502	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
3.	Develop media content and graphic designs for software products and applications	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people</li> <li>• access reusable components, media and graphical packages and tools from your organization's knowledge base</li> <li>• convert requirements into media content and graphic designs, leveraging reusable components where available</li> <li>• review media content and graphic designs with appropriate people and analyze their feedback</li> <li>• record any defects and corrective actions taken to inform future work</li> <li>• rework media content and graphic designs, incorporating feedback</li> <li>• submit media content and graphic designs for approval by appropriate people</li> <li>• update your organization's knowledge base with your experiences of the media content and graphic designs developed</li> <li>• comply with your organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications</li> </ul>	SSC/N050 3	
4.	Manage your work to meet requirements	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• establish and agree your work requirements with appropriate people</li> <li>• keep your immediate work area clean and tidy</li> <li>• utilize your time effectively</li> <li>• use resources correctly and efficiently</li> <li>• treat confidential information correctly</li> <li>• work in line with your organization's policies and procedures</li> <li>• work within the limits of your job role</li> <li>• obtain guidance from appropriate people, where necessary</li> <li>• ensure your work meets the agreed requirements</li> </ul>	SSC/N900 1	



Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
5.	Work effectively with colleagues	10:00	40:00	Candidates will be able to: <ul style="list-style-type: none"> <li>• communicate with colleagues clearly, concisely and accurately</li> <li>• work with colleagues to integrate your work effectively with theirs</li> <li>• pass on essential information to colleagues in line with organizational requirements</li> <li>• work in ways that show respect for colleagues</li> <li>• carry out commitments you have made to colleagues</li> <li>• let colleagues know in good time if you cannot carry out your commitments, explaining the reasons</li> <li>• identify any problems you have working with colleagues and take the initiative to solve these problems</li> <li>• follow the organization's policies and procedures for working with colleagues</li> </ul>	SSC/N900 2	
6.	Maintain a healthy, safe and secure working environment	7:00	18:00	Candidates will be able to: <ul style="list-style-type: none"> <li>• comply with your organization's current health, safety and security policies and procedures</li> <li>• report any identified breaches in health, safety, and security policies and procedures to the designated person</li> <li>• identify and correct any hazards that you can deal with safely, competently and within the limits of your authority</li> <li>• report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected</li> <li>• follow your organization's emergency procedures promptly, calmly, and efficiently</li> <li>• identify and recommend opportunities for improving health, safety, and security to the designated person</li> </ul>	SSC/N900 3	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>• complete any health and safety records legibly and accurately</li> </ul>		
7.	Provide data/information in standard formats	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it</li> <li>• obtain the data/information from reliable sources</li> <li>• check that the data/information is accurate, complete and up-to-date</li> <li>• obtain advice or guidance from appropriate people where there are problems with the data/information</li> <li>• carry out rule-based analysis of the data/information, if required</li> <li>• insert the data/information into the agreed formats</li> <li>• check the accuracy of your work, involving colleagues where required</li> <li>• report any unresolved anomalies in the data/information to appropriate people</li> <li>• provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time</li> </ul>	SSC/N900 4	

8.	Develop your knowledge, skills and competence	5:00	20:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• obtain advice and guidance from appropriate people to develop your knowledge, skills and competence</li> <li>• identify accurately the knowledge and skills you need for your job role</li> <li>• identify accurately your current level of knowledge, skills and competence and any learning and development needs</li> <li>• agree with appropriate people a plan of learning and development activities to address your learning needs</li> <li>• undertake learning and development activities in line with your plan</li> <li>• apply your new knowledge and skills in the workplace, under supervision</li> <li>• obtain feedback from appropriate people on your knowledge and skills and how effectively you apply them</li> </ul>	SSC/N900 5
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>review your knowledge, skills and competence regularly and take appropriate action</li> </ul>		
	<b>Total Duration:</b>	<b><u>95:00</u></b>	<b><u>305:00</u></b>	<p><b>Unique Equipment Required:</b> Training room should be fully furnished with the following equipment/tools/accessories. Additional/specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome.</p> <p><b>Domain NOS requirements</b></p> <ul style="list-style-type: none"> <li>Visio, UML, freeminds, mockingbird HTML 5, CSS, Java Script and SQL</li> <li>IDEs such as Web Builder, WordPress, Joomla Wordpress, psdGraphics etc.</li> <li>HTML, CSS, Flash, Photoshop, Windows media player, Eclipse, XAMPP</li> </ul> <p><b>Common requirements</b></p> <ul style="list-style-type: none"> <li>Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning</li> <li>White Board, Markers and Eraser</li> <li>Projector with screen</li> <li>Flipchart with markers</li> <li>Faculty's PC/Laptop with latest configuration and internet connection</li> <li>Supporting software/applications for projecting audio, video, recording,</li> <li>Presentation Tools to support learning activities: <ul style="list-style-type: none"> <li>Intranet</li> <li>Email</li> <li>IMs</li> <li>Learning management system e.g. Moodle, Blackboard to enable blended learning</li> </ul> </li> <li>Microphone/voice system for lecture and class activities</li> <li>Handy Camera</li> <li>Stationery kit – Staples, Glue, Chart Paper, Sketch Pens, Paint Box, Scale, A4 Sheets</li> <li>For IT Lab sessions: Computer Lab with 1:1 PC: trainee ratio and having internet connection, MS Office / Open office, Browser, Outlook/Any other Email Client and chat tools.</li> <li>Assessment and Test Tools for day to day online Tests and Assessments</li> <li>For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition.</li> </ul>		

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<ul style="list-style-type: none"> <li>Reading Resources: Access to relevant sampled documents and learning forums to enable self-study before and after each training session.</li> </ul>		

Grand Total Course Duration: **400 Hours 0 Minutes**

*(This syllabus/curriculum has been approved IT-ITeS Sector Skills Council NASSCOM.)*

**Notes from IT-ITeS Sector Skills Council NASSCOM**

1. This document outlines the broad scope of coverage. This should be linked with OBF and training delivery plan. OBF (Outcome based framework) reflects the pedagogy used to ensure an expected outcome. Training delivery plan focuses on the sequence of delivery.
2. Though many NOSs have some seemingly common outcomes, notably core/generic, professional and technical skills, it is imperative to understand the contextual difference between them. Training providers are advised to,
  - a. Embed such skills development in the learning pedagogy for each expected outcome
  - b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
3. Run a diagnostic test to assess prior learning of students and help trainers / students identify the need for gap training and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.



### Annexure 1: Assessment Criteria

Assessment Criteria for <QP Name>	
Job Role	User Interface (UI) Developer
Qualification Pack	SSC/Q0502
Sector Skill Council	IT-ITeS

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit <a href="http://www.sscnasscom.com">www.sscnasscom.com</a> .

Assessable Outcomes	Assessment criteria for the outcome	Total Mark	Out of	Theory	Skills Practical
<b>1. SSC/N0501 (Contribute to the design of software products and applications)</b>	PC1. check your understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	<b>100</b>	10	10	0
	PC2. check your understanding of the Software Requirements Specification (SRS) with appropriate people		10	10	0
	PC3. check your understanding of High Level Design (HLD) with appropriate people		10	10	0
	PC4. design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD		30	0	30
	PC5. review your designs with appropriate people		5	5	0
	PC6. analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs		15	0	15
	PC7. document your designs using standard templates and tools		10	0	10
	PC8. comply with your organization's policies, procedures and guidelines when contributing to the design of software products and applications		10	0	10
	<b>Total</b>		100	35	65
<b>2. SSC/N0502 (Develop software code to specification)</b>	PC1. check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people	<b>100</b>	5	5	0
	PC2. access reusable components, code generation tools and unit testing tools from your organization's knowledge base		10	0	10



Assessable Outcomes	Assessment criteria for the outcome	Total Mark	Out of	Theory	Skills Practical
	PC3. convert technical specifications into code to meet the requirements, leveraging reusable components, where available		10	0	10
	PC4. create appropriate unit test cases (UTCs)		10	0	10
	PC5. review codes and UTCs with appropriate people		5	5	0
	PC6. execute UTCs and document results		10	0	10
	PC7. rework the code and UTCs to fix identified defects		10	0	10
	PC8. analyze inputs from appropriate people to inform future designs		5	5	0
	PC9. record corrective actions for identified defects to inform future designs		10	0	10
	PC10. submit tested code for approval by appropriate people		5	5	0
	PC11. update your organization's knowledge base with your experiences of the code developed		10	0	10
	PC12. comply with your organization's policies, procedures and guidelines when developing software code to specification		10	0	10
			<b>Total</b>	100	20
<b>3.SSC/N0503 (Develop media content and graphic designs for software products and Applications)</b>	PC1. check your understanding of the Business Requirements Specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate people	<b>100</b>	10	10	0
	PC2. access reusable components, media and graphical packages and tools from your organization's knowledge base		10	0	10
	PC3. convert requirements into media content and graphic designs, leveraging reusable components where available		25	0	25
	PC4. review media content and graphic designs with appropriate people and analyze their feedback		10	10	0
	PC5. record any defects and corrective action taken to inform future work		10	0	10
	PC6. rework media content and graphic designs, incorporating feedback		10	0	10
	PC7. submit media content and graphic designs for approval by appropriate people		5	5	0
	PC8. update your organization's knowledge base with your experiences of the media content and graphic designs developed		10	0	10
	PC9. comply with your organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications		10	0	10
	<b>Total</b>	100	25	75	
<b>4.SSC/N9001 (Manage your work to meet requirements)</b>	PC1. establish and agree your work requirements with appropriate people	<b>100</b>	6.25	0	6.25
	PC2. keep your immediate work area clean and tidy		12.5	6.25	6.25
	PC3. utilize your time effectively		12.5	6.25	6.25
	PC4. use resources correctly and efficiently		18.75	6.25	12.5



Assessable Outcomes	Assessment criteria for the outcome	Total Mark	Out of	Theory	Skills Practical	
	PC5. treat confidential information correctly		6.25	0	6.25	
	PC6. work in line with your organization's policies and procedures		12.5	0	12.5	
	PC7. work within the limits of your job role		6.25	0	6.25	
	PC8. obtain guidance from appropriate people, where necessary		6.25	0	6.25	
	PC9. ensure your work meets the agreed requirements		18.75	6.25	12.5	
		<b>Total</b>	<b>100</b>	<b>25</b>	<b>75</b>	
<b>5.SSC/N9002 (Work effectively with colleagues)</b>	<b>(Work with</b>	PC1. communicate with colleagues clearly, concisely and accurately	<b>100</b>	20	0	20
		PC2. work with colleagues to integrate your work effectively with theirs		10	0	10
		PC3. pass on essential information to colleagues in line with organizational requirements		10	10	0
		PC4. work in ways that show respect for colleagues		20	0	20
	PC5. carry out commitments you have made to colleagues		10	0	10	
	PC6. let colleagues know in good time if you cannot carry out your commitments, explaining the reasons		10	10	0	
	PC7. identify any problems you have working with colleagues and take the initiative to solve these problems		10	0	10	
	PC8. follow the organization's policies and procedures for working with colleagues		10	0	10	
		<b>Total</b>	<b>100</b>	<b>20</b>	<b>80</b>	
<b>6.SSC/N9003 (Maintain a healthy, safe and secure working environment)</b>	<b>(Maintain a healthy, safe and secure working environment)</b>	PC1. comply with your organization's current health, safety and security policies and procedures	<b>100</b>	20	10	10
		PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10
		PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority		20	10	10
		PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		10	0	10
		PC5. follow your organization's emergency procedures promptly, calmly, and efficiently		20	10	10
		PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		10	0	10
		PC7. complete any health and safety records legibly and accurately		10	0	10
				<b>Total</b>	<b>100</b>	<b>30</b>
	PC1. establish and agree with appropriate people the data/information you need to provide, the formats	<b>100</b>	12.5	12.5	0	

Assessable Outcomes	Assessment criteria for the outcome	Total Mark	Out of	Theory	Skills Practical
<b>7.SSC/N9004 (Provide data/information in standard formats)</b>	in which you need to provide it, and when you need to provide it				
	PC2. obtain the data/information from reliable sources		12.5	0	12.5
	PC3. check that the data/information is accurate, complete and up-to-date		12.5	6.25	6.25
	PC4. obtain advice or guidance from appropriate people where there are problems with the data/information		6.25	0	6.25
	PC5. carry out rule-based analysis of the data/information, if required		25	0	25
	PC6. insert the data/information into the agreed formats		12.5	0	12.5
	PC7. check the accuracy of your work, involving colleagues where required		6.25	0	6.25
	PC8. report any unresolved anomalies in the data/information to appropriate people		6.25	6.25	0
	PC9. provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time		6.25	0	6.25
			<b>Total</b>	<b>100</b>	<b>25</b>
<b>8.SSC/N9005 (Develop your knowledge, skills and competence)</b>	PC1. obtain advice and guidance from appropriate people to develop your knowledge, skills and competence	<b>100</b>	10	0	10
	PC2. identify accurately the knowledge and skills you need for your job role		10	0	10
	PC3. identify accurately your current level of knowledge, skills and competence and any learning and development needs		20	10	10
	PC4. agree with appropriate people a plan of learning and development activities to address your learning needs		10	0	10
	PC5. undertake learning and development activities in line with your plan		20	10	10
	PC6. apply your new knowledge and skills in the workplace, under supervision		10	0	10
	PC7. obtain feedback from appropriate people on your knowledge and skills and how effectively you apply them		10	0	10
	PC8. review your knowledge, skills and competence regularly and take appropriate action		10	0	10
			<b>Total</b>	<b>100</b>	<b>20</b>



**Annexure 2: Trainer Prerequisites for Job role: User Interface (UI) Developer mapped to Qualification Pack: SSC/Q0502**

Sr. No.	Area	Details
1	<b>Job Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0502.
2	<b>Personal Attributes</b>	<p>Aptitude to conduct training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in the mentioned field.</p> <p>The individual should be result oriented. The individual should also be able to demonstrate skills for communication, creative and logical thinking.</p>
3	<b>Minimum Educational Qualifications</b>	Bachelor's Degree in Science/Technology/Computers or any graduate course
4a	<b>Domain Certification</b>	<p>Minimum accepted score in SSC Assessment is 90% per NOS being taught in SSC/Q0502.</p> <p>Additional certification in computers/technology/animation/graphics</p>
4b	<b>Platform Certification</b>	<p>Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402".</p> <p>Minimum accepted score is 70% per NOS.</p>
5	<b>Experience</b>	<p>Field experience: Minimum 2 years' experience in the same domain</p> <p>Training experience: 1 year preferred</p>

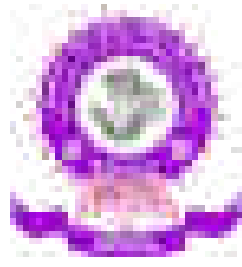


**IT-ITeS Sector Skills Council NASSCOM**

4E-Vandana Building(4th Floor),11,Tolstoy Marg,New Delhi-110001 T

+91 11 41519230/60 | F +91 11 41519240

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**JSS COLLEGE OF ARTS COMMERCE &  
SCIENCE**

**(Autonomous)**

**Ooty Road, Mysuru – 25**

**DEPARTMENT OF COMMERCE AND  
MANAGEMENT**

**BBA Programme  
( II & II Year)  
Syllabus as per NEP  
(Modified)**

**w.e.f  
2023-24**

## BBA PROGRAM

Semester I								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
1	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
2	Lang.1.2	Language - II	AECC	3+1+0	60	40	100	3
3	BBA.1.1	Management Principles & Practice	DSC	4+0+0	60	40	100	4
4	BBA.1.2	Fundamentals of Business Accounting	DSC	3+0+2	60	40	100	4
5	BBA.1.3	Marketing Management	DSC	4+0+0	60	40	100	4
6	BBA.1.4	Digital Fluency	SEC-SB	1+0+2	50	50	100	2
7	BBA.1.5	Business Organization and Management / Skills For Management	OEC	3+0+0	50	50	100	3
<b>Sub –Total (A)</b>					450	250	700	23
Semester II								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
8	Lang.2.1	Language - I	AECC	3+1+0	60	40	100	3
9	Lang.2.2	Language - II	AECC	3+1+0	60	40	100	3
10	BBA.2.1	Financial Accounting and Reporting	DSC	3+0+2	60	40	100	4
11	BBA.2.2	Human Resource Management	DSC	4+0+0	60	40	100	4
12	BBA.2.3	Business Environment/ Business Mathematics	DSC	4+0+0/ 3+0+2	60	40	100	4
13	BBA.2.4	Health Wellness/ Social & Emotional Learning	SEC-VB	1+0+2	-	100	100	2
14	BBA.2.5	Environmental Studies	AECC	2+0+0	50	50	100	2
15	BBA.2.6	People Management / Functional Areas of Management	OEC	3+0+0	50	50	100	3
<b>Sub –Total (B)</b>					450	350	800	25

EXIT OPTION WITH CERTIFICATION - **with ability to solve well defined problems**

**Notes:**

- **One Hour of Lecture is equal to 1 Credit.**
- **One Hour of Tutorial is equal to 1 Credit (Except Languages).**
- **Two Hours of Practical is equal to 1 Credit**

**Acronyms Expanded**

- **AECC** : **Ability Enhancement Compulsory Course**
- **DSC ©** : **Discipline Specific Core (Course)**
- **SEC-SB/VB** : **Skill Enhancement Course-Skill Based/Value Based**
- **OEC** : **Open Elective Course**
- **DSE** : **Discipline Specific Elective**
- **SEE** : **Semester End Examination**
- **CIE** : **Continuous Internal Evaluation**
- **L+T+P** : **Lecture+Tutorial+Practical(s)**

**Note: Practical Classes may be conducted in the Business Lab or in Computer Lab or in Class room depending on the requirement. One batch of students should not exceed half (i.e., 30 or less than 30 students) of the number of students in each class/section. 2 Hours of Practical Class is equal to 1 Hour of Teaching, however, whenever it is conducted for the entire class (i.e., more than 30 students) 2 Hours of Practical Class is equal to 2 Hours of Teaching.**



# Revised Syllabus for 1<sup>st</sup> And 2<sup>nd</sup> Semester BBA Degree as Per NEP Regulations to be implemented From the Academic Year 2023-2024

## **I. OBJECTIVES OF THE COURSE:**

1. To develop the skills required for the application of business concepts and techniques learned in the classroom at the workplace.
2. To provide competent and technical skills personnel to the industry in the area of Marketing, Finance, Human Resource, Data Analytics, Retailing and Logistics And Supply Chain Management. To enhance the employability skills of the management students.
3. To enhance the capability of the students improve their decision-making skills.
4. To encourage entrepreneurship among students pursuing education in the field of Business Administration.
5. To empower students for pursuing professional courses like MBA, Chartered Accountancy, Company Secretary, etc.,
6. To ensure holistic development of Business administration students.

## **II. ELIGIBILITY FOR ADMISSION:**

Candidates who have passed Two Year Pre University Course of Karnataka State in any discipline or its equivalent (viz., 10+2 of other states, ITI, Diploma etc.) are eligible for admission into this program.

## **III. DURATION OF THE PROGRAM:**

The program of study is Four years of Eight Semesters. A candidate shall complete his/her degree within eight academic years from the date of his/her admission to the first semester. The NEP 2020 provides multiple exit options for students as specified below:

### **EXIT OPTION:**

- a. The students who successfully complete ONE year/ 2 Semesters and leave the program, will be awarded Certificate in Business Administration.
- b. The students who successfully complete TWO years/ 4 Semesters and leave the program, will be awarded Diploma in Business Administration.
- c. The students who successfully complete THREE years/ 6 Semesters and leave the program, will be awarded Bachelors Degree in Business Administration (BBA)

## **IV. MEDIUM OF INSTRUCTION**

The medium of instruction shall be English.

## **V. ATTENDANCE**

- a. For the purpose of calculating attendance, each semester shall be taken as a Unit.
- b. A student shall be considered to have satisfied the requirement of attendance for the semester, if he/she has attended not less than 75% in aggregate of the number of working periods in each of the subjects compulsorily.

- c. A student who fails to complete the course in the manner stated above shall not be permitted totake the University Examination.

## VI. TEACHING AND EVALUATION

MBA graduates with BBM/BBA, B.Com and BBS as basic degree from a recognized University are only eligible to teach and to evaluate all the Business Administration courses except Languages, Constitution of India, Environmental Studies, Health Wellness/Social and Emotional learning, Sports/NCC/NSS/Other)

## VII. SKILL DEVELOPMENT / RECORD MAINTENANCE

- Every college is required to establish a dedicated business lab for the purpose of conducting practical/ assignments to be written in the record.
- In every semester, the student should maintain a record book in which a minimum of 5exercise or activities per course are to be recorded.

## VIII. SCHEME OF EXAMINATION

- There shall be an University examination at the end of each semester. The maximum marks for the university examination in each paper shall be 60 marks for DSC, DSE, Vocational,SEC and OEC.
- Internal Assessment 40 marks for DSC, DSE, Vocational, SEC and OEC.

## IX. GUIDELINES FOR CONTINUOUS INTERNAL EVALUATION AND SEMESTER END EXAMINATION:

The CIE and SEE will carry 40% and 60% weightage each, to enable the course to be evaluated for a total of 100 marks, irrespective of its credits. The evaluation system of the course is comprehensive & continuous during the entire period of the Semester. For a course, the CIE and SEE evaluation will be on the following parameters:

SI No.	Parameters for the Evaluation	Marks
	<b>Continuous Internal Evaluation (CIE)</b>	
1	Continuous and Comprehensive Evaluation (CCE) – (A)	20 Marks
2	Internal Assessment test (IAT) – (B)	20 Marks
	<b>Total of CIE (A+B)</b>	<b>40 Marks</b>
3	Semester End Examination (SEE) – (C)	60 Marks
	<b>Total of CIE and SEE (A+B+C)</b>	<b>100 Marks</b>

### Continuous Internal Evaluation (CIE)

- Continuous & Comprehensive Evaluation (CCE):** The CCE will carry a maximum of 20% weightage (20 marks) of total marks of a course. Before the start of the academic session in each semester, a faculty membershould choose for his/her course, minimum of the following assessment methods with 5markse each ( 4x5=20 marks)
  - Individual Assignments
  - Seminars/Class room Presentations/Quizzes

- iii. Group Discussions/Class Discussion / group assignments
- iv. Casestudies/ Caselets
- v. Participatory & Industry-Integrated Learning/Industrial visits
- vi. Practical Activities / Problem Solving Exercises
- vii. Participation in seminars/ academic events /symposia
- viii. Mini project / Capstone projects

**b. Internal Assessment Test (IAT):**

The IAT will carry a maximum of 20% weightage (20 marks) of total marks of a course. Under this component, two tests will have to be conducted in a semester for 30 marks each and the same is to be scaled down to 10 marks each.

**c. Semester End Examination (SEE):**

The semester end examination for all the students for which students who get registered during the semester shall be conducted for 60 marks. SEE of the course shall be conducted subject to their fulfillment of minimum attendance requirement as per the university norms. The BOS of the university shall prepare the SEE framework and the question paper pattern.

**d. Minimum marks for a Pass:**

Candidates who have obtained 35% marks in semester end examination i.e., 21 marks out of 60 marks of theory examination and 40% in aggregate i.e., total 40 marks out of 100 marks of semester end examination marks and continuous internal evaluation marks.

<b>Name of the Program:</b> Bachelor of Business Administration (BBA)		
<b>Course Code:</b> BBA 1.1		
<b>Name of the Course:</b> Management Principles & Practice		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>a) The ability to understand concepts of business management, principles and function of management.</li> <li>b) The ability to explain the process of planning and decision making.</li> <li>c) The ability to create organization structures based on authority, task and responsibilities.</li> <li>d) The ability to explain the principles of direction, importance of communication, barrier of communication, motivation theories and leadership styles.</li> <li>e) The ability to understand the requirement of good control system and control techniques.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO MANAGEMENT</b>		<b>10</b>
Introduction –Meaning, Evolution of management thought, Pre-Scientific Management Era, Classical Management Era, Neo-Classical Management Era, Modern Management Era; Nature and Characteristics of Management - Scope and Functional areas of Management; Management as a Science, Art or Profession; Management and Administration; Principles of Management.		
<b>Module No. 2: PLANNING AND DECISION MAKING</b>		<b>08</b>
Nature, Importance and Purpose of Planning - Planning Process; Objectives; Types of plans (Meaning only); Decision making- Importance and steps; MBO and MBE (Meaning only)		
<b>Module No. 3: ORGANIZING AND STAFFING</b>		<b>12</b>
Nature and purpose of Organization; Principles of Organizing; Delegation of Authority; Types of Organization - Departmentation, Centralization vs Decentralization of Authority and Responsibility, Span of Control; Nature and importance of Staffing		
<b>Module No. 4: DIRECTING AND COMMUNICATING</b>		<b>12</b>
Meaning and Nature of Direction, Principles of Direction; Communication - Meaning and Importance, Communication Process, Barriers to Communication, Steps to overcome Communication Barriers, Types of Communication; Motivation theories – Maslow’s Need Hierarchy Theory, Herzberg’s Two Factor Theory, Mc.Gregor’s X and Y theory. Leadership – Meaning, Formal and Informal Leadership, Characteristics of Leadership; Leadership Styles – Autocratic Style, Democratic Style, Participative Style, Laissez Faire Leadership Styles, Transition Leadership, Charismatic Leadership Style.		
<b>Module No. 5: COORDINATING AND CONTROLLING</b>		<b>10</b>
Coordination–Meaning, Importance and Principles. Controlling–Meaning and steps in controlling, Essentials of Effective Control system, Techniques of Control (in brief).		
<b>Module No. 6: BUSINESS SOCIAL RESPONSIBILITY AND MANAGERIAL ETHICS</b>		<b>04</b>

Business Social Responsibility - Meaning, Arguments for and against Business Social Responsibility; Green management - Meaning, Green Management Actions; Managerial Ethics – Meaning - Importance of Ethics in Business, Factors that determine Ethical or Unethical behavior.

**Skill Developments Activities:**

1. Two cases on the above syllabus should be analyzed by the teacher in the classroom and the same needs to be recorded by the student in the Skill Development Book.
2. Draft different types of Organization structure.
3. Draft Control charts.

**Text Books:**

1. Stephen P. Robbins, Management, Pearson
2. Koontz and O'Donnell, Management, McGraw Hill.
3. L M Prasad, Principles of management, Sultan Chand and Sons
4. V.S.P Rao/Bajaj, Management process and organization, Excel Books.GH25
5. Appanniah and Reddy, Management, HPH.
6. T. Ramaswamy : Principles of Management, HPH.

**Note: Latest edition of text books may be used.**

<b>Name of the Program:</b> Bachelor of Business Administration (BBA) <b>Course Code:</b> BBA 1.2 <b>Name of the Course:</b> Fundamentals of Business Accounting		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and problem solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b> <ol style="list-style-type: none"> <li>a) Understand the framework of accounting as well accounting standards.</li> <li>b) The Ability to pass journal entries and prepare ledger accounts</li> <li>c) The Ability to prepare subsidiaries books</li> <li>d) The Ability to prepare trial balance and final accounts of proprietary concern.</li> <li>e) Construct final accounts through application of tally.</li> </ol>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO FINANCIAL ACCOUNTING</b>		<b>08</b>
Introduction – Meaning and Definition – Objectives of Accounting – Functions of Accounting – Users of Accounting Information – Limitations of Accounting – Accounting Cycle - Accounting Principles – Accounting Concepts and Accounting Conventions. Accounting Standards – objectives- significance of accounting standards. List of Indian Accounting Standards.		
<b>Module No. 2: ACCOUNTING PROCESS</b>		<b>12</b>
Meaning of Double entry system – Process of Accounting – Kinds of Accounts – Rules - Transaction Analysis – Journal – Ledger – Balancing of Accounts – Trial Balance – Problems on Journal, Ledger Posting and Preparation of Trial Balance.		
<b>Module No. 3: SUBSIDIARY BOOKS</b>		<b>14</b>
Meaning – Significance – Types of Subsidiary Books –Preparation of Purchases Book, Sales Book, Purchase Returns Book, Sales Return Book, Bills Receivable Book, Bills Payable Book. Types of Cash Book- Simple Cash Book , Double Column Cash Book , Three Column Cash Book and Petty Cash Book(Problems only on Three Column Cash Book and Petty Cash Book), Bank Reconciliation Statement – Preparation of Bank Reconciliation Statement (Problems on BRS)		
<b>Module No. 4: FINAL ACCOUNTS OF PROPRIETARY CONCERN</b>		<b>10</b>
Preparation of Statement of Profit and Loss and Balance Sheet of a proprietary concern with special adjustments like depreciation, outstanding and prepaid expenses, outstanding and received in advance of incomes, provision for doubtful debts, drawings and interest on capital.		
<b>Module No. 5: ACCOUNTING SOFTWARE</b>		<b>12</b>

Introduction-meaning of accounting software, types accounting software-accounting software Tally-Meaning of Tally software – Features – Advantages, Creating a New Company, Basic Currency information, other information, Company features and Inventory features. Working in Tally: Groups, Ledgers, writing voucher, different types of voucher, voucher entry Problem on Voucher entry - Generating Basic Reports in Tally-Trail Balance, Accounts books, Cash Book, Bank Books, Ledger Accounts, Group Summary, Sales Register and Purchase Register, Journal Register, Statement of Accounts, and Balance Sheet.

**Skill Developments Activities:**

1. List out the accounting concepts and conventions.
2. Prepare a Bank Reconciliation Statement with imaginary figures
3. Collect the financial statement of a proprietary concern and record it.
4. Prepare a financial statement of an imaginary company using tally software.

**Text Books:**

1. Hanif and Mukherjee, Financial Accounting, Mc Graw Hill Publishers
2. Arulanandam & Raman; Advanced Accountancy, Himalaya Publishing House
3. S.Anil Kumar,V.Rajesh Kumar and B.Mariyappa–Fundamentals of Accounting, Himalaya Publishing House.
4. Himalaya Publishing House.
5. Dr. S.N. Maheswari, Financial Accounting, Vikas Publication
6. S P Jain and K. L. Narang, Financial Accounting, Kalyani Publication
7. Radhaswamy and R.L. Gupta, Advanced Accounting , Sultan Chand
8. M.C. Shukla and Goyel, Advaced Accounting , S Chand.

**Note: Latest edition of text books may be used.**

<b>Name of the Program: Bachelor of Business Administration (BBA)</b>		
<b>Course Code: BBA 1.3</b>		
<b>Name of the Course: Marketing Management</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>a) Understand the concepts and functions of marketing.</li> <li>b) Analyse marketing environment impacting the business.</li> <li>c) Segment the market and understand the consumer behaviour</li> <li>d) Describe the 4 p's of marketing and also strategize marketing mix</li> <li>e) Describe 7 p's of service marketing mix.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO MARKETING</b>		<b>10</b>
Meaning and Definition, Concepts of Marketing, Approaches to Marketing, Functions of Marketing. <b>Recent trends in Marketing</b> -E- business, Tele-marketing, M-Business, Green Marketing, Relationship Marketing, Concept Marketing, Digital Marketing, social media marketing and E-tailing (Meaning only).		
<b>Module No. 2: MARKETING ENVIRONMENT</b>		<b>10</b>
<b>Micro Environment</b> – The company, suppliers, marketing intermediaries competitors, public and customers; <b>Macro Environment</b> - Demographic, Economic, Natural, Technological, Political, Legal, Socio-Cultural Environment.		
<b>Module No. 3: MARKET SEGMENTATION AND CONSUMER BEHAVIOUR</b>		<b>10</b>
Meaning and Definition, Bases of Market Segmentation, Requisites of Sound Market Segmentation; Consumer Behavior-Factors influencing Consumer Behavior; Buying Decision Process.		
<b>Module No. 4: MARKETING MIX</b>		<b>20</b>
Meaning, Elements of Marketing Mix (Four P's) – Product, Price, Place, Promotion. Product-Product Mix, Product Line, Product Lifecycle, New Product Development, Reasons for Failure of New Product, Branding, Packing and Packaging, Labeling, Pricing – Objectives, Factors influencing Pricing Policy, Methods of Pricing; Physical Distribution–Meaning, Factors affecting Channel Selection, Types of Marketing Channels. Promotion – Meaning and Significance of Promotion, Personal Selling and Advertising (Meaning Only)		
<b>Module No. 5: SERVICES MARKETING</b>		<b>06</b>
Meaning and definition of services, difference between goods and services, features of services, seven P's of services marketing (concepts only).		



**Skill Developments Activities:**

1. Two cases on the above syllabus should be analyzed and recorded in the skill development
2. Design a logo and tagline for a product of your choice
3. Develop an advertisement copy for a product.
4. Prepare a chart for distribution network for different products.

**Text Books:**

1. Philip Kotler, Marketing Management, Prentice Hall.
2. Lovelock Christopher, Services Marketing: People, Technology, Strategy, PHI
3. William J. Stanton, Michael J. Etzel, Bruce J Walker, Fundamentals of Marketing, McGraw Hill Education.
4. Bose Biplab, Marketing Management, Himalaya Publishers.
5. J.C. Gandhi, Marketing Management, Tata McGraw Hill.
6. Ramesh and Jayanti Prasad: Marketing Management, I.K. International
7. Sontakki, Marketing Management, Kalyani Publishers.
8. P N Reddy and Appanniah, Marketing Management

**Note: Latest edition of text books may be used.**

<b>Name of the Program:</b> Bachelor of Business Administration (BBA)		
<b>Course Code:</b> BBA 1.5 (OEC)		
<b>Name of the Course:</b> Business Organization and Management		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>45 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,		
<b>Course outcomes: on successful completion of the course, the Students will demonstrate:</b>		
a) To Understand the concepts of Business organizations and Social Responsibilities of Business		
b) To Describe the various forms of Business organization		
c) To Understand the levels of managements and Describe the contribution of management thinkers		
d) To demonstrate the functions of management effectively		
e) To describe the technology driven work Place and some recent trends in Management		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: NATURE AND SCOPE OF BUSINESS</b>		<b>08</b>
Meaning and Definition of Business, Characteristics, Objectives. Classification of Business Activities; Manufacturing, Trading and Services Organizations. Relationship between Trade, Industry and Commerce. Social Responsibilities of business towards stake holders.		
<b>Module No. 2: FORMS OF BUSINESS ORGANISATIONS</b>		<b>12</b>
Meaning and Features of Sole Proprietorship, Partnership, One Person Company, Limited Liability Partnerships, Hindu Undivided Family and Joint Stock Companies: Difference between Private and Public companies		
<b>Module No. 3: NATURE OF MANAGEMENT</b>		<b>08</b>
Definition , Characteristics- Management as an Art, Science or Profession - Levels of Management – Management Thoughts of FW Taylor , Henry Fayol, Max Weber and Peter Drucker.		
<b>Module No. 4: FUNCTIONS OF MANAGEMENT</b>		<b>10</b>
Planning – Importance, Steps in planning, Types of plans. Organising - Meaning, Organisation structure. Directing – Motivation, Leadership, Communication and Coordination – Definition and Meaning. Controlling: Concept and Process		
<b>Module No 5: CURRENT TRENDS IN MANAGEMENT</b>		<b>07</b>
Technology Driven Work place, Learning Organisations, Diversity of Work Force, Public Consciousness, Global market place, Community of stake holders		
<b>Skill Developments Activities:</b>		
1. Collection of Partnership Deed		
2. Collect the nature of business activities of any 10 Private and Public Companies		
3. Collect the profiles of FW Taylor and Henry Fayol		
4. Preparation of Imaginary Business plan		
5. List the latest trends in Management		

**Text Books:**

1. C B. Guptha - Business Organisation and Management, Sultan Chand & Sons.
2. Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan.
3. M. C. Shukla - Business Organisation and Management. S Chand & Company Pvt. Ltd.
4. S.A Sherlekar - Business Organization, Himalaya Publishing House.
5. Y.K. Bhushan. Fundamentals of Business Organisation and Management, Sultan Chand & Sons.
6. R.K. Sharma, Business Organisation & Management Kalyani Publishers
7. Dr. I.M. Sahai, Dr. Padmakar Asthana, 'Business Organisation & Administration', Sahitya Bhawan Publications Agra.
8. Richard L. Daft – Principles of management

<b>Name of the Program:</b> Bachelor of Business Administration (BBA)		
<b>Course Code:</b> BBA 1.5(OEC)		
<b>Name of the Course:</b> Skills For Management (OEC)		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>45 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
a) The Ability to communicate and Present effectively by inculcating listing skills		
b) To Understand the value of Time through various Time Management tips and strategies		
c) To take the right decisions of the enterprise for success and to achieve its predetermined goals		
d) To Identify as a Responsible team member and carry out the team activates effectively and abili understand need leadership in management		
e) To apply Emotional Intelligence at organization and Overcoming the conflicts using various techniques		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: COMMUNICATION AND PRESENTATION</b>		<b>08</b>
Fundamentals, Types - Horizontal, Vertical, Oral, Written, Email Etiquettes; Virtual Meetings; Listening, Importance and Need, Features of a Good Listening; Presentation skills, Etiquettes for Effective Presentation		
<b>Module No. 2: TIME MANAGEMENT</b>		<b>10</b>
Importance of Discipline & Punctuality – The Pareto Principle, Time Management Matrix – Scheduling - Grouping of Activities, Overcoming Procrastination – Time Circle Planner, Time Management Tips and Strategies.		
<b>Module No. 3: DECISION MAKING</b>		<b>10</b>
Decision making, Importance, Types of Decisions, Programmed and Non- programmed decisions - Steps in decision making Process - Decision Making Styles -Participation in decision making.		
<b>Module No. 4: TEAM BUILDING AND LEADERSHIP</b>		<b>10</b>
Teams – Types of Teams, Characteristics of an effective team- Stages of team Development- Team cohesiveness and its importance. Leadership- Nature of Leadership, Leadership vs Management-Leadership traits - Leadership styles		
<b>Module No. 5 : EMOTIONAL INTELLIGENCE AND CONFLICT MANAGEMENT</b>		<b>07</b>
Emotional Intelligence- Concept, Components and Application of Emotions Intelligence in organizations. Conflict- Types of conflict, Sources of Conflict, Conflict resolution techniques.		
Skill Developments Activities:		
1. Preparation of Business presentation		
2. Team Building Practices through group exercises, team task.		
3. Practice by Game play & other learning methodology for achieving Given targets		
4. Writing Business Letters through E-mails		

**Text Books:**

1. Alex K., Managerial Skills, S. Chand
2. V.S.P. Rao Managerial Skills Excel Books, New Delhi
3. David A Whetten, Cameron Developing Management skills, PHI 2008
4. Ramnik Kapoor Managerial Skills Path Makers, Bangalore
5. Kevin Gallagher, Skills development for Business and Management Students,Oxford
6. Monipally,Muttthukutty Business Communication Strategies Tata McGraw Hill.

**Note: Latest edition of text books may be used.**

<b>Name of the Program:</b> Bachelor of Business Administration (BBA)		
<b>Course Code:</b> BBA 2.1		
<b>Name of the Course:</b> Financial Accounting and Reporting		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>a) The ability to prepare final accounts of partnership firms</li> <li>b) The ability to understand the process of public issue of shares and accounting for the same</li> <li>c) The ability to prepare final accounts of joint stock companies.</li> <li>d) The ability to prepare and evaluate vertical and horizontal analysis of financial statements</li> <li>e) The ability to understand company's annual reports.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: FINAL ACCOUNTS OF PARTNERSHIP FIRM</b>		<b>10</b>
Meaning of Partnership Firm, Partnership deed-clauses in partnership deed, Preparation of Final accounts of partnership firm-Trading and Profit and Loss Account, Profit and Loss Appropriation Account, Partners capital account and Balance sheet. Goodwill- Nature, Factors influencing goodwill and methods of valuation of goodwill (Average and super profit methods)		
<b>Module No. 2: ISSUE OF SHARES</b>		<b>08</b>
Meaning of Share, Types of Shares – Preference shares and Equity shares – Issue of Shares at par, at Premium, at Discount: Pro-Rata Allotment; Journal Entries relating to issue of shares; Preparation of respective ledger accounts; Preparation of Balance Sheet in the Vertical form (Practical Problems).		
<b>Module No. 3: FINAL ACCOUNTS OF JOINT STOCK COMPANIES</b>		<b>12</b>
Statutory Provisions regarding preparation of Company Final Accounts – Treatment of Special Items, Managerial Remuneration, Tax deducted at source, Advance payment of Tax, Provision for Tax, Depreciation, Interest on debentures, Dividends, Rules regarding payment of dividends, Transfer to Reserves, Preparation of Profit and Loss Account and Balance Sheet (Vertical Form Schedule -III) (Practical Problems).		
<b>Module No. 4: FINANCIAL STATEMENTS ANALYSIS</b>		<b>12</b>
Comparative Statements - Comparative Income Statement, Comparative Balance Sheet; Common size Statements – Common Size Income Statement, Common Size Balance Sheet – Trend Percentages. (Analysis and Interpretation)		
<b>Module No. 5: CORPORATE FINANCIAL REPORTING PRACTICES</b>		<b>10</b>

Corporate Financial Reporting - meaning, types, characteristics of Corporate financial report, users of corporate financial report; Components corporate financial report- general corporate information, financial highlights, management's discussion and analysis; Financial Statements- balance sheet, income statement, cash flow statement, and notes to the financial statements; Auditor's report; Significant Accounting Policies; Corporate Governance Report; Corporate Social Responsibility Report (Discuss only Role and Significance of above components of corporate financial report).

**Skill Developments Activities:**

1. Collect financial statement of a company for five years and analyse the same using trend analysis.
2. Refer annual reports of two companies and list out the components.
3. Draft a partnership deed as per Partnership Act.
4. List out the accounting policies in annual report of the company

**Text Books:**

1. Stephen P. Robbins, Management, Pearson
2. Koontz and O'Donnell, Management, McGraw Hill.
3. L M Prasad, Principles of management, Sultan Chand and Sons
4. V.S.P Rao/Bajaj, Management process and organization, Excel Books.GH25
5. Appanniah and Reddy, Management, HPH.
6. T. Ramaswamy : Principles of Management, HPH.

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:** BBA 2.2

**Name of the Course:** Human Resource Management

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classroom's lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,		
<b>Course Outcomes: On successful completion of the course, the students will be able to demonstrate</b>		
a) Ability to describe the role and responsibility of Human resources management functions on business		
b) Ability to describe HRP, Recruitment and Selection process		
c) Ability to describe to induction, training, and compensation aspects.		
d) Ability to explain performance appraisal and its process.		
e) Ability to demonstrate Employee Engagement and Psychological Contract.		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: Introduction to Human Resource Management</b>		<b>10</b>
Meaning and Definition of HRM – Features Objectives, Differences between Human Resource Management and Personnel Management, Importance, Functions and Process of HRM, Role of HR Manager, Trends influencing HR practices		
<b>Module No. 2: Human Resource Planning, Recruitment &amp; Selection</b>		<b>14</b>
<b>Human Resource Planning:</b> Meaning and Importance of Human Resource Planning, Process of HRP		
<b>HR Demand Forecasting-</b> Meaning and Techniques (Meanings Only) and HR supply forecasting.		
<b>Succession Planning</b> – Meaning and Features		
<b>Job Analysis:</b> Meaning and Uses of Job Analysis, Process of Job Analysis – Job Description, Job Specification, Job Enlargement, Job Rotation, Job Enrichment (Meanings Only)		
<b>Recruitment</b> – Meaning, Methods of Recruitment, Factors affecting Recruitment, Sources of Recruitment		
<b>Selection</b> – Meaning, Steps in Selection Process, Psychometric tests for Selection, Barriers to effective Selection, Making Selection effective; Placement, Gamification – Meaning and Features		
<b>Module No. 3: Induction, Training and Compensation</b>		<b>10</b>
<b>Induction:</b> Meaning, Objectives and Purpose of Induction, Problems faced during Induction, Induction Program Planning.		
<b>Training:</b> Need for training, Benefits of training, Assessment of Training Needs and Methods of Training and Development; Kirkpatrick Model; Career Development.		
<b>Compensation:</b> Direct and Indirect forms of Compensation (Meaning Only), Compensation Structure.		
<b>Module No. 4: Performance Appraisal, Promotion &amp; Transfers</b>		<b>14</b>



**Performance appraisal:** Meaning and Definition, Objectives and Methods of Performance Appraisal – Uses and Limitations of Performance Appraisal, Process of Performance Appraisal

**Promotion:** Meaning and Definition of Promotion, Purpose of Promotion, Basis of Promotion **ransfer:** Meaning of Transfer, Reasons for Transfer, Types of Transfer, Right Sizing of Work Force, Need for Right Sizing

<b>Module No. 5: Employee Engagement and Psychological Contract</b>	<b>08</b>
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**Employee Engagement (EE):** Meaning and Types of EE, Drivers of Engagement - Measurement of EE, Benefits of EE. **Psychological contract:** Meaning and features

**Skill Developments Activities:**

1. Preparation of Job Descriptions and Job specifications for a Job profile
2. Choose any MNC and present your observations on training program
3. Develop a format for performance appraisal of an employee.
4. Discussion of any two Employee Engagement models.
5. Analysis of components of pay structure based on the CTC sent by the Corporate to the institute for the various jobs of different sectors.

**Textbooks:**

Aswathappa, Human Resource Management, McGraw Hill

Edwin Flippo, Personnel Management, McGraw Hill

C.B.Mamoria, Personnel Management, HPH

Subba Rao, Personnel and Human Resources Management, HPH

Reddy & Appanniah, Human Resource Management, HPH

Madhurimalal, Human Resource Management, HPH

S.Sadri & Others: Geometry of HR, HPH

Rajkumar: Human Resource Management I.K. Intl

Michael Porter, HRM and Human Relations, Juta & Co.Ltd.

K. Venkataramana, Human Resource Management, SHBP

**Note: Latest edition of textbooks may be used.**

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:** BBA 2.3

**Name of the Course:** BUSINESS ENVIRONMENT

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	4 Hrs	56 Hrs

**Pedagogy:** Classrooms lecture, tutorials, Group discussion, Seminar, Case studies.

**Course Outcomes: On successful completion Student will demonstrate**

- a) An Understanding of components of business environment.
- b) Ability to analyse the environmental factors influencing business organisation.
- c) Ability to demonstrate Competitive structure analysis for select industry.
- d) Ability to explain the impact of fiscal policy and monetary policy on business.
- e) Ability to analyse the impact of economic environmental factors on business.

**Syllabus:**

**Hours**

**Module No. 1: INTRODUCTION BUSINESS ENVIRONMENT**

**12**

Meaning of business, scope and objectives Business, business environment, Micro and Macro-environment of business (social, cultural, economic, political, legal technological and natural) Impact of these factors on decision making in business, Environmental analysis.

**Module No. 2: GOVERNMENT AND LEGAL ENVIRONMENT**

**16**

**Government Functions** of the State, Economic role of government, State intervention in business- reasons for and types of state intervention in business. Impact of Monetary policy, Fiscal policy, Exim policy and industrial policy on business.

**Legal environment** - Various laws affecting Indian businesses

**Module No. 3: ECONOMIC ENVIRONMENT AND GLOBAL ENVIRONMENT**

**13**

An overview of economic environment, structure of economy, factors affecting economic environment.

**Globalisation of business;** meaning and dimensions, stages, essential conditions of globalisation, foreign market entry strategies, merits and demerits of globalisation of business, Impact of Globalisation on Indian businesses, Forms of globalisation of businesses - MNCs, TNCs etc..

**Module No. 4: TECHNOLOGICAL ENVIRONMENT**

**10**

Meaning and features; types of innovation, Impact of Technological changes on business, Technology and Society, Technological Acquisition modes, IT revolution and business, Management of Technology.

**Module No. 5: NATURAL ENVIRONMENT**

**05**

Meaning and nature of physical environment. Impact of Natural environment on business.

**Skill Developments Activities:**

- a) List out key features of recent Monetary policy published by RBI impacting businesses.
- b) Give your observation as to how technology has helped society.
- c) Draft Five Forces Model for Imaginary business.
- d) Identify the benefits of Digital transformation in India.

**Text Books:**

1. Dr. K Ashwatappa: Essentials Of Business Environment
2. Sundaram & Black: The International Business Environment; Prentice Hall
3. Chidambaram: Business Environment; Vikas Publishing
4. Upadhyay, S: Business Environment, Asia Books
5. Chopra, BK: Business Environment in India, Everest Publishing
6. Suresh Bedi: Business Environment,Excel Books
7. Economic Environment of Business by M. Ashikary.
8. Business Environment by Francis Cherrinulam

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:** BBA 2.3

**Name of the Course:** Business Mathematics

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	4 Hrs	56 Hrs

**Pedagogy:** Classroom's lecture, tutorials, Problem solving.

**Course Outcomes: On successful completion of the course, the students will demonstrate**

- The Understanding of the basic concepts of business maths and apply them to create solve and interpret application problems in business
- Ability to solve problems on various types of equation.
- Ability to solve problems on Matrices and execute the laws of indices, law of logarithm and evaluate them.
- Ability to apply the concept of simple interest and compound interest bills discounted etc. and apply them in day-to-day life.
- Ability to solve problems on Arithmetic progression, Geometric progression and construct logical application of these concepts.

**Syllabus:**

**Hours**

**Module No. 1: NUMBER SYSTEM**

**04**

Introduction – Natural Numbers - Even Numbers – Odd Numbers – Integers – Prime Numbers – Rational and Irrational numbers, Real Numbers, HCF and LCM (Simple problems).

**Module No. 2: THEORY OF EQUATIONS**

**10**

Introduction – Meaning - Types of Equations – Simple/ Linear Equations and Simultaneous Equations (only two variables), Elimination and Substitution Methods only. Quadratic Equation - Factorization and Formula Method ( $ax^2 + bx + c = 0$  form only). Simple problems.

**Module No.3: INDICIES, MATRICES AND LOGARITHMS**

**16**

Meaning – types – operation on matrices – additions – subtractions and multiplication of two matrices – transpose – determinants – minor of an element – co-factor of an element – inverse – crammers rule in two variables – problems.

Indices and Logarithms: Meaning- Basic Laws of Indices and their application for simplification. Laws of Logarithms –Common Logarithm, Application of Log Table for Simplification.

**Module No. 4: COMMERCIAL ARITHMETIC**

**16**

Simple Interest, Compound Interest including yearly and half yearly calculations, Annuities, Percentages, Bills Discounting, Ratios and proportions, duplicate-triplicate and sub-duplicate of a ratio. Proportions: third, fourth and inverse proportion - problems.

**Module No. 5: PROGRESSIONS**

**10**

PROGRESSIONS: Arithmetic Progression - Finding the 'n<sup>th</sup>' term of AP and Sum to nth term of AP. Insertion of Arithmetic Mean Geometric Progression – Finding the 'n<sup>th</sup>' term of GP and sum to 'n<sup>th</sup>' term of GP and insertion of Geometric Mean.

**Skill Developments Activities:**

1. Develop an Amortization Table for Loan Amount – EMI Calculation.
2. Secondary overhead distribution summary using Simultaneous Equations Method.
3. Application of Matrix In Business Problems

**Text Books:**

1. Saha: Mathematics for Cost Accountants, Central Publishers
2. R.G. Saha and Others – Methods and Techniques for Business Decisions, VBH
3. Dr. Sancheti and Kapoor: Business Mathematics and Statistics, Sultan Chand
4. Zamarudeen: Business Mathematics, Vikas
5. R.S Bhardwaj :Mathematics for Economics and Business
6. Madappa, mahadi Hassan, M. Iqbal Taiyab – Business Mathematics, Subhash
7. G.R. Veena and Seema : Business Mathematics and Statistics I.K. Intl Publishers

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor Business Administration (BBA)

**Course Code:** BBA.2.6 (OEC)

**Name of the Course:** People Management

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>45 Hrs</b>

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.

**Course outcome: On successful completion of the course, student will demonstrate:**

1. Ability to examine the difference between People Management with Human resource Management
2. Ability to explain the need for and importance of People Management.
3. Ability to explain role of manager in different stages of performance management process
4. Ability to list modern methods of performance and task assessment.
5. Ability to analyse the factors influencing the work life balance of an working individual.

**Syllabus:**

**Hours**

**Module No. 1: Introduction to People Management**

**06**

Diversity in organisation: age, gender, ethnicity, race, and ability. People Management: Meaning, Features, Significance of people management, Difference between People Management and Human Resource Management, impact of individual and organizational factors on people management.

**Module No. 2: Getting Work Done and Assessment and Evaluation**

**12**

Getting work done: Challenges of getting work done, significance of prioritization and assigning work to team members.

Performance Management: meaning, role of a manager in the different stages of the performance management process, Types of Performance assessment, Assessment and Evaluation Process of evaluation of tasks in the organisation. Modern tools of assessment and evaluation of tasks and performance.

**Module No. 3: Building Peer Networks and Essentials of Communication**

**12**

**Building Peer Networks:** Understanding the importance of peer networks in an organization; being able to influence those on whom you have no authority; challenges Peer networking and different types of people networking in the workplace.

**Essentials of Communication:** Concept of the communication process with reflection on various barriers to effective communication and ways to overcome, Types of Communication and Channels of Communication.

**Module No. 4: Motivation**

**08**

Meaning, Importance and need for motivation, team motivation- meaning, importance team motivation, types of Motivators and Modern methods of motivation

**Module No. 5: Managing Self**

**07**

Reflection on what does it mean to be a people manager; building a personal development plan for oneself, Self-Stress Management: Causes for stress, work life Balance, Importance of Work life balance, Factors influencing Work life Balance.

**Skill Developments Activities:**

1. Analyse two cases on any of the above content indicated above.
2. List out the modern tools to performance assessment and evaluation.
3. Conduct a survey of work life balance of working individuals
4. Draft a Career development of working individual in the middle level management.

**Text Books:**

1. McShane, Steven L. and Mary Ann Von Glinow, Organizational Behavior: Emerging Knowledge and Practice for the Real World. McGraw-Hill, latest edition, ISBN: 0-07-115113-3.
2. Bernardin, H. John and Joyce E. A. Russell. Human Resource Management: An Experiential Approach. McGraw-Hill, 6/e. ISBN: 0078029163
3. Argyris, C. (1974). Personality vs. Organization. Organizational Dynamics. Vol. 3. No. 2, Autumn.
4. Blume, B. Baldwin, T. and Ryan, K. (2013). Communication Apprehension. A barrier to students leadership, adaptability and multicultural appreciation. Academy of Management Learning & Education, Jun, Vol. 12 Issue 2, p158-172.
5. Colquitt, J.A., LePine, J.A., & Wesson, M.J. (2009) Organizational Behavior: Improving Performance and Commitment in the Workplace (International edition). New York: McGraw-Hill.
6. Goleman, D. (1998). Working with Emotional Intelligence. Bantam Books,

**Note: Latest edition of text books may be used.**

**Name of the Program: Bachelor of Business Administration****Course Code: BBA 2.6 (OEC)****Name of the Course: Functional Areas of Management**

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>45 Hrs</b>

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.**Course Outcomes: On successful completion Student will demonstrate ;**

- Understand the concepts and functions of marketing and analyzing the Marketing Mix.
- Ability to describe Man power Planning and Implement Recruitment, Selection process and Evaluate Performance
- Understanding various functions of Financial Management
- Understanding the basics of production and operations management
- Understanding the need for Information Systems in organization.

**Syllabus:****Module No. 1: MARKETING MANAGEMENT** **10**

Meaning and Definitions-Evolution of marketing-Marketing Vs Selling-Marketing concepts-Nature and Scope of Marketing-Functions of Marketing, Elements of Marketing Mix (7Ps)

**Module No. 2: HUMAN RESOURCE MANAGEMENT** **10**

Meaning and Definitions-Functions of HR-Man power planning-Recruitment-Selection-Training and development- Placement-Compensation-Incentives-monetary and non monetary-Performance Appraisal

**Module No. 3: FINANCIAL MANAGEMENT** **10**

Meaning-Definitions-Objectives-Profit maximization vs. Wealth maximization-Scope of Financial management-Investment decisions- Financing decisions, Dividend decisions-Working capital decisions

**Module No. 4: PRODUCTION AND OPERATIONS MANAGEMENT** **08**

Meaning, Objectives and Functions -Plant Location -Plant Layout-Factors-Types- Production Planning and Control-Inventory Management-Total Quality Management-Concept of Supply Chain management

**Module No. 5: INFORMATION SYSTEM** **07**

Introduction, Data Vs Information, Information system in an Organisation, Importance of Information System in Decision making - Information system and sub systems

**Skill Developments Activities:**

- List the sources of recruitment and draw a Selection process chart of an organisation
- Draw a chart showing a Plant layout operations
- List out the current trends in Marketing and Human Resource Management
- List out the Factors Influencing Financing and Investment Decisions

**Books Recommended:**

- Richard Pettiger. Introduction to Management, Palgrave Macmillan, New York
- M.J.Mathew,Functional Management, RBSA Publishers, Jaipur.
- Meenakshy Gupta . Principles of Management, PHI, New Delhi.
- Koonts and Heinz Weihrich. Essentials of Management, Tata McGraw-Hill Publishing Co.Ltd.
- Modern Production Management Buffa Ekwood. S, and Rakesh K. Saren, John wiley and Sonss., 2003
- Operations Management K.N. Krishnaswamy
- Management Information System – C.S.V Murthy







**JSS COLLEGE OF ARTS COMMERCE & SCIENCE**

**(Autonomous)**

**Ooty Road, Mysuru – 25**

**DEPARTMENT OF COMMERCE AND  
MANAGEMENT**

**BBA Programme  
( II Year)  
Syllabus as per NEP  
(Modified)**

**w.e.f  
2023-24**

## **SYLLABUS FOR BBA DEGREE AS PER NEP – 2020 REGULATIONS IMPLEMENTED FROM THE ACADEMIC YEAR 2021-22**

### **I. OBJECTIVES:**

1. To develop the skills required for the application of business concepts and techniques learned in the classroom at the workplace.
2. To provide competent and technical skills personnel to the industry in the area of Marketing, Finance, Human Resource, Data Analytics, Retailing and Logistics And Supply Chain Management. To enhance the employability skills of the management students.
3. To enhance the capability of the students improve their decision-making skills.
4. To encourage entrepreneurship among students pursuing education in the field of Business Administration.
5. To empower students for pursuing professional courses like MBA, Chartered Accountancy, Company Secretary, etc.,
6. To ensure holistic development of Business administration students.

### **II. ELIGIBILITY FOR ADMISSION:**

Candidates who have passed Two Year Pre University Course of Karnataka State in any discipline or its equivalent (viz., 10+2 of other states, ITI, Diploma etc.) are eligible for admission into this program.

### **III. DURATION OF THE PROGRAM:**

The program of study is Four years of Eight Semesters. A candidate shall complete his/her degree within eight academic years from the date of his/her admission to the first semester. The NEP 2020 provides multiple exit options for students as specified below:

#### **EXIT OPTION:**

- a. The students who successfully complete ONE year/ 2 Semesters and leave the program, will be awarded Certificate in Business Administration.
- b. The students who successfully complete TWO years/ 4 Semesters and leave the program, will be awarded Diploma in Business Administration.
- c. The students who successfully complete THREE years/ 6 Semesters and leave the program, will be awarded Bachelors Degree in Business Administration ( BBA )
- d. An option is given to the students to continue their education to the Fourth year and those who successfully complete FOUR years/ 8 Semesters will be awarded Bachelors Degree in Business Administration (Hons). [BBA (Hons)]

### **IV. MEDIUM OF INSTRUCTION**

The medium of instruction shall be English. .

### **V. ATTENDANCE**

- a. For the purpose of calculating attendance, each semester shall be taken as a Unit.

- b. A student shall be considered to have satisfied the requirement of attendance for the semester if he/she has attended not less than 75% in aggregate of the number of working periods in each of the subjects compulsorily.
- c. A student who fails to complete the course in the manner stated above shall not be permitted to take the University Examination.

**VI. TEACHING AND EVALUATION**

MBA graduates with B.Com, BBM/BBA and BBS as basic degree from a recognized university are only eligible to teach and to evaluate all the Business Administration courses except Languages (Constitution of India, Environmental Studies, Health Wellness/Social and Emotional learning (Sports/NCC/NSS/Other))

**VII. SKILL DEVELOPMENT / RECORD MAINTENANCE**

- a. Every college is required to establish a dedicated business lab for the purpose of conducting practical/ assignments to be written in the record.
- b. In every semester, the student should maintain a record book in which a minimum of 10 exercise or activities per course are to be recorded.

**VIII. SCHEME OF EXAMINATION**

- a. There shall be an University examination at the end of each semester. The maximum marks for the university examination in each paper shall be 60 marks for DSC, DSE, Vocational, SEC and OEC.
- b. Internal Assessment 40 marks for DSC, DSE, Vocational, SEC and OEC.

**Guidelines for Continuous Internal Evaluation and Semester End Examination:**

**The CIE and SEE will carry 40% and 60% weightage each, to enable the student to be evaluated at a total of 100 marks, irrespective of its credits. The evaluation system of the course & continuous during the entire period of the Semester. The CIE and SEE evaluation will be on the following parameters:**

Sl. No	Parameters for the Evaluation	Marks
	Continuous Internal Evaluation (CIE)	
1	Continuous & Comprehensive Evaluation (CCE) – (A)	20 Marks
2	Internal Assessment Tests (IAT) – (B)	20 Marks

	Total of CIE (A+B)	40 Marks
3	Semester End Examination (SEE) – (C)	60 Marks
	Total of CIE and SEE (A+B+C)	100 Marks

**Continuous Internal Evaluation:**

**a. Continuous & Comprehensive Evaluation (CCE):** The CCE will carry a maximum of 20% weightage (20 marks) of total marks of a course. Before the start of the academic session in each semester, a faculty member should choose for his/her course, minimum of four of the following assessment methods with 5 marks each (4x5=20 marks)

- i. Individual Assignments
- ii. Seminars/Class Room Presentations/Quizzes
- iii. Group Discussions/Class Discussion/Group Assignments
- iv. Case studies/Caselets
- v. Participatory & Industry-Integrated Learning/ n
- vi. Practical activities/Problem Solving Exercises s
- vii. Participation in Seminars/Academic Events/S n
- viii. Mini Projects/Capstone Projects

**b. Internal Assessment Tests (IAT):** The IAT will carry a maximum of 20% weightage (20 marks) of total marks of a course. Under this component, two tests will have to be conducted in a semester for 30 marks each and the same is to be scaled down to 10 marks each.

**Internal Assessment Test**

Course Code:

Name of the Course:

Duration: 1 Hour

Total Marks: 30

**PART-A**

Answer any one of the following questions (5 marks)

1. ....

2. ....

**PART-B**

Answer any one of the following questions (10 marks)

3. ....

4.....

**SECTION-C**

Answer any one of the following questions (x 15 = 15) marks

5.....

6.....

**SEMESTER END EXAMINATION (SEE):**

**The Semester End Examination for all the courses for which in these semesters shall be conducted. SEE of the courses shall be in a minimum attendance requirement as per the University. No has prepared the SEE framework and the questions presented below for 60 marks.**

**PATTERN OF QUESTION PAPER**

**TIME : 3 HOURS**

**MARKS: 60**

**PART - A**

Answer any FIVE of the following questions. Each question carries 2 marks.

**(5x2= 10)**

1. ....
2. ....
3. ....
4. ....
5. ....
6. ....
7. ....

**PART - B**

Answer any TWO of the following questions. Each question carries 10 Marks.

**(2x10 =20)**

8. ....
9. ....
10. ....
11. ....

**PART - C**

Answer any TWO of the following questions. Each question carries 15 Marks

**(2x15=30)**

12. ....
13. ....
14. ....
15. ....

### Minimum Marks for a Pass:

Candidates who have obtained a minimum of 35% marks out of 60 marks of theory examination and 40% marks of Semester End Examination marks and Continuous

### BBA PROGRAM

#### Proposed Scheme of Teaching & Evaluation for BBA (Basic/Hons) with Business Administration as Core subject

Semester I								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
1	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
2	Lang.1.2	Language - II	AECC	3+1+0	60	40	100	3
3	BBA.1.1	Management Principles & Practice	DSC	3+2+0	60	40	100	4
4	BBA.1.2	Fundamentals of Business Accounting	DSC	3+2+0	60	40	100	4
5	BBA.1.3	Marketing Management	DSC	3+2+0	60	40	100	4
6	BBA.1.4	Digital Fluency	SEC-SB	1+0+2	25	25	50	2
7	BBA.1.5	Business Organization / Office Organization and Management	OEC	3+0+0	60	40	100	3
<b>Sub-Total (A)</b>					<b>385</b>	<b>265</b>	<b>650</b>	<b>23</b>

Semester II								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
8	Lang.2.1	Language - I	AECC	3+1+0	60	40	100	3
9	Lang.2.2	Language - II	AECC	3+1+0	60	40	100	3

10	BBA.2.1	Financial Accounting and Reporting	DSC	3+2+0	60	40	100	4
11	BBA.2.2	Human Resource Management	DSC	3+2+0	60	40	100	4
12	BBA.2.3	Business Environment/ Business Mathematics	DSC	3+2+0	60	40	100	4
13	BBA.2.4	Health & Wellness/ Social & Emotional Learning	SEC-VB	1+0+2	25	25	50	2
14	BBA.2.5	Environmental Studies	AECC	2+0+0	30	20	50	2
15	BBA.2.6	People Management /Retail Management	OEC	3+0+0	60	40	100	3
<b>Sub–Total (B)</b>					415	285	700	25

**EXIT OPTION WITH CERTIFICATION** - with ability to solve well defined problems



### Semester III

Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
16	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
17	Lang.1.2	Language - II	AECC	3+1+0	60	40	100	3
18	BBA.3.1	Cost Accounting	DSC	3+2+0	60	40	100	4
19	BBA.3.2	Organizational Behavior	DSC	3+2+0	60	40	100	4
20	BBA.3.3	Statistics for Business Decisions	DSC	3+2+0	60	40	100	4
21	BBA.3.4	Artificial Intelligence/Critical thinking & Problem Solving	SEC	1+0+2	25	25	50	2
22	BBA.3.5	Social Media Marketing/ Rural Marketing	OEC	3+0+0	60	40	100	3
<b>Sub-Total (C)</b>					<b>385</b>	<b>265</b>	<b>650</b>	<b>23</b>

### Semester IV

Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
23	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
24	Lang.1.2	Language - II	AECC	3+1+0	60	40	100	3
25	BBA.4.1	Management Accounting	DSC	3+2+0	60	40	100	4
26	BBA.4.2	Business Analytics / Financial Markets & Services	DSC	3+2+0	60	40	100	4
27	BBA.4.3	Financial Management	DSC	3+2+0	60	40	100	4
28	BBA.4.4	Constitution of India	AECC	2+0+0	30	20	50	2
29	BBA.4.5	Sports/NCC/NSS/YOGA	SEC-VB	1+0+2	25	25	50	2
40	BBA.4.6	Business Leadership Skills/Personal Wealth Management	OEC	3+0+0	60	40	100	3
<b>Sub-Total (D)</b>					<b>415</b>	<b>285</b>	<b>700</b>	<b>25</b>

**EXIT OPTION WITH DIPLOMA to solve broadly defined problems**

Semester V								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
31	<b>BBA.5.1</b>	Production And Operations Management/ International Business	<b>DSC</b>	3+2+0	60	40	100	4
32	<b>BBA.5.2</b>	Income Tax	<b>DSC</b>	3+2+0	60	40	100	4
33	<b>BBA.5.3</b>	Elective-1(PAPER 1)	<b>DSE</b>	3+2+0	60	40	100	4
34	<b>BBA.5.4</b>	Elective-2 (PAPER1)	<b>DSE</b>	3+2+0	60	40	100	4
35	<b>BBA.5.5</b>	Information Technology for Managers	Vocational - 1	3+0+2	50	50	100	4
36	<b>BBA.5.6</b>	Cyber Security/Ethics & Self-Awareness	<b>SEC - VB</b>	1+0+2	25	25	50	2
<b>Sub–Total (E)</b>					<b>315</b>	<b>235</b>	<b>550</b>	<b>22</b>

Semester VI								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
37	<b>BBA.6.1</b>	Business Laws	<b>DSC</b>	4+0+0	60	40	100	4
38	<b>BBA.6.2</b>	Entrepreneurship & Startup Management	<b>DSC</b>	3+2+0	60	40	100	4
39	<b>BBA Elective</b>	Elective-1(PAPER2)	<b>DSE</b>	3+2+0	60	40	100	4
40	<b>BBA.6.4</b>	Elective-2(PAPER2)	<b>DSE</b>	3+2+0	60	40	100	4
41	<b>BBA.6.5</b>	Goods & Services Tax(GST)	<b>Vocational</b>	1-24+0+0	60	40	100	4
42	<b>BBA.6.6</b>	Professional Communication	<b>SEC - SB</b>	2+0+0	30	20	50	2
<b>Sub–Total (F)</b>					<b>330</b>	<b>220</b>	<b>550</b>	<b>22</b>
							<b>Total</b>	<b>140</b>

Students have to select dual electives out of the list of electives given in Fifth and Sixth Semester. Electives selected in the fifth semester should be continued in the sixth semester. However they can change the electives in the seventh semester. The electives selected in the seventh semester will continue in the eighth semester.

**EXIT OPTION WITH BACHELOR DEGREE -Ability to solve complex problems that are ill-structured requiring multi-disciplinary skills to solve them.**

Semester VII								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
44	BBA.7	Business Ethics & Governance	DSC	4+0+0	60	40	100	4
45	BBA.7.2	E Commerce	DSC	4+0+0	60	40	100	4
46	BBA.7.3	Advance Statistics for Business Research	DSC	3+2+0	60	40	100	4
47	BBA.	One Course from the Selected Elective Group	DSE	3+2+0	60	40	100	4
48	BBA.7	Application of Statistical Software (Any one Statistical Software)	Vocational	2+0+2	50	50	100	3
49	BBA.	Research Methodology	DSC	3+0+0	60	40	100	3
Sub–Total (G)					350	250	600	22

Semester VIII								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
50	BBA.8.1	Strategic Management	DSC	4+0+0	60	40	100	4
51	BBA.8.2	Operations Research and Quantitative Techniques	DSC	4+0+0	60	40	100	4
52	BBA.8.3	Project Management	DSC	4+0+0	60	40	100	4
53	BBA.8.5	Digital Marketing	Vocational	1-2+0+2	50	50	100	3
54	BBA.8.5	Research Projects/Internship with Viva – voce	DSC	-	100+20(viva)	80	200	6
		OR						
		Elective Paper (Courses from the Selected Elective Group)	DSE	3+2+0	60*	40*	100*	3*
Sub–Total (H)					350	250	600	21
Grand Total Honors					3440	1520	4950	183

\* Students who do not opt for Research Project / Internship shall take two elective courses.

**BACHELOR DEGREE WITH HONORS** **Presence of workplace problem solving in the form of research experience preparing for higher education or entrepreneurship experience.**

Notes:

- One Hour of Lecture is equal to 1 Credit.
- Two Hours of Tutorial is equal to 1 Credit (Except Languages).
- Two Hours of Tutorial is equal to 2 Hours of Teaching
- Two Hours of Practical is equal to 1 Credit.
- Two Hours of Practical is equal to 1 Hour of Teaching
- Practical Classes may be conducted in the Business Lab or in Computer Lab or in Class room

depending on therequirement. One batch of students should not exceed half (i.e., 30 or less than 30 students) of the number of students ineach class/section. 2 Hours of Practical Class is equal to 1 Hour of Teaching, however, whenever it is conducted for theentireclass(i.e., morethan30students)2HoursofPractical Classisequal to2HoursofTeaching.

**Acronyms Expanded**

- AECC : Ability Enhancement Compulsory Course
- DSC© : Discipline Specific Core(Course)
- SEC-SB/VB : Skill Enhancement Course-Skill Based/Value Based
- OEC : Open Elective Course
- DSE : Discipline Specific Elective
- SEE : Semester End Examination
- CIE : Continuous Internal Evaluation
- L+T+P : Lecture+Tutorial+Practical(s)

**ELECTIVE GROUPS AND COURSES:**

**Discipline Specific Ele-V Semes**

Sl. No	Finance	Marketing	Human Resource Management	Data Analytics	Retailing	Logistics And Supply Chain Management
Paper-1	Advanced Corporate Financial Management	Consumer Behavior	Compensation and Performance Management	Financial Analytics	Retail Operations Management	Freight Transport Management

**Discipline Specific Ele-VI Semes**

Sl. No	Finance	Marketing	Human Resource Management	Data Analytics	Retailing	Logistics And Supply Chain Management
Paper-2	Security Analysis and Portfolio Management	Advertising Management & Sales promotion	Employee Welfare & Social Security	Marketing Analytics	Strategic Brand Management	Sourcing for Logistics and SCM

**Discipline Specific Ele-VII Semes**

Sl. No	Finance	Marketing	Human Resource Management	Data Analytics	Retailing	Logistics And Supply Chain Management
Paper-3	Strategic Financial Management	Brand Management / Rural Marketing	Labor Laws & IR	HR Analytics	Merchandising Planning and Buying	Managing Procurement contract and relationship

**Discipline Specific Ele-VIII Seme**

Sl. No	Finance	Marketing	Human Resource Management	Data Analytics	Retailing	Logistics And Supply Chain Management
Paper-4	Derivatives and Risk Management	B to B Marketing (Industrial Marketing)	HRD	Web and Social Intelligence	IT applications in Retail Business	Global Environment for Supply chain Management

<b>Paper-5</b>	<b>International Financial Management</b>	<b>Sales &amp; Distribution Management</b>	<b>International HRM</b>	<b>Machine Learning in Business</b>	<b>Visual Merchandising</b>	<b>International Supply Chain</b>
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**NOTE: Student shall continue with the same elective group in V and VI semesters, however, he/she may change the elective group in VII semester, but shall continue in the same group in VIII semester.**

**The regulations of the University of Mysore is applicable wherever required.**

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:**BBA 1.1

**Name of the Course:** Management Principles & Practice

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>5 Hrs</b>	<b>70 Hrs</b>

**Pedagogy:** Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will demonstrate**

- a) The ability to understand concepts of business management, principles and function of management.
- b) The ability to explain the process of planning and decision making.
- c) The ability to create organization structures based on authority, task and responsibilities.
- d) The ability to explain the principles of direction, importance of communication, barrier of communication, motivation theories and leadership styles.
- e) The ability to understand the requirement of good control system and control techniques.

<b>Syllabus:</b>	<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO MANAGEMENT</b>	<b>14</b>
Introduction –Meaning, Evolution of management thought, Pre-Scientific Management Era, Classical Management Era, Neo-Classical Management Era, Modern Management Era; Nature and Characteristics of Management - Scope and Functional areas of Management; Management as a Science, Art or Profession; Management and Administration; Principles of Management.	
<b>Module No. 2: PLANNING AND DECISION MAKING</b>	<b>12</b>
Nature, Importance and Purpose of Planning - Planning Process; Objectives; Types of plans (Meaning only); Decision making- Importance and steps; MBO and MBE (Meaning only)	
<b>Module No. 3: ORGANIZING AND STAFFING</b>	<b>14</b>
Nature and purpose of Organization; Principles of Organizing; Delegation of Authority; Types of Organization - Departmentation, Committees; Centralization vs Decentralization of Authority and Responsibility, Span of Control; Nature and importance of Staffing	
<b>Module No. 4: DIRECTING AND COMMUNICATING</b>	<b>16</b>
Meaning and Nature of Direction, Principles of Direction; Communication - Meaning and Importance, Communication Process, Barriers to Communication, Steps to overcome Communication Barriers, Types of Communication; Motivation theories – Maslow’s Need Hierarchy Theory, Herzberg’s Two Factor Theory, Mc.Gregor’s X and Y theory. Leadership – Meaning, Formal and Informal Leadership, Characteristics of Leadership; Leadership Styles – Autocratic Style, Democratic Style, Participative Style, Laissez Faire Leadership Styles, Transition Leadership, Charismatic Leadership Style.	
<b>Module No. 5: COORDINATING AND CONTROLLING</b>	<b>16</b>
Coordination–Meaning, Importance and Principles. Controlling-Meaning and steps in controlling, Essentials of Effective Control system, Techniques of Control (in brief).	
Business Social Responsibility - Meaning, Arguments for and against Business Social Responsibility; Green management - Meaning, Green Management Actions; Managerial Ethics – Meaning - Importance of Ethics in Business, Factors that determine Ethical or Unethical behavior.	

**Skill Developments Activities:**

1. Two cases on the above syllabus should be analyzed by the teacher in the classroom and the same needs to be recorded by the student in the Skill Development Book.
2. Draft different types of Organization structure.
3. Draft Control charts.

**Text Books:**

1. Stephen P. Robbins, Management, Pearson
2. Koontz and O'Donnell, Management, McGraw Hill.
3. L M Prasad, Principles of management, Sultan Chand and Sons
4. V.S.P Rao/Bajaj, Management process and organization, Excel Books.GH25
5. T. Ramaswamy : Principles of Management, HPH.

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:**BBA 1.2

**Name of the Course:** Fundamentals of Business Accounting

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>5 Credits</b>	<b>5 Hrs</b>	<b>70 Hrs</b>

**Pedagogy:** Classrooms lecture, tutorials, and problem solving.

**Course Outcomes: On successful completion of the course, the Students will demonstrate**

- a) Understand the framework of accounting as well accounting standards.
- b) The Ability to pass journal entries and prepare ledger accounts
- c) The Ability to prepare subsidiaries books
- d) The Ability to prepare trial balance and final accounts of proprietary concern.
- e) Construct final accounts through application of tally.

**Syllabus:**

<b>Module No. 1: INTRODUCTION TO FINANCIAL ACCOUNTING</b>	<b>Hours</b>
<b>12</b>	

Introduction – Meaning and Definition – Objectives of Accounting – Functions of Accounting – Users of Accounting Information – Limitations of Accounting – Accounting Cycle - Accounting Principles – Accounting Concepts and Accounting Conventions. Accounting Standards – objectives- significance of accounting standards. List of Indian Accounting Standards.

<b>Module No. 2: ACCOUNTING PROCESS</b>	<b>14</b>

Meaning of Double entry system – Process of Accounting – Kinds of Accounts – Rules - Transaction Analysis – Journal – Ledger – Balancing of Accounts – Trial Balance – Problems on Journal, Ledger Posting and Preparation of Trial Balance.

<b>Module No. 3: SUBSIDIARY BOOKS</b>	<b>16</b>

Meaning – Significance – Types of Subsidiary Books –Preparation of Purchases Book, Sales Book, Purchase Returns Book, Sales Return Book, Bills Receivable Book, Bills Payable Book. Types of Cash Book- Simple Cash Book , Double Column Cash Book , Three Column Cash Book and Petty Cash Book(Problems only on Three Column Cash Book and Petty Cash Book), Bank Reconciliation Statement – Preparation of Bank Reconciliation Statement (Problems on BRS)

<b>Module No. 4:FINAL ACCOUNTS OF PROPRIETARY CONCERN</b>	<b>16</b>

Preparation of Statement of Profit and Loss and Balance Sheet of a proprietary concern with special adjustments like depreciation, outstanding and prepaid expenses, outstanding and received in advance of incomes, provision for doubtful debts, drawings and interest on capital.

<b>Module No. 5: ACCOUNTING SOFTWARE</b>	<b>22</b>

Introduction-meaning of accounting software, types accounting software-accounting software Tally-Meaning of Tally software – Features – Advantages, Creating a New Company, Basic Currency information, other information, Company features and Inventory features. Configuring Tally - General Configuration, Numerical symbols, accounts/inventory info – master configuration -voucher entry configuration. Working in Tally: Groups, Ledgers, writing voucher, different types of voucher, voucher entry Problem on Voucher entry - Generating Basic Reports in Tally-Trail Balance, Accounts books, Cash Book, Bank Books, Ledger Accounts, Group Summary, Sales Register and Purchase Register, Journal Register, Statement of Accounts, and Balance Sheet.

**Skill Developments Activities:**



1. List out the accounting concepts and conventions.
2. Prepare a Bank Reconciliation Statement with imaginary figures
3. Collect the financial statement of a proprietary concern and record it.
4. Prepare a financial statement of an imaginary company using tally software.

**Text Books:**

1. Hanif and Mukherjee, Financial Accounting, Mc Graw Hill Publishers
2. Arulanandam & Raman; Advanced Accountancy, Himalaya Publishing House
3. S.Anil Kumar,V.Rajesh Kumar and B.Mariyappa–Fundamentals of Accounting, Himalaya Publishing House.
4. Dr. S.N. Maheswari, Financial Accounting, Vikas Publication
5. S P Jain and K. L. Narang, Financial Accounting, Kalyani Publication
6. Radhaswamy and R.L. Gupta, Advanced Accounting , Sultan Chand
7. M.C. Shukla and Goyel, Advaced Accounting , S Chand.

<b>Name of the Program:</b> Bachelor of Business Administration (BBA) <b>Course Code:</b> BBA 1.3 <b>Name of the Course:</b> Marketing Management		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
4 Credits	5 Hrs	70 Hrs
<b>Pedagogy:</b> Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b> <ol style="list-style-type: none"> <li>a) Understand the concepts and functions of marketing.</li> <li>b) Analyse marketing environment impacting the business.</li> <li>c) Segment the market and understand the consumer behaviour</li> <li>d) Describe the 4 p's of marketing and also strategize marketing mix</li> <li>e) Describe 7 p's of service marketing mix.</li> </ol>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO MARKETING</b>		<b>14</b>
Meaning and Definition, Concepts of Marketing, Approaches to Marketing, Functions of Marketing. <b>Recent trends in Marketing</b> -E- business, Tele-marketing, M-Business, Green Marketing, Relationship Marketing, Concept Marketing, Digital Marketing, social media marketing and E-tailing (Meaning only).		
<b>Module No. 2: MARKETING ENVIRONMENT</b>		<b>14</b>
<b>Micro Environment</b> – The company, suppliers, marketing intermediaries competitors, public and customers; <b>Macro Environment</b> - Demographic, Economic, Natural, Technological, Political, Legal, Socio-Cultural Environment.		
<b>Module No. 3: MARKET SEGMENTATION AND CONSUMER BEHAVIOUR</b>		<b>12</b>
Meaning and Definition, Bases of Market Segmentation, Requisites of Sound Market Segmentation; Consumer Behavior-Factors influencing Consumer Behavior; Buying Decision Process.		
<b>Module No. 4:MARKETING MIX</b>		<b>20</b>
Meaning, Elements of Marketing Mix (Four P's) – Product, Price, Place, Promotion. Product-Product Mix, Product Line, Product Lifecycle, New Product Development, Reasons for Failure of New Product, Branding, Packing and Packaging, Labeling, Pricing – Objectives, Factors influencing Pricing Policy, Methods of Pricing; Physical Distribution–Meaning, Factors affecting Channel Selection, Types of Marketing Channels. Promotion – Meaning and Significance of Promotion, Personal Selling and Advertising (Meaning Only)		
<b>Module No. 5: SERVICES MARKETING</b>		<b>12</b>
Meaning and definition of services, difference between goods and services, features of services, seven P's of services marketing (concepts only).		
<b>Skill Developments Activities:</b> <ol style="list-style-type: none"> <li>1. Two cases on the above syllabus should be analyzed and recorded in the skill development</li> <li>2. Design a logo and tagline for a product of your choice</li> <li>3. Develop an advertisement copy for a product.</li> <li>4. Prepare a chart for distribution network for different products.</li> </ol>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Philip Kotler, Marketing Management, Prentice Hall.</li> </ol>		

2. Lovelock Christopher, Services Marketing: People, Technology, Strategy, PHI
3. William J. Stanton, Michael J. Etzel, Bruce J Walker, Fundamentals of Marketing, McGraw Hill Education.
4. Bose Biplab, Marketing Management, Himalaya Publishers.
5. J.C. Gandhi, Marketing Management, Tata McGraw Hill.
6. Ramesh and Jayanti Prasad: Marketing Management, I.K. International
7. Sontakki, Marketing Management, Kalyani Publishers.

<b>Name of the Program:</b> Bachelor of Business Administration (BBA) <b>Course Code:</b> BBA 1.5 (OEC) <b>Name of the Course:</b> Business Organization		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
3 Credits	3 Hrs	45 Hrs
<b>Pedagogy:</b> Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate:</b> <ol style="list-style-type: none"> <li>a) An understanding of the nature, objectives and social responsibilities of business</li> <li>b) An ability to describe the different forms of organisations</li> <li>c) An understanding of the basic concepts of management</li> <li>d) An understanding of functions of management.</li> <li>e) An understanding of different types of business combinations</li> </ol>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO BUSINESS</b>		<b>10</b>
<b>Business:</b> Meaning, Nature, Scope and Social responsibility of Business, Objectives, Essentials of successful business; Functional areas of business. Concept of Business Organisation.		
<b>Module No. 2: FORMS OF BUSINESS ORGANIZATION:</b>		<b>12</b>
Sole proprietorship: Definitions, Features, Merits and Demerits. Partnership: Definitions, partnership deed, Features, Merits and Demerits. Joint Stock Company: Definitions, Features, Merits and Demerits. Co-operatives: Definitions, Features, Merits and Demerits.		
<b>Module No. 3: PUBLIC ENTERPRISES</b>		<b>08</b>
Departmental Undertaking: Definitions, Features, Merits and Demerits. Public Corporations: Definitions, Features, Merits and Demerits. Government Companies: Definitions, Features, Merits and Demerits		
<b>Module No. 4: BUSINESS COMBINATIONS</b>		<b>08</b>
Meaning Definitions, Causes, Types, Forms, merits and demerits of Business Combinations, Recent Trends in Business Combinations.		
<b>Module No 5: MANAGEMENT OF ORGANIZATIONS</b>		<b>07</b>
Management-Meaning, Definitions, Difference between Management and Administration, Levels of Management, Objectives of Management, Functions of management- planning, organizing, staffing, directing, coordinating, controlling, Principles of Management.		
<b>Skill Developments Activities:</b> <ol style="list-style-type: none"> <li>1. Preparation of partnership deed</li> <li>2. Draw a business tree</li> <li>3. Make a list of 10 PSUs</li> <li>4. Prepare a list of different types of business combinations</li> </ol>		

**Text Books:**

1. C B. Guptha - Business Organisation and Management, Sultan Chand & Sons.
2. Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan.
3. M. C. Shukla - Business Organisation and Management. S Chand & Company Pvt. Ltd.
4. S.A Sherlekar - Business Organization, Himalaya Publishing House.
5. Y.K. Bhushan. Fundamentals of Business Organisation and Management, Sultan Chand & Sons.
6. R.K. Sharma, Business Organisation & Management Kalyani Publishers
7. Dr. I.M. Sahai, Dr. Padmakar Asthana, ' **Business Organisation & Administration**', Sahitya Bhawan Publications Agra.

<p align="center"><b>Name of the Program:</b> Bachelor of Business Administration (BBA)  <b>Course Code:</b>BBA 1.5  <b>Name of the Course:</b> Office Organization and Management (OEC)</p>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
3 Credits	3 Hrs	45 Hrs
<p><b>Pedagogy:</b> Classrooms lecture, tutorials, Group discussion, Seminar, Case studies &amp; field work etc.,</p>		
<p><b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b></p> <ol style="list-style-type: none"> <li>An understanding of basic knowledge of office organisation and management</li> <li>Demonstrate skills in effective office organisation</li> <li>Ability to maintain office records</li> <li>Ability to maintain digital record.</li> <li>Understanding of different types of organisation structures and responsibilities as future office managers.</li> </ol>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: FUNDAMENTALS OF OFFICE MANAGEMENT</b>		<b>08</b>
<p><b>Introduction:</b> Meaning, importance and functions of modern office  <b>Modern Office Organisation:</b> Meaning; Steps in office organisation; Principles of Office organisation, Organisation structure types,  <b>Nature of office services:</b> Types of services in a modern office, decentralisation and centralisation of office services, Departmentation of Office  <b>Office management:</b> Meaning, Elements and major processes of Office management  <b>Office Manager:</b> Functions and qualifications of Office manager.</p>		
<b>Module No. 2: ADMINISTRATIVE ARRANGEMENT AND FACILITIES</b>		<b>07</b>
<p><b>Office Accommodation and its Importance:</b> Location of Office, Choice of Location: Urban vs Suburban, Factors to be Considered in Selecting the Site, Securing Office Space,  <b>Office Lay-out:</b> Objectives of Office Lay-out, Principles of Office Lay-out, Steps in Lay-out Planning, Advantages of a Good Lay-out.  <b>Types of offices:</b> Open Office and Private Office- advantages and disadvantages.</p>		
<b>Module No. 3: OFFICE ENVIRONMENT:</b>		<b>10</b>
<p><b>Meaning and Components of Office Environment</b>  <b>Interior Decoration:</b> Colour Conditioning, Floor Coverings, Furnishings,  <b>Furniture and Fixtures:</b> Types of Furniture, Choice between Wooden and Steel Furniture, Principles Governing Selection of Furniture  <b>Lighting</b> and Ventilation,  <b>Noise:</b> Internal Noise, External Noise  <b>Cleanliness, Sanitation and Health</b>  <b>Safety and Security</b></p>		
<b>Module No. 4:RECORDS MANAGEMENT</b>		<b>10</b>
<p><b>Introduction to records:</b> Importance of Records, types of office records,  <b>Records Management:</b> Meaning, Principles of Record Keeping, Functions of 'Records Management  <b>Filing:</b> Elements of Filing and Filing Functions, Objectives and Importance of Filing, Advantages of Filing, Essentials of a Good Filing System, Classification of Files, Filing Procedure or Routine.</p>		

**Filing Methods:** Horizontal Filing -meaning, types and advantages, Vertical Filing-meaning, equipment used, advantage and disadvantages.  
**Centralisation and Decentralisation of Filing-** Centralised filing and Decentralised Filing  
**Office manual:** contents, Importance, types of office manuals.  
**Indexing:** Meaning, importance, advantages and essentials of good indexing, type of index  
**Retention and disposal of files:** Meaning and benefits of record retention, need for disposal of files, life-cycle stages of files.

<b>Module No. 5: OFFICE MECHANISATION AND DATA PROCESSING</b>	<b>10</b>
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**Meaning, Importance and Objectives of Office Mechanisation,** Advantages and disadvantages of Office Mechanisation, Factors Determining Office Mechanisation  
**Kinds of Office Machines:** Duplicating Machines and Photocopying Machines, Accounting, tabulating and computing machines, communication machines  
**Introduction to Data and Information:** Distinction between Data and Information, Importance of Data and Information, Classification of Data, Classification of Information, Data Lifecycle (chart), **Data Collection Methods-** Primary and secondary data collection methods  
**Data presentation** Methods of Presentation of Data  
**Data processing using computers:** Components of Computers, Input and Output Devices, Software used in Computers (names and uses only), Computer Applications in Office' Management, Advantages and Limitations of Computerisation

**Skill Developments Activities:**

1. Visit an office and enlist the different types of machines used in the office
2. Identify the different types of stationery used in offices today
3. Draw a data life cycle chart
4. Draw charts indicating different types of office layouts.

**Text Books:**

1. S.P Arora, Office Organisation and Management, Vikas Publishing House Pvt Ltd
2. M.E Thakuram Rao, Office organisation and Management, Atlantic
3. Judith Read, Mary Lea Ginn, Record Management, 10<sup>th</sup> Edition, Cengage Learning.

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:**BBA 2.1

**Name of the Course:**Financial Accounting and Reporting

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>5 Hrs</b>	<b>70 Hrs</b>

**Pedagogy:** Classrooms lecture, tutorials, and Problem Solving.

**Course Outcomes: On successful completion of the course, the Students will demonstrate**

- a) The ability to prepare final accounts of partnership firms
- b) The ability to understand the process of public issue of shares and accounting for the same
- c) The ability to prepare final accounts of joint stock companies.
- d) The ability to prepare and evaluate vertical and horizontal analysis of financial statements
- e) The ability to understand company's annual reports.

**Syllabus:**

**Hours**

**Module No. 1: FINAL ACCOUNTS OF PARTNERSHIP FIRM**

**14**

Meaning of Partnership Firm, Partnership deed-clauses in partnership deed, Preparation of Final accounts of partnership firm-Trading and Profit and Loss Account, Profit and Loss Appropriation Account, Partners capital account and Balance sheet. Goodwill-Nature, Factors influencing goodwill and methods of valuation of goodwill (Average and super profit methods)

**Module No. 2: ISSUE OF SHARES**

**12**

Meaning of Share, Types of Shares – Preference shares and Equity shares – Issue of Shares at par, at Premium, at Discount: Pro-Rata Allotment; Journal Entries relating to issue of shares; Preparation of respective ledger accounts; Preparation of Balance Sheet in the Vertical form (Practical Problems).

**Module No. 3: FINAL ACCOUNTS OF JOINT STOCK COMPANIES**

**14**

Statutory Provisions regarding preparation of Company Final Accounts – Treatment of Special Items, Managerial Remuneration, Tax deducted at source, Advance payment of Tax, Provision for Tax, Depreciation, Interest on debentures, Dividends, Rules regarding payment of dividends, Transfer to Reserves, Preparation of Profit and Loss Account and Balance Sheet (Vertical Form Schedule -III) (Practical Problems).

**Module No. 4: FINANCIAL STATEMENTS ANALYSIS**

**16**

Comparative Statements - Comparative Income Statement, Comparative Balance Sheet; Common size Statements – Common Size Income Statement, Common Size Balance Sheet – Trend Percentages. (Analysis and Interpretation)

**Module No. 5: CORPORATE FINANCIAL REPORTING PRACTICES**

**14**

Corporate Financial Reporting - meaning, types, characteristics of Corporate financial report, users of corporate financial report; Components corporate financial report-general corporate information, financial highlights, letter to the shareholders from the CEO, management's discussion and analysis; Financial Statements-balance sheet, income statement, cash flow statement, and notes to the financial statements; Auditor's report; Significant Accounting Policies; Corporate Governance Report; Corporate Social Responsibility Report (Discuss only Role and Significance of above components of



corporate financial report).

**Skill Developments Activities:**

1. Collect financial statement of a company for five years and analyse the same using trend analysis.
2. Refer annual reports of two companies and list out the components.
3. Draft a partnership deed as per Partnership Act.
4. List out the accounting policies in annual report of the company

**Text Books:**

1. B S Raman, Financial Accounting, HPH.
2. RL GUPTHA & Radha swamy M. , Advanced Accounting. S Chand and co., NewDelhi
3. C Shukla and T S Grewal, Advanced accounting, S Chand and co., NewDelhi
4. S P Jain and Narang K L, Financial Accounting, Tenth Edition, Kalyani Publishers, New. Delhi.

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:**BBA 2.2

**Name of the Course:**Human Resource Management

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	5 Hrs	70 Hrs

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

**Course Outcomes: On successful completion of the course, the students will be able to demonstrate**

- a) Ability to describe the role and responsibility of Human resources management functions on business
- b) Ability to describe HRP, Recruitment and Selection process
- c) Ability to describe to induction, training, and compensation aspects.
- d) Ability to explain performance appraisal and its process.
- e) Ability to demonstrate Employee Engagement and Psychological Contract.

**Syllabus:**

	Hours
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<b>Module No. 1: Introduction to Human Resource Management</b>	<b>14</b>
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Meaning and Definition of HRM – Features Objectives, Differences between Human Resource Management and Personnel Management, Importance, Functions and Process of HRM, Role of HR Manager, Trends influencing HR practices

<b>Module No. 2: Human Resource Planning, Recruitment &amp; Selection</b>	<b>16</b>
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**Human Resource Planning:** Meaning and Importance of Human Resource Planning, Process of HRP

**R Demand Forecasting-** Meaning and Techniques (Meanings Only) and HR supply forecasting.

**ccession Planning** – Meaning and Features

**b Analysis:** Meaning and Uses of Job Analysis, Process of Job Analysis – Job Description, Job Specification, Job Enlargement, Job Rotation, Job Enrichment (Meanings Only)

**ruitment** – Meaning, Methods of Recruitment, Factors affecting Recruitment, Sources of

Recruitment

**lection** – Meaning, Steps in Selection Process, Psychometric tests for Selection, Barriers to effective Selection, Making Selection effective; Placement, Gamification – Meaning and Features

**Module No. 3: Induction, Training and Compensation**

**14**

**Induction:** Meaning, Objectives and Purpose of Induction, Problems faced during Induction, Induction Program Planning.

**aining:** Need for training, Benefits of training, Assessment of Training Needs and Methods of Training and Development; Kirkpatrick Model; Career Development.

**mpensation:** Direct and Indirect forms of Compensation (Meaning Only), Compensation Structure.

**Module No. 4: Performance Appraisal, Promotion & Transfers**

**16**

**rformance appraisal:** Meaning and Definition, Objectives and Methods of Performance Appraisal – Uses and Limitations of Performance Appraisal, Process of Performance Appraisal

**omotion:** Meaning and Definition of Promotion, Purpose of Promotion, Basis of promotion

**Transfer:** Meaning of Transfer, Reasons for Transfer, Types of Transfer, Right Sizing of Work Force, Need for Right Sizing

**Module No. 5: Employee Engagement and Psychological Contract**

**10**

**mployee Engagement (EE):** Meaning and Types of EE, Drivers of Engagement - Measurement of EE, Benefits of EE.

**ychological contract:** Meaning and features

**Skill Developments Activities:**

1. Preparation of Job Descriptions and Job specifications for a Job profile
2. Choose any MNC and present your observations on training program
3. Develop a format for performance appraisal of an employee.
4. Discussion of any two Employee Engagement models.
5. Analysis of components of pay structure based on the CTC sent by the Corporate to the institute for the various jobs of different sectors.

**Textbooks:**

Aswathappa, Human Resource Management, McGraw Hill

Edwin Flippo, Personnel Management, McGraw Hill

C.B.Mamoria, Personnel Management, HPH

Subba Rao, Personnel and Human Resources Management, HPH

Madhurimalal, Human Resource Management, HPH

Rajkumar: Human Resource Management I.K. Intl

Michael Porter, HRM and Human Relations, Juta & Co.Ltd.

K. Venkataramana, Human Resource Management, SHBP

Chartered Accountants of India, New Delhi.

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:**BBA 2.3

**Name of the Course:**BUSINESS ENVIRONMENT

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	5 Hrs	70 Hrs

**Pedagogy:** Classrooms lecture, tutorials, Group discussion, Seminar, Case studies.

**Course Outcomes:** On successful completion Student will demonstrate

- An Understanding of components of business environment.
- Ability to analyse the environmental factors influencing business organisation.
- Ability to demonstrate Competitive structure analysis for select industry.
- Ability to explain the impact of fiscal policy and monetary policy on business.
- Ability to analyse the impact of economic environmental factors on business.

Syllabus:	Hours
<b>Module No. 1: INTRODUCTION BUSINESS ENVIRONMENT</b>	<b>14</b>
Meaning of business, scope and objectives Business, business environment, Micro and Macro-environment of business (social, cultural, economic, political, legal technological and natural) Impact of these factors on decision making in business, Environmental analysis, and Competitive structure analysis of Business.	
<b>Module No. 2: GOVERNMENT AND LEGAL ENVIRONMENT</b>	<b>18</b>
<b>Government Functions</b> of the State, Economic role of government, State intervention in business- reasons for and types of state intervention in business. Impact of Monetary policy, Fiscal policy, Exim policy and industrial policy on business.	
<b>Legal environment</b> - Various laws affecting Indian businesses	

<b>Module No. 3: ECONOMIC ENVIRONMENT AND GLOBAL ENVIRONMENT</b>	<b>16</b>
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An overview of economic environment, nature of the economy, structure of economy, factors affecting economic environment.

**Globalisation of business;** meaning and dimensions, stages, essential conditions of globalisation, foreign market entry strategies, merits and demerits of globalisation of business, Impact of Globalisation on Indian businesses, Forms of globalisation of businesses - MNCs, TNCs etc..

<b>Module No. 4: TECHNOLOGICAL ENVIRONMENT</b>	<b>14</b>
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Meaning and features; types of innovation, Impact of Technological changes on business, Technology and Society, Technological Acquisition modes, IT revolution and business, Management of Technology.

<b>Module No. 5: NATURAL ENVIRONMENT</b>	<b>08</b>
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Meaning and nature of physical environment. Impact of Natural environment on business.

**Skill Developments Activities:**

- a) List out key features of recent Monetary policy published by RBI impacting businesses.
- b) Give your observation as to how technology has helped society.
- c) Draft Five Forces Model for Imaginary business.
- d) Identify the benefits of Digital transformation in India.

**Text Books:**

1. Dr. K Ashwatappa: Essentials Of Business Environment
2. Sundaram & Black: The International Business Environment; Prentice Hall
3. Chidambaram: Business Environment; Vikas Publishing
4. Upadhyay, S: Business Environment, Asia Books
5. Chopra, BK: Business Environment in India, Everest Publishing
6. Suresh Bedi: Business Environment, Excel Books
7. Economic Environment of Business by M. Ashikary.
8. Business Environment by Francis Cherrinulam

**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:**BBA 2.3

**Name of the Course:** Business Mathematics

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>5 Hrs</b>	<b>70 Hrs</b>

**Pedagogy:** Classroom's lecture, tutorials, Problem solving.

**Course Outcomes: On successful completion of the course, the students will demonstrate**

- The Understanding of the basic concepts of business maths and apply them to create solve and interpret application problems in business
- Ability to solve problems on various types of equation.
- Ability to solve problems on Matrices and execute the laws of indices, law of logarithm and evaluate them.
- Ability to apply the concept of simple interest and compound interest bills discounted etc. and apply them in day-to-day life.
- Ability to solve problems on Arithmetic progression, Geometric progression and construct logical application of these concepts.

<b>Syllabus:</b>	<b>Hours</b>
<b>Module No. 1: NUMBER SYSTEM</b>	<b>06</b>

roduction – Natural Numbers - Even Numbers – Odd Numbers – Integers – Prime Numbers – Rational and Irrational numbers, Real Numbers, HCF and LCM (Simple problems).

<b>Module No. 2: THEORY OF EQUATIONS</b>	<b>14</b>
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Introduction – Meaning - Types of Equations – Simple/ Linear Equations and Simultaneous Equations (only two variables), Elimination and Substitution Methods only. Quadratic Equation - Factorization and Formula Method ( $ax^2 + bx + c = 0$  form only). Simple problems.

<b>Module No.3: INDICIES, MATRICES AND LOGARITHMS</b>	<b>18</b>
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eaning – types – operation on matrices – additions – subtractions and multiplication of two matrices – transpose – determinants – minor of an element – co-factor of an element –inverse – crammers rule in two variables – problems.

Indices and Logarithms: Meaning- Basic Laws of Indices and their application for simplification. Laws of Logarithms –Common Logarithm, Application of Log Table for Simplification.

<b>Module No. 4:COMMERCIAL ARITHMETIC</b>	<b>18</b>
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imple Interest, Compound Interest including yearly and half yearly calculations, Annuities, Percentages, Bills Discounting, Ratios and proportions, duplicate-triplicate and sub-duplicate of a ratio. Proportions: third, fourth and inverse proportion - problems.

<b>Module No. 5: PROGRESSIONS</b>	<b>14</b>
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ROGRESSIONS: Arithmetic Progression - Finding the 'n<sup>th</sup>' term of AP and Sum to nth term of AP. Insertion of Arithmetic Mean Geometric Progression – Finding the 'n<sup>th</sup>' term of GP and sum to 'n<sup>th</sup>' term of GP and insertion of Geometric Mean.

**Skill Developments Activities:**

- Develop an Amortization Table for Loan Amount – EMI Calculation.
- Secondary overhead distribution summary using Simultaneous Equations

Method.

3. Application of Matrix In Business Problems

**Text Books:**

1. Saha: Mathematics for Cost Accountants, Central Publishers
2. R.G. Saha and Others – Methods and Techniques for Business Decisions, VBH
3. Dr. Sancheti and Kapoor: Business Mathematics and Statistics, Sultan Chand
4. Zamarudeen: Business Mathematics, Vikas
5. R.S Bhardwaj :Mathematics for Economics and Business
6. Madappa, Mahadi Hassan, M. Iqbal Taiyab – Business Mathematics, Subhash
7. G.R. Veena and Seema : Business Mathematics and Statistics I.K. Intl Publishers

**Name of the Program:** Bachelor Business Administration (BBA)

**Course Code:**BBA.2.6 (OEC)

**Name of the Course:** People Management

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	45 Hrs

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.

**Course outcome: On successful completion of the course, student will demonstrate:**

1. Ability to examine the difference between People Management with Human resource Management
2. Ability to explain the need for and importance of People Management.
3. Ability to explain role of manager in different stages of performance management process
4. Ability to list modern methods of performance and task assessment.
5. Ability to analyse the factors influencing the work life balance of an working individual.

**Syllabus:**

**Module No. 1: Introduction to People Management** **Hours**  
**06**

Diversity in organisation: age, gender, ethnicity, race, and ability. People Management: Meaning, Features, Significance of people management, Difference between People Management and Human Resource Management, impact of individual and

organizational factors on people management.

<b>Module No. 2: Getting Work Done and Assessment and Evaluation</b>	<b>12</b>
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Getting work done: Challenges of getting work done, significance of prioritization and assigning work to team members.

Performance Management: meaning, role of a manager in the different stages of the performance management process, Types of Performance assessment, Assessment and Evaluation Process of evaluation of tasks in the organisation. Modern tools of assessment and evaluation of tasks and performance.

<b>Module No. 3: Building Peer Networks and Essentials of Communication</b>	<b>12</b>
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**Building Peer Networks:** Understanding the importance of peer networks in an organization; being able to influence those on whom you have no authority; challenges Peer networking and different types of people networking in the workplace.

**Essentials of Communication:** Concept of the communication process with reflection on various barriers to effective communication and ways to overcome, Types of Communication and Channels of Communication.

<b>Module No. 4: Motivation</b>	<b>08</b>
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Meaning, Importance and need for motivation, team motivation- meaning, importance team motivation, types of Motivators and Modern methods of motivation

<b>Module No. 5: Managing Self</b>	<b>07</b>
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Reflection on what does it mean to be a people manager; building a personal development plan for oneself, Self-Stress Management: Causes for stress, work life Balance, Importance of Work life balance, Factors influencing Work life Balance.

**Skill Developments Activities:**

1. Analyse two cases on any of the above content indicated above.
2. List out the modern tools to performance assessment and evaluation.
3. Conduct a survey of work life balance of working individuals
4. Draft a Career development of working individual in the middle level management.

**Text Books:**

1. McShane, Steven L. and Mary Ann Von Glinow, Organizational Behavior: Emerging Knowledge and Practice for the Real World. McGraw-Hill, latest edition, ISBN: 0-07-115113-3.
2. Bernardin, H. John and Joyce E. A. Russell. Human Resource Management: An Experiential Approach. McGraw-Hill, 6/e. ISBN: 0078029163
3. Argyris, C. (1974). Personality vs. Organization. Organizational Dynamics. Vol. 3. No. 2, Autumn.
4. Blume, B. Baldwin, T. and Ryan, K. (2013). Communication Apprehension. A barrier to students leadership, adaptability and multicultural appreciation. Academy of Management Learning & Education, Jun, Vol. 12 Issue 2, p158-172.
5. Colquitt, J.A., LePine, J.A., & Wesson, M.J. (2009) Organizational Behavior: Improving Performance and Commitment in the Workplace (International edition). New York: McGraw-Hill.
6. Goleman, D. (1998). Working with Emotional Intelligence. Bantam Books,



**Name of the Program:** Bachelor of Business Administration (BBA)

**Course Code:**BBA 2.6 (OEC)

**Name of the Course:**RETAIL MANAGEMENT

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>45 Hrs</b>

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.

**Course Outcomes: On successful completion Student will demonstrate ;**

- a) An understanding of the types and forms of Retail business.
- b) Ability to examine Consumer Behaviour in various environment.
- c) Ability to analyse various Retail operations and evaluate them.
- d) Ability to analyse various marketing mix elements in retail operations.
- e) An understanding of Information Technology in retail business.

**Syllabus:**

<b>Module No. 1: INTRODUCTION TO RETAIL BUSINESS</b>	<b>Hours</b>
<b>08</b>	

Definition – functions of retailing - types of retailing – forms of retail business ownership. Retail theories – Wheel of Retailing – Retail life cycle. Retail business in India: Influencing factors – present Indian retail scenario.

<b>Module No. 2: CONSUMER BEHAVIOUR IN RETAIL BUSINESS</b>	<b>Hours</b>
<b>08</b>	

Buying decision process and its implication on retailing – Influence of group and individual factors, Customer shopping behaviour, Customer service and customer satisfaction.

<b>Module No. 3: RETAIL OPERATIONS</b>	<b>Hours</b>
<b>08</b>	

Factors influencing location of Store - Market area analysis – Trade area analysis – Rating Plan method - Site evaluation. Retail Operations: Stores Layout and visual merchandising, Stores designing, Space planning, Inventory management, Merchandise Management, Category Management.

<b>Module No. 4: RETAIL MARKETING MIX</b>	<b>Hours</b>
<b>14</b>	

Introduction -Product : Decisions related to selection of goods (Merchandise Management revisited) – Decisions related to delivery of service. Pricing : Influencing factors – approaches to pricing – price sensitivity - Value pricing – Markdown pricing. Place : Supply channel – SCM principles – Retail logistics – computerized replenishment system – corporate replenishment policies. Promotion : Setting objectives – communication effects - promotional mix.

<b>Module No. 5: INFORMATION TECHNOLOGY IN RETAILING</b>	<b>Hours</b>
<b>07</b>	

Non store retailing (e-retailing) - The impact of Information Technology in retailing - Integrated systems and networking – EDI – Bar coding – Electronic article surveillance – Electronic shelf labels – customer database management system.

**Skill Developments Activities:**

1. Draw a retail life cycle chart and list the stages
2. Draw a chart showing a store operations
3. List out the major functions of a store manager diagrammatically

4. List out the current trends in e-retailing
5. List out the Factors Influencing in the location of a New Retail outlet

**Text Books:**

1. Suja Nair; Retail Management, HPH
2. Karthic – Retail Management, HPH
3. S.K. Poddar& others – Retail Management, VBH.
4. R.S Tiwari ; Retail Management, HPH

**Curriculum as per  
National Educational Policy (NEP 2020)**

**BACHELOR OF BUSINESS ADMINISTRATION  
(BBA)  
III and IV Semester Syllabus.**

Semester III								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
16	Lang.1.1	Language - I	AECC	3+1+0	70	30	100	3
17	Lang.1.2	Language - II	AECC	3+1+0	70	30	100	3
18	BBA.3.1	Cost Accounting	DSC	3+0+2	70	30	100	4
19	BBA.3.2	Organizational Behavior	DSC	4+0+0	70	30	100	4
20	BBA.3.3	Statistics for Business Decisions	DSC	3+0+2	70	30	100	4
21	BBA.3.4	Artificial Intelligence	SEC	1+0+2	50	50	100	2
22	BBA.3.5	Social Media Marketing/ Rural Marketing	OEC	3+0+0	50	50	100	3
Sub -Total (C)					450	250	700	23

Semester IV								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
23	Lang.1.1	Language - I	AECC	3+1+0	70	30	100	3
24	Lang.1.2	Language - II	AECC	3+1+0	70	30	100	3
25	BBA.4.1	Management Accounting	DSC	3+0+2	70	30	100	4
26	BBA.4.2	Business Analytics / Financial Markets & Services	DSC	4+0+0	70	30	100	4
27	BBA.4.3	Financial Management	DSC	3+0+2	70	30	100	4
28	BBA.4.4	Constitution of India	AECC	2+0+0	50	50	100	2
29	BBA.4.5	Sports/NCC/NSS/others (if any)	SEC-VB	1+0+2	-	100	100	2
30	BBA.4.6	Business Leadership Skills/Personal Wealth Management	OEC	3+0+0	50	50	100	3
Sub -Total (D)					450	350	800	25

EXIT OPTION WITH DIPLOMA – Ability to solve broadly defined problems.

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 3.1</b>		
<b>Name of the Course: COST ACCOUNTING</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate.</b>		
<ul style="list-style-type: none"> <li>• Understand the elements of costing and preparation of cost sheet.</li> <li>• The ability to prepare material requisitions and management of store.</li> <li>• The ability to compare and contrast labour cost techniques.</li> <li>• Ability to differentiate kinds of overhead costing.</li> <li>• Ability to reconcile the cost.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO COST ACCOUNTING</b>		<b>12</b>
Introduction: Meaning, Objectives, Importance and Uses of Cost Accounting, Functions of Cost Accounting Department in an Organization, Difference between Cost Accounting and Financial Accounting; Various elements of Cost and Classification of Cost; Cost Object, Cost Unit; Cost Reduction and Cost Control; Limitations of Cost Accounting; Cost Sheet: Meaning and Cost Heads in a Cost Sheet, Presentation of Cost information in Cost Sheet/Statement- Problems on Cost Sheet, Tenders and Quotations.		
<b>Module No. 2: MATERIALS COST</b>		<b>12</b>
<b>Materials:</b> Meaning, Importance and Types of Materials - Direct and Indirect Material.		
<b>Materials Procurement:</b> Procedure for procurement of materials and documentation involved in procurement of materials- (Bill of materials, Material requisition note, Purchase requisition note,, Purchase order, Goods received note); <b>Material Storage and Records:</b> Duties of Store keeper, Store records- (Bin cards, Stores Ledger, Stock Control Cards); <b>Material Issues and Valuation:</b> Procedure for material issues, Documents used in material issues- (Material Requisition Note, Material Transfer Note, Materials Return		

Note); Valuation of material issues- preparation of Stores Ledger/ Account - FIFO, LIFO, - problems.

**Inventory Control:** Inventory control techniques and determination of various stock levels- Problems on Level Setting and Computation of EOQ; ABC Analysis, FSN Inventory, VED Inventory, HML Inventory, (Concepts only).

**Module No. 3: EMPLOYEE COST**

**10**

**Employee Cost:** Meaning, Components, Classification and Importance of Employee (Labour) Cost in Organisations; Attendance Procedure- Time keeping and Time Booking, Idle Time- Causes and treatment of Normal and Abnormal Idle Time, Overtime- Causes and treatment (Theory only);

**Methods of Remuneration** (Payment of Wages and Incentives) Problems on calculation of earnings under Time Rate (Straight time rate, Halsey and Rowan Methods) and Piece rate systems (Straight piece rate and Taylor's differential piece rate); Employee Turnover- Meaning, Reasons and Effects of LTO/ETO.

**Module No. 4: OVERHEADS**

**12**

Overheads: Meaning and Classification of Overheads; Accounting and Control of Manufacturing Overheads: Estimation and Collection, Cost allocation, Apportionment, Re-apportionment and Absorption of Manufacturing Overheads; Problems on Primary and Secondary distribution and Secondary distribution using Reciprocal Service Methods only; Absorption of overheads: Meaning and Methods of Absorption of overheads; Problems on Machine hour rate

**Module No. 5: RECONCILIATION OF COST AND FINANCIAL ACCOUNTS**

**10**

Reasons for differences in Profits under Financial and Cost Accounts; Procedure for Reconciliation –Ascertainment of Profits as per Financial Accounts and Cost Accounts and Reconciliation of Profits of both sets of Accounts – Preparation of Reconciliation Statement – Problems.

**Skill Developments Activities:**

- Prepare a Cost Sheet with imaginary figures.
- List the documents required in Inventory Management.
- Demonstrate the valuation of inventory using any one method of pricing material issues.
- Calculate the amount of Wages under Halsey / Rowan Plans, using imaginary data.

**Text Books:**

1. Jain and Narang, Cost Accounting, Kalyani Publication House.
2. N.K. Prasad, Cost Accounting, Books Syndicate Pvt. Ltd.
3. P C Tulsian, Cost Accounting, MHE India
4. Nigam & Sharma, Cost Accounting, HPH
5. Dr. B. Mariyappa, Cost Accounting, HPH
6. Khanna, Ahuja & Pandey, Practical Costing, S Chand & Co. Ltd.
7. B.S. Raman, Cost Accounting, United Publisher

<b>Name of the Program: BBA</b> <b>Course Code: BBA 3.2</b> <b>Name of the Course: ORGANIZATIONAL BEHAVIOR</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate:</b> <ul style="list-style-type: none"> <li>• To recall role of OB in business organization.</li> <li>• Able to understand group dynamics in an organization.</li> <li>• Able to understand the change management.</li> <li>• Able to construct the process of organizational development.</li> <li>• Ability to understand the kinds of Interventions in OB.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: ORGANIZATIONAL BEHAVIOUR AND FOUNDATIONS OF INDIVIDUAL BEHAVIOUR</b>		<b>10</b>
Organization Behavior– Meaning, Definition of OB, Importance of OB, Foundations of OB. Individual Behavior - Personal Factors, Environmental Factors, organization systems and resources Personality-Meaning, Nature, Determinants and Traits of Personality Perception- Meaning, Factors influencing perception, Perceptual Process, Perceptual Errors, Managing Perceptions.		
<b>Module No. 2: GROUP AND TEAM DYNAMICS</b>		<b>8</b>
Group Dynamics-meaning, Types of Group, Development of Groups- Stages of Group Development, Determinants of Group Behavior, Team Dynamics- meaning, Types of Teams: Conflict-sources of conflict and ways of resolving conflict, managing interpersonal relationships		
<b>Module No. 3: CHANGE MANAGEMENT</b>		<b>10</b>
Introduction to Change Management: OD and Change, Importance and Nature of Planned Change; Theories of Planned Change - Action Research Model, Kurt Lewin’s Change Model <b>Introducing Change Effectively:</b> Basic steps, Factors Influencing Change - Resistance to Change, Overcoming Resistance to Change; Empowering People to Manage Change, Activities Contributing to Effective Change Management		



<b>Module No. 4: ORGANIZATIONAL DEVELOPMENT</b>	<b>12</b>
<p>OD: Meaning and Nature of Organizational Development (OD), Competencies of an OD Practitioner, Ethical Guidelines for OD Practitioners Process of Organizational Development: Overview of Entering and Contracting Diagnosing: Meaning of Diagnosing, Comprehensive Model for Diagnosing Organizational Systems (Organizational Level, Group Level and Individual Level)</p>	
<b>Module No. 5: OD INTERVENTIONS</b>	<b>16</b>
<p>Designing Effective OD Interventions: How to Design Effective Interventions, Overview of OD interventions - Human Process Interventions, Techno Structural Interventions, HRM Interventions and Strategic Change Interventions, Conditions for optimal success of OD</p> <p><b>(a) Human Process Interventions</b></p> <p>T-Groups, Process Consultation, Third-party Intervention; Team building; Organization Confrontation Meeting, Inter-group relation Intervention: Microcosm Group; Large Group Intervention: Open -Systems Method, and Open-Space Method(in brief)</p> <p><b>(b) Techno Structural Interventions</b></p> <p>Restructuring Organization: Structural Design: Functional structures, Divisional structure - Product structure, Geographic and Market structure, Metrics structure, Network structure, Boundary less organization; (in brief)</p> <p><b>(c) Human Resource Management Interventions</b></p> <p>Overview of Performance Management Interventions: Performance Management Model, Goal Setting, Performance Appraisal Process, Reward Systems. (in brief)</p>	
<p><b>Skill Developments Activities:</b></p> <ul style="list-style-type: none"> <li>• Two cases on the above syllabus should be analyzed and record in the skill development</li> <li>• Draw Blake and Mouton managerial grid</li> <li>• List the determinants of personality</li> </ul>	

**Text Books:**

1. Fred Luthans, Organizational Behaviour. McGraw Hill
2. Robbins, Organizational Behaviour, International Book House.
3. K. Aswathappa, Organizational Behaviour, HPH.
4. Appanniah and, Management and Behavioural Process, HPH
5. Sharma R.K and Gupta S.K, Management and Behaviour Process, Kalyani Publishers.

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 3.3</b>		
<b>Name of the Course: Statistics for Business Decisions</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>• To understand the requirements of statistical framework</li> <li>• To construct and visualize the data.</li> <li>• To determine the data adequacy for analysis.</li> <li>• To Review the data by using various tools.</li> <li>• To understand and analyze the impact of probability.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO STATISTICS</b>		<b>12</b>
Introduction – Meaning, Functions and Uses of Statistics; Collection of Data - Techniques of Data Collection – Census Technique and Sampling Technique (Concepts). Classification: Meaning, and Methods of Classification of Data, Tabulation: Meaning, Parts of a Table – Simple problems on Tabulation; Diagrammatic Presentation: Bar Diagrams – Simple Bars, Multiple Bars, Percentage Sub-divided Bar Diagram; Two Dimensional Diagrams – Pie Diagram.		
<b>Module No. 2: MEASURES OF CENTRAL TENDENCY AND DISPERSION</b>		<b>14</b>
Measures of Central Tendency: Calculation of Arithmetic Mean, Median and Mode for Individual, Discrete and Continuous Series – Problems; Empirical relation between Mean, Median and Mode.		
Measures of Dispersion: Absolute and Relative measures of Range, Quartile deviation, Standard Deviation in Individual, Discrete and Continuous Series – Problems		
Measures of Skewness: Calculation of Karl Pearson’s (Uni-modal) and Bowley’s Co-efficient of Skewness		
<b>Module No. 3: CORRELATION AND REGRESSION ANALYSIS</b>		<b>10</b>

**Correlation Analysis** - Meaning, Types of Correlation, Calculation of Karl Pearson's Coefficient of Correlation, Computation of Probable Error, Spearman's Rank Coefficient of correlation-problems. Regression Analysis – Concept of Regression, Regression equations- Problems.

**TIME SERIES ANALYSIS:** Meaning, Components, fitting a straight-line trend using Least Square Method (Problems where  $\Sigma X=0$  only), calculation and estimation of trend values.

**Module No. 4: TIME SERIES ANALYSIS**

**10**

Meaning, Components, fitting a straight-line trend using Least Square Method (Problems where  $\Sigma X=0$  only), calculation and estimation of trend values.

**Module No. 5: INDEX NUMBERS**

**10**

Index number, Construction of Index number, Methods of Index number - simple aggregate method, Weighted method (Laspeyres, Paashes, Marshal - Edgeworth and Fishers Ideal Index number). Tests of Adequacy (Unit test, TRT, FRT, Circular test). Consumer Price Index number

**Skill Developments Activities:**

- a) Data Visualization practical session Using Tableau/Power BI.
- b) Execute Average, Variance, Standard Deviation, CV, Covariance using Excel.
- c) Execute and Analyse Regression Model using Excel,
- d) Practical session on Time series models using GRETL
- e) Collect past years' Indian consumer price index data (as of the current base year) and analyse its impact on any macroeconomic indicator.

**Text Books:**

1. S P Gupta: Statistical Methods- Sultan Chand
2. Dr. B N Gupta: Statistics, Sahithya Bhavan
3. S.C Gupta: Business Statistics, HPH
4. Elhance: Statistical Methods, Kitab Mahal
5. Chikoddi & Satya Prasad: Quantitative Analysis for Business Decision, HPH
6. Sanchethi and Kapoor: Business Mathematics, Sultan Chand

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 3.5</b>		
<b>Name of the Course: Social Media Marketing (OEC)</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate:</b>		
<ul style="list-style-type: none"> <li>• Define social media marketing goal setting for successful online campaigns.</li> <li>• Analyze the effective social media marketing strategies for various types of industries and businesses.</li> <li>• Design social media content and create strategies to optimize the content's reach to the target audience.</li> <li>• Appraise the reach and track progress in achieving social media objectives with a variety of measurement tools and metrics.</li> <li>• Design a suitable social media campaign for the business goals.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: Social Media Introduction</b>		<b>08</b>
Introduction to social media, how to build a successful Social Media Strategy, Goal setting, Overview of Global E-Marketing Issues, Country and Market Opportunity Analysis, User engagement on social networks; Social advertising; Social, media analytics; Impact of online reputation; Social Technology and its marketing influence in India.		
<b>Module No. 2: Facebook -Instagram marketing</b>		<b>10</b>
Exploring the use of a Facebook page, Facebook Ad campaign, Facebook groups, Hashtags, Instagram, Creating automation for Instagram, Audience Insights, page Insights, exploring the various IG content types, Setting a theme and flow on Instagram, and generating Leads.		
<b>Module No. 3: Twitter Marketing</b>		<b>08</b>
Creating a Twitter account, optimizing a page, content types, posting contents, Integrating a personal brand on Twitter, Twitter Analytics & Ads, post assistants and automation for Twitter.		
<b>Module No. 4: YouTube marketing</b>		<b>08</b>

Youtube marketing, creating a youtube channel, posting content, youtube analytics, Google Pages for YouTube Channels, Video Flow, Verify Channel, Webmaster Tool – Adding Asset.

**Module No. 5: Search Engine Optimization-Recent trends and challenges**

**08**

Search Engine Optimisation (SEO) Introduction, Understanding SEO, User Insights, Benefits and Challenges, Content Marketing, Traditional Media vs Social Media, recent trends and challenges in Social Media marketing.

**Skill Developments Activities:**

- a) Prepare Facebook Page in your name.
- b) Open a YouTube channel.
- c) Create a blog and write an article on Climate change.
- d) Create a search engine optimization (SEO) dashboard.

**Text Books:**

1. Annmarie Hanlon (2022), Digital Marketing Strategic Planning & Integration, 2nd Edition, SAGE Publications Ltd.
2. Matt Golden (2022), Social Media Marketing, 1<sup>st</sup> Edition, Bravex Publications.
3. Simon Kingsnorth (2022), The Digital Marketing Handbook: Deliver Powerful Digital Campaigns, 1st Edition, Kogan Page.
4. Melissa Barker, Donald I. Barker, Nicholas F. Bormann and Debra Zahay (2016), Social Media Marketing: A Strategic Approach, 2nd Edition, Cengage Learning.
5. Tracy L. Tuten and Michael R. Solomon, (2016), Social Media Marketing, 2nd Edition, Sage Publications India Private Limited.

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 3.5</b>		
<b>Name of the Course: Rural Marketing (OEC)</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>• Describe the importance and application of various concepts of rural marketing.</li> <li>• demonstrate the appropriate selection of the segmentation, targeting and positioning strategies along with the environmental factors that influence rural consumers' buying behavior.</li> <li>• Design a Pricing Strategy that suits the characteristics of rural products and the stage in the product life cycle.</li> <li>• Formulate the appropriate marketing communication and rural distribution channel plans to promote and deliver the rural products.</li> <li>• Appraise the recent trends in Rural marketing and the application of digital technology in rural marketing.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: Introduction to Rural Marketing</b>		<b>08</b>
Nature and scope of rural marketing, rural vs urban markets, concepts and classification of rural markets, rural marketing environment: rural population, occupation pattern, income generation, location of the rural population, expenditure pattern, literacy level, land distribution, land use pattern, irrigation, development programs, infrastructure facilities.		
<b>Module No. 2: Rural Consumer Behavior</b>		<b>08</b>
Consumer buying behavior in rural markets, factors affecting consumer behaviour, rural consumer buying process, the rise of rural consumerism. Market segmentation – Bases for segmenting rural consumer markets.		
<b>Module No. 3: Rural Product and Pricing Strategy</b>		<b>08</b>
Rural product, Rural product classification, product life cycle, Product Life Cycle strategies in rural markets, New Product Development in rural markets, Branding for rural markets. Pricing for rural markets – Factors and strategies.		

<b>Module No. 4: Rural Distribution and Communication Strategy</b>	<b>08</b>
<p>Wholesaling and retailing in the rural market, rural mobile traders, rural distribution models- FMCG companies, durable companies, Service organizations, emerging distribution models.</p> <p>Rural communication strategy, challenges in rural Communication, creating promotion mix for rural audiences: advertisement, sales promotion, publicity.</p>	
<b>Module No. 5: Regulations and Recent Trends in Rural Marketing</b>	<b>10</b>
<p>Regulated market, Regulated Market in India, Future of Regulated Markets in India, Role of Govt in Developing rural marketing, Public Distribution Systems (PDS), Food Corporation of India, Self Help Groups (SHG's). Agricultural Credit Policy, Digitalizing rural India, online marketing reach in the rural market, recent trends in packing, labelling, grading, transporting, order processing, payment methods, storage and warehousing and Corporate farming.</p>	
<p><b>Skill Developments Activities:</b></p> <ol style="list-style-type: none"> <li>a) Prepare a Product life cycle for a Rural product</li> <li>b) Select a Rural Product and conduct a Consumer Satisfaction Survey</li> <li>c) Prepare an advertisement copy for a rural product</li> <li>d) Visit an APMC Yard/Mandi's and prepare a report on any one Agri product pricing.</li> </ol>	
<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Debarun Chakraborty and Soumya Kanti Dhara, et al. ( 2021), Rural Marketing in India: Texts and Cases, 1st Edition Atlantic Publishers and Distributors Pvt Ltd</li> <li>2. Acharya SS and Agarwal NL (2019), Agricultural Marketing in India, 6th Edition, Oxford &amp; IBH Publishing Co Pvt Ltd.</li> <li>3. Dinesh Kumar and Punam Gupta (2019), Rural Marketing), 1st Edition, SAGE Publications India Pvt Ltd.</li> <li>4. C. G. Krishnamacharyulu (2010), Rural Marketing: Text and Cases, 2nd Edition, Pearson India Education Services Pvt Ltd.</li> <li>5. T.P. Gopalaswamy (2009) Rural Marketing-Environment, Problems and Strategies, 3rd Edition, Vikas Publishing House.</li> </ol>	



<p align="center"><b>Name of the Program: BBA</b></p> <p align="center"><b>Course Code: BBA 4.1</b></p> <p align="center"><b>Name of the Course: MANAGEMENT ACCOUNTING</b></p>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<p><b>Course Outcomes: On successful completion of the course, the Students will demonstrate:</b></p> <ul style="list-style-type: none"> <li>• Able to understand the concept of Management Accounting.</li> <li>• To Understand and recall ratios and apply the same on given case.</li> <li>• To construct cash flow statement.</li> <li>• Should be able to apply Marginal cost ratios to make business decisions.</li> <li>• Student should be able to analyze business problems through applications.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO MANAGEMENT ACCOUNTING</b>		<b>8</b>
Introduction- Meaning and Definition – Objectives – Nature and Scope–Functions- Role of Management Accountant, Relationship between Financial Accounting and Management Accounting, Relationship between Cost Accounting and Management Accounting, advantages and limitations of Management Accounting.		
<b>Module No. 2: RATIO ANALYSIS</b>		<b>14</b>
Introduction-Meaning and Definition of ratio, Meaning of Accounting ratio, and Ratio Analysis – Uses and Limitations –Classification of ratios- Liquidity ratios, Profitability ratios and Solvency ratios. Problems on conversion of financial statements into ratios and ratios into financial statements.		
<b>Module No. 3: CASH FLOW ANALYSIS</b>		<b>12</b>
Meaning and Definition of Cash Flow Statement – Concept of Cash and Cash Equivalents - Uses of Cash Flow Statement – Limitations of Cash Flow Statement– Differences between Cash Flow Statement and Fund Flow Statement – Provisions of Ind. AS-7. Procedure for preparation of Cash Flow Statement – Cash Flow from Operating Activities – Cash Flow from Investing Activities and Cash Flow from Financing Activities – Preparation of Cash Flow Statement according to Ind. AS- 7		
<b>Module No. 4: MARGINAL COSTING</b>		<b>12</b>

Introduction-Meaning and definition of marginal cost, marginal costing, features of marginal costing- terms used in marginal costing – P/V ratio, BEP, Margin of Safety, Angle of Incidence and Break-Even Chart. Break Even Analysis- assumption and uses- problems.

Decision Making-Make or Buy, -problems on decision making.

**Module No. 5: STANDARD COSTING**

**10**

Historical costing - Introduction – Meaning & Definition of Standard Cost and Standard Costing - Advantages & Disadvantages of Standard Costing –preliminaries in establishing system of standard costing – Variance Analysis – Material Variance, Labour Variance and Overheads Variance – Problems on Material Variances and Labor Variances only.

**Skill Developments Activities:**

- Collect the financial statement of a company and calculate important ratios.
- Collect the annual report of a company and prepare a cash flow statement.
- Prepare a Break-even-chart with imaginary figures.
- Prepare a flexible budget using imaginary figures of at least three levels.
- Draft the chart of various total cost variances.

**Text Books:**

1. Dr. S.N. Maheswari, Management Accounting, Mahavir Publications
2. T.S.Sexana, Advanced Cost and Management Accounting, Sultan Chand
3. Sudhindra Bhat, Management Accounting, Excel Books.
4. Dr. S.N. Goyal and Manmohan, Management Accounting, S.N. Publications.
5. B.S. Raman, Management Accounting, United Publishers.
6. Sharma and Gupta, Management Accounting, Kalyani Publishers.
7. M Muniraju & K Ramachandra, Management Accounting, HPH
8. PN Reddy & Appanaiah, Essentials of Management Accounting, HPH.

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 4.2</b>		
<b>Name of the Course: Business Analytics</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>• Able to understand Data Types and storage of Data.</li> <li>• To understand types of analytics and data models.</li> <li>• To demonstrate visualization of data.</li> <li>• To recall the data mining and processing of data.</li> <li>• Able to understand concepts of different analytics model.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO BUSINESS ANALYTICS</b>		<b>12</b>
Business Analytics, Terminologies used in Analytics: Business Analytics, Business Intelligence, Meaning, Importance, Scope, Uses of Business Analytics, Architecture of Business Analytics, Types of Analytics: Descriptive, Diagnostics, Predictive, Prescriptive, Application of Business analytics, Introduction to Data Science and Big Data.		
<b>Module No. 2: ROLE OF DATA IN THE ORGANIZATION</b>		<b>10</b>
Sources of data, Use of Data in Decision making, Importance of data quality, dealing with missing or incomplete data, Types of Digital Data- Structured, Semi Structured, Unstructured Data. Data warehouse, Data mining, Data Integration – What, need, advantages, approaches of Data integration, Data profiling.		
<b>Module No. 3: TOOLS USED FOR DATA ANALYTICS</b>		<b>12</b>
Introduction to data analytics software – Types of data analytics software – open source and proprietary software.		
<b>Lab sessions:</b>		
R, JAMOVI, GRETL, Python: Installation of software –Installation of packages / library - Importing of data – Saving of data – Run descriptive Statistics – Interpret result – plotting of charts – inferences of chart. (Using all the four specified softwares).		
<b>Module No. 4: DATABASE ORIENTATION</b>		<b>12</b>

Database definition, types of structures, DBMs, RDBMS, Relational Database Language , Introduction to SQL, Features of SQL, SQL Languages, DDL commands - Create, Add, Drop, Constraints in SQL, DML Commands – Insert, Delete, Update, Data Query Language – Where clause, Order by, Group by, DCL commands – Grant, Revoke, TCL Commands – Commit, Roll Back, Save point. Aggregate Functions, Relational Algebra.

**Module No. 5: DATA VISUALIZATION USING TABLEAU (PUBLIC VERSION)**

**10**

Introduction to Dimensions and measures, Types of Charts, (Pie Chart, Column Chart, Line Chart, Bar Chart, Area Chart, Scatter Chart, Bubble Chart, Stock Chart), Basic understanding in dashboard and storyboard. (Explain using practical examples and students executes the examples using tableau.)

**Skill Developments Activities:**

1. Prepare tree map chart using Tableau.
2. Run a descriptive statistic using R and Python software.
3. Execute a summary chart in JAMOVI.
4. Execute DCL and TCL Command in SQL.

**Text Books:**

1. Business Analytics: Text and Cases, Tanushri Banerjee, Arvindram Banerjee, Publisher: Sage Publication
2. Business Analytics, U Dinesh Kumar, Publication: Wiley
3. Business Analytics, R. Evans James, Publisher: Pearson
4. Fundamental of Business Analytics, Seema Acharya R N Prasad, Publisher: Wiley
5. Business Analytics: Data Analysis and Decision Making, Albright and Winston published by Cengage Learning.
6. Swain Scheps, Business Intelligence for Dummies.
7. Rick Sherman, Business Intelligence Guidebook: From Data Integration to Analytics

8. Cindi Howson. Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big Data

9. Seema Acharya R N Prasad, Fundamentals of Business Analytics, 2ed, Wiley

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 4.2</b>		
<b>Name of the Course: Financial Markets &amp; Services</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>• To able to recall concepts of financial system.</li> <li>• Able to differentiate the roles of financial institutions.</li> <li>• Able understand concept of financial services.</li> <li>• To understand the trading process of Instruments.</li> <li>• Able to Summarize the concept of stock market.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: OVERVIEW OF FINANCIAL SYSTEM</b>		10
Financial System – Features, Constituents of Financial System; Financial Institutions; Financial Services; Financial Markets and Financial Instruments.		
<b>Module No. 2: FINANCIAL INSTITUTIONS</b>		14
Characteristics of Financial Institutions, Broad Categories – Money Market Institutions and Capital Market Institutions. Objectives and Functions of Industrial Finance Corporation of India, Industrial Development Bank of India, State Financial Corporations, Industrial Credit and Investment Corporation of India, EXIM Bank of India, National Small Industrial Development Corporation, National Industrial Development Corporation, RBI Measures for NBFCs.		
<b>Module No. 3: FINANCIAL SERVICES</b>		12
Financial Services – Meaning, Objectives, Functions, Characteristics; Types of Financial Services - Merchant Banking – Functions and Operations, Leasing, Mutual Funds, Venture Capital & Credit Rating.		
<b>Module No. 4: FINANCIAL MARKETS AND INSTRUMENTS</b>		10
Meaning and Definition, Role and Functions of Financial Markets, Constituents of Financial Markets; Money Market Instruments, Capital Market and Instruments; SEBI guidelines for Listing of Shares and Issue of Commercial Papers.		

<b>Module No. 5: STOCK MARKETS</b>	10
Introduction - Functions of Stock Exchange; Stock Market Operations - Trading, Settlement and Custody (Brief discussion on NSDL & CSDL); Brief discussion of BSE, NSE and OTCEI.	
<p><b>Skill Developments Activities:</b></p> <ul style="list-style-type: none"> <li>• Visit any financial institution and prepare a report regarding its structure, functions and</li> <li>• performance.</li> <li>• Analyze the ratings given by any credit rating agency, for at least 5 companies.</li> <li>• Conduct a mock stock-trading session and record the outcome.</li> <li>• Identify a company of your choice and record its share prices for one month.</li> </ul>	
<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. L.M. Bhole, Financial Institutions &amp; Markets, McGraw Hill</li> <li>2. Khan, M.Y, Indian Financial System, McGraw Hill</li> <li>3. Sharma, Meera, Management of Financial Institutions, Eastern Economy Edition</li> <li>4. Bhole and Mahakud, Financial Institutions and Markets – Structure, Growth and Innovations, McGraw Hill</li> <li>5. Guruswamy, S., Financial Services and System, McGraw Hill</li> <li>6. Edminister. R.O, Financial Institutions, Markets &amp; Management, McGraw Hill</li> <li>7. Khan. M.Y, Indian Financial System, Vikas Pub. House</li> <li>8. H.R Machiraju, Indian Financial System, Vikas Pub. House</li> <li>9. E.Gorden &amp; K. Nataraj, Financial Markets and Services, HPH</li> </ol>	

**Name of the Program: BBA**

**Course Code: BBA 4.3**

**Name of the Course: FINANCIAL MANAGEMENT**

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>

**Course Outcomes: On successful completion of the course, the Students will demonstrate.**

- To identify the goals of financial management.
- To appraise the concepts of time value of money.
- To understand the different models of dividend policy.
- Able to analyze the business problem related to investments.
- Able to appraise the working capital requirements in an organization.

**Syllabus:**

<b>Module No. 1: INTRODUCTION TO FINANCIAL MANAGEMENT</b>	<b>Hours</b>
Introduction – Meaning of Finance, Business Finance, Finance Functions, Organization structure of Finance Department; Financial Management – Goals of Financial Management, Financial Decisions, Role of a Financial Manager; Financial Planning – Steps in Financial Planning, Principles of Sound Financial Planning, Factors influencing a Sound Financial Plan	<b>12</b>
<b>Module No. 2: TIME VALUE OF MONEY</b>	
Meaning, Need, Future Value (Single Flow, Uneven Flow & Annuity); Present Value (Single Flow – Uneven Flow & Annuity); Doubling Period; Concept of Valuation -- Valuation of Bonds, Debentures and Shares (Simple Problems)	<b>12</b>
<b>Module No. 3: FINANCING &amp; DIVIDEND DECISIONS</b>	
Financing Decision: Sources of Long-Term Finance -- Meaning of Capital Structure, Factors influencing Capital Structure, Optimum Capital Structure – EBIT, EPS Analysis, Leverages – Problems Dividend Decision: Meaning & Determinants of Dividend Policy, Types of Dividends, Bonus Shares (Meaning only)	<b>12</b>



<b>Module No. 4: INVESTMENT DECISION</b>	
Meaning and Scope of Capital Budgeting, Features & Significance, Techniques --Payback Period, Accounting Rate of Return, Net Present Value, Internal Rate of Return and Profitability Index (Problems)	<b>10</b>
<b>Module No. 5: WORKING CAPITAL MANAGEMENT</b>	
Working Capital -- Concept of Working Capital, Significance of Adequate Working Capital, Types of Working Capital, Problems of Excess or Inadequate Working Capital, Determinants of Working Capital, Sources of Working Capital, Estimation of Working Capital (Simple Problems)	<b>10</b>
<b>Skill Developments Activities:</b>	
<ul style="list-style-type: none"> <li>• Calculate Equated Installment and prepare Loan Repayment schedule for the loan borrowed by your family / friend.</li> <li>• Identify the capital budgeting and capital structure practices followed in any firm/company of your choice (using primary/secondary data)</li> <li>• Visit a business entity and estimate working capital requirement for the entity.</li> <li>• Develop spreadsheet models for different components of time value of money and capital budgeting.</li> </ul>	
<b>Text Books:</b>	
<ol style="list-style-type: none"> <li>1. I M Pandey, Financial Management. Vikas Publication.</li> <li>2. Prasanna Chandra, Financial Management, TMH</li> <li>3. S N Maheshwari, Financial Management, Sultan Chand</li> <li>4. Khan and Jain, Financial Management, TMH</li> <li>5. Dr. V Rajeshkumar and Nagaraju V, Financial management, MH India</li> <li>6. Dr. Aswathanarayana.T ,Financial Management, VBH</li> </ol>	

7.	E. Systemic Financial Management, DIBP
8.	E. National Bank, Financial Management, HPH
9.	Bank and State Bank, Financial Management, Federal Publications

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 4.6</b>		
<b>Name of the Course: Business Leadership Skills (OEC)</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will Demonstrate</b>		
<ul style="list-style-type: none"> <li>■ To make students understand the significance of leadership skills for effective peoplemanagement</li> <li>■ To increase the comprehension of leadership through various leadership theories</li> <li>■ To make students understand different leadership styles, types, patterns and functions</li> <li>■ To introduce various leadership approaches for effective management of people</li> <li>■ To make students aware of recent trends in the area of business leadership</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: INTRODUCTION TO BUSINESS LEADERSHIP</b>		10
Introduction to business leadership, meaning/definition of leadership, evolution and growth of leadership; functions and characteristics of leadership; latest trends/current scenario of business leadership.		

<b>Module No. 2: LEADERSHIP FROM MANAGERIAL PERSPECTIVE</b>	12
Nature of leadership, Significance or importance of leadership, Qualities of an effective leader, leader v/s manager; authority v/s leadership; formal v/s informal leadership; different roles of leadership; different levels of leadership;	
<b>Module No. 3: LEADERSHIP FROM THEORETICAL PERSPECTIVE</b>	8
Great man theory, Trait theory, Situational leadership theory, transactional leadership, transformational leadership theory, Likert's Management System; Fielder's contingency model, Blake and Mouton's Managerial Grid.	
<b>Module No. 4: LEADERSHIP FROM AN OPERATIONAL PERSPECTIVE</b>	6
<b>Leadership styles:</b> a) Autocratic leadership, b) Bureaucratic leadership, c) Democratic leadership, and d) Laissez faire leadership;	
<b>Module No. 5: LEADERSHIP STRATEGIES</b>	6
Leadership Strategies a) leading from the front, b) supporting leadership, c) interactive leadership. Group conflict, leader's role in managing group conflict; challenges in leadership; change management.	
<b>Skill Developments Activities:</b> <ul style="list-style-type: none"> <li>■ Collect information about the real time corporate leaders with different leadership styles &amp; discuss their leadership styles and traits in the class room.</li> <li>■ Present the students with a workplace problem, and have each student participant write down what they would do to solve it. Then, have each participant read their response aloud. This can help the teacher to identify the types of leadership styles that are present among the student participants and thereby highlight and discuss them in the class.</li> <li>■ Student can make a presentation on any famous corporate/political personality covering their leadership style, their approach to people management, their</li> </ul>	

effectiveness in managing conflicts and how did they manage the crisis situations and so on.

**Text Books:**

1. Northouse, P. (2007). Leadership: Theory and Practice. Sage Publications.
2. Stephen, R. P. (1988). Organizational Behaviour - Concepts, controversies and Applications. New Delhi: Printice Hall of India Ltd.
3. Subba Rao. (2018). Organizational Behaviour (18th ed.). Himalaya Publishing House.
4. Subba Rao. (2022). Personnel and Human Resource Management (5th ed.). Bangalore: Himalay Publishing House.

<b>Name of the Program: BBA</b>		
<b>Course Code: BBA 4.6</b>		
<b>Name of the Course: Personal Wealth Management</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, tutorials, and Problem Solving.		
<b>Course Outcomes: On successful completion of the course, the Students will demonstrate</b>		
<ul style="list-style-type: none"> <li>• Demonstrate an understanding of the importance of Wealth Management and Financial Planning in personal life</li> <li>• Identify the Real Estate Investment Routes and understand the tax planning that minimises tax burden</li> <li>• Select and Apply the Asset Allocation strategies to balance between Risk and Return</li> <li>• Analyse the Retirement Planning Benefits and retirement strategies to provide regular income for life.</li> <li>• Understand the basic principles and importance various insurance policies</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: Wealth Management and Financial Planning</b>		<b>08</b>
Meaning of Wealth Management, Need, Scope and Components of Wealth Management, Process of Wealth Management, Expectations of Clients, Code of Ethics for Wealth Manager. Challenges to WM in India – Financial Planning - Systematic Approach to Investing (SIP, STP & SWP)- Life Cycle and Wealth Cycle - Financial Planning in India, Legal aspects of Financial Planning.		
<b>Module No. 2: Estate Planning and Tax Planning</b>		<b>08</b>
Real Estate, Role of Real Estate, Real Estate Investment Routes, Real Estate Indices -Assets & Liabilities, Nomination, Inheritance Law, Will, Understanding Trust and Trust Documents – Tax Planning Concepts, Assessment Year, Financial Year, Income Tax Slabs, TDS, Advance Tax, LTCG, STCG, Carry Forward and Set-off.		
<b>Module No. 3: Asset Allocation Strategies</b>		<b>08</b>
<b>Asset allocation Strategies</b> -Asset allocation Decision, Equity portfolio strategies - Active Vs Passive, Management strategies, Value Vs growth investing, -Tactical, Fixed & Flexible. <b>Portfolio Management Strategies</b> - Indexing - Active - interest rate anticipation, Valuation analysis, Credit		

analysis, Yield spread analysis and Bond swaps - Allocation to Speculation, Diversification in Perspective.

<b>Module No. 4: Retirement Planning and Employee Benefits</b>	<b>10</b>
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Introduction to Retirement Planning - Types of Retirement Plans - Defined Benefit and Defined Contribution plan, Superannuation Fund and other retirement plans, Pre and Post Retirement Planning Strategies – ESOP and ESPP.

<b>Module No. 5: Insurance Products in Wealth Management</b>	<b>08</b>
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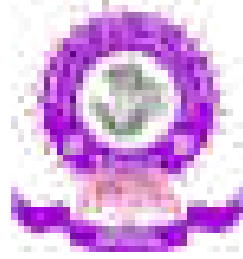
Meaning, Basic Principles of Insurance, Functions and Characteristics of Insurance - Group Life and Health Insurance; Types of Life Insurance Policies, Types of General Insurance Policies, Health Insurance and Group Insurance Policy – Risk Management through Insurance.

- Skill Developments Activities:**
- List out different Insurance schemes
  - Create your own personal portfolio using imaginary numbers and justify.
  - Conduct a survey of 20 salaried employees on their investment avenues through questionnaire.
  - Prepare technical charts report of any 5 listed stocks in BSE S&P SENSEX.

**Text Books:**

- Pawan V. Jhabak – Wealth Management, Himalaya Publishing Hou Himalaya Publishing House Pvt. Ltd., Mumbai - 400 004.
- S.K Bagchi – Wealth Management Jaico Publishing House, Firs Edition.
- NSE Academy – Financial Planning and Wealth Management.
- NCFM Work Book – Financial Markets (Advanced).





**JSS COLLEGE OF ARTS COMMERCE &  
SCIENCE  
(Autonomous)  
Ooty Road, Mysuru – 25**

**DEPARTMENT OF COMMERCE AND  
MANAGEMENT**

**BBA Programme  
(III Year)**

**Syllabus  
CHOICE BASED CREDIT SYSTEM**

**2019-20**

**Programme Outcomes**

**This program could provide well trained dynamic personnel and professionals for**



PO2: Banking Sectors and Insurance Companies

PO3: Financing and Leasing Companies

PO4: Transport Agencies and Warehousing

PO5: Stock Markets and Foreign Trade,

**This program could provide well trained professionals to practice and work as**

PO6: Chartered accountants, advocates, cost accountants and company secretaries

PO7: Financial Analysts, Tax consultants, Tax Practitioners and Investment consultants

PO8: Financial and management accountants

PO9: Marketing Manager, Store manager, Purchase Manager and Sales Manager

PO10: Human Resources Manager, Counsellor

PO11: Retail Manager, Middle men and Customer relation manager

PO12: Decision Maker

PO13: Stock broker

PO14: Official receiver and Liquidator,

PO15: Market researcher, supply chain manger and Franchisee

PO16: Administrator of the different types of Business and Non-business organizations

## **Programme Specific Outcomes**

The students at the end of the BBA programme can become a

PSO2: Business Administrator

PSO3: Financial, Cost and Management Accountant

PSO4: Business Researcher

PSO5: Bank Manager

PSO6: Personal Secretary

PSO7: Project Manager

PSO8: Legal adviser

**I SEMESTER BBA**  
**FINANCIAL ACCOUNTING – I – DSC -1**

**L: T: P- 4:0:1**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand in details with application of accounting software and generate financial statement

CO2: Write down the characteristics of special types of accounting transactions and able to prepare financial statement

CO3: Understand in details with application of principles of accounting

CO4: Learn the characteristic of financial statement and can prepare financial statements of all types of organisation

CO5: Learn in depth and able to work as financial accountant

**CDA22001**

**I SEMESTER**  
**PRINCIPLES OF MANAGEMENT– DSC -2**

**L: T: P- 3:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Identify the details of Management functions and become manager

CO2: Understand the characteristics and classifications of leadership and able to become a good business leader

CO3: Learn in depth to work as a manager at top level or middle level Management

CO4: Write down long term as well as short term plans for the organisation

CO5: Understand and apply the principles of management for effective functioning of the organisation

CO6: Learn in depth and apply the theories of Motivation to motivate the workers for better performance

**CDA23001**

**I SEMESTER  
BUSINESS ENVIRONMENT – DSC - 3**

**L: T: P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the characteristics and types of environment

CO2: Understand the management structure and nature

CO3: Learn in depth the digital Economic Environment

CO4: Understand the different forms of business organization.

CO5: Understand the Global business environment

CO6: Learn in depth the Concepts of Network Marketing, Franchising, Business Process Management, Knowledge Process Management-Business-Commerce and acquire Business foundation skills

**CDB21001**

**II SEMESTER  
BUSINESS DECISION THEORIES – DSC -4**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in detail the economic theories to analyse situations and solve problems in business settings

CO2: Learn in detail with examples the economic environment to make appropriate business decisions

CO3: Deliberate the characteristics of consumers behaviour and able to analyse to take effective decisions

CO4: Write down the characteristics of forecast the demand for products

CO5: Understand in details with application, if applicable, of impact of cost on income

**CDB22001**

**II SEMESTER  
MANAGEMENT OF SERVICES – DSC -5**

**L:T:P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in detail and identify the requirements to start Tours and Travels Agency and able to manage effectively

CO2: Learn in depth to manage a retail business efficiently

CO3: Learn in depth the procedure to prepare advertisement copy and able to start advertisement agency

CO4: Understand the required characteristics to become an event manager and able to manage effectively

CO5: Specify in depth the required tools and techniques pertaining to management of transaction based service process

**CDB23001**

**II SEMESTER**

**FINANCIAL ACCOUNTING – II – DSC -6**

**L: T: P - 4:1:0**

**Course Outcomes:**

On successful completion of this course the students are able to:

CO1: Understand in depth the details of consignment transaction

CO2: Learn in depth the accounting procedure of joint venture and able to maintain the books of accounts

CO3: Identify the causes for differences between the cash balance in cash book and pass book statement

CO4: Understand in depth the details of hire purchase and installment agreement

**CDC21001**

**III SEMESTER**

**MANAGEMENT INFORMATION SYSTEM – DSC -7**

**L: T: P - 2:0:2**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand in depth the evolution, significance and need of Management Information System

CO2: Learn in depth the structure of MIS based on management activity

CO3: Types of information systems - Operations support system - Transaction Processing Systems - Decision support System - Process Control Systems

CO4: Identify the Information required for various levels of management and Value of information in decision making

CO5: Understand in depth the details of Managing and Controlling information

CO6: Understand in depth the ERP Concepts, Evolution of ERP, and ERP packages,

**CDC22001**

**III SEMESTER  
FINANCIAL ACCOUNTING –III – DSC – 8**

**L: T: P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth different sources of finance and become a corporate accountant

CO2: Understand the provision of Companies Act 2013

CO3: Identify the provisions for issue of debenture and bonds

CO4: Prepare the financial statement of companies as per the schedule of Companies Act 2013

CO5: Understand the details of liquidation of company and can become a liquidator

**CDC23001**

**III SEMESTER  
COST ACCOUNTING – II – DSC -9**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO 1: Identify and classify different elements of cost and able to prepare cost sheet, estimation, tender and quotation

CO 2: Learn in depth characteristics of a cost accountant and help the management in decision making

CO 3: Deliberate in depth cost minimization and profit maximization

CO 4: Deliberate the details of reconciliation of cost and financial statement

CO5: Write down the characteristics of inventory, labour and overhead control techniques and apply the same in manufacturing concern

**CDD21001**

#### **IV SEMESTER**

#### **QUANTATIVE TECHNIQUES– DSC -10**

**L:T:P - 4:1:0**

#### **Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth the classification and operation of matrices and determinants

CO2: Learn the details of progression and their application to business

CO3: Understand in detail the concept of Ratio, proportion and variation

CO4: Learn in depth the Laws of indices and logarithms and its application

CO5: Understand the details of simple interest and compound interest

**CDD22001**

#### **IV SEMESTER**

#### **COMMERCIAL LAW– DSC -11**

**L:T:P - 4:1:0**

#### **Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in details various laws related to business and able to work as legal adviser of Business enterprises

CO2: Understand the characteristics of legal environment and practice business ethics

CO3: Learn in depth and apply the basic legal knowledge to business enterprises

CO4: Understand the characteristics of different intellectual properties and protect them

CO5: Deliberate the provisions of competition Protection Act 2002

CO6: Identify the provisions of special contracts



**CDD23001**

**IV SEMESTER**  
**ORGANISATIONAL BEHAVIOUR– DSC -12**

**L:T:P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

- CO1: Understand in detail behaviour of employees and able to manage them efficiently
- CO2: Identify in details employees performance and able to motivate for effective performance
- CO3: Learn in depth and analyse the behaviour of employees
- CO4: Understand in details key positions in an organisation and able to occupy them
- CO5: Learn in details with examples frame policies and strategies in organisation

**CDD24001**

**IV SEMESTER**  
**MANAGEMENT ACCOUNTING – DSC -13**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

- CO1: Learn in depth the characteristics to become a management accountant and able to work effectively
- CO2: Understand in detail the required characteristics to become a good decision maker and able to make effective decisions
- CO3: Understand in depth the accounting for management and able to occupy key position in an organisation
- CO4: Learn in depth the financial analysis techniques and able to analyse and interpret the financial statements
- CO5: Learn in depth the details of different types of budget and able to prepare them
- CO6: Understand in depth standard costing and variance analysis

**CDE21001**

**V SEMESTER  
COMPANY LAW– DSC -14**

**L:T:P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth Memorandum and Articles of Association and able to draft them

CO2: Learn in details the Formation of a Joint Stock Company

CO3: Write down the details of conducting the Board of Directors and Subcommittee meetings

CO4: Identify the provisions relating to Membership of a company

CO5: Learn in details Company frauds and their prevention

CO6: Understand in depth characteristics of different types of company and corporate veil

**CDE22001**

**V SEMESTER  
BUSINESS STATISTICS - I – DSC -15**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth the characteristics of statistics and data collection

CO2: Learn in details with examples Measures of Central tendency

CO3: Understand the classification and characteristics of Measures of dispersion

CO4: Learn in detail the correlation and determine the relation between two variables

CO5: Understand in depth regression and able to find unknown variable value based on known variable value

**CDE23001**

**V SEMESTER  
TAX MANAGEMENT– I – DSC -16**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth Income Tax Act of 1961 and able to practice as Tax Consultant and Tax

CO2: Identify the different heads of income and able to compute assessable income

CO3: Identify in detail different sections of IT Act to reduce tax liability

CO4: Deliberate in details with examples and appear before IT tribunal on behalf of his clients

CO5: Understand in details with examples IT Authorities and able to work in different position of CBDT

**CDE24001**

**V SEMESTER**

**BUSINESS RESEARCH METHODS – SEC -1**

**L:T:P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth different methods of research, methodology, data collection, analysis and interpretation of data to become a good business researcher

CO2: Understand and able to report about various issues of different organisations through research report

CO3: Understand the details of types of Business Research and Research design

CO4: Identify and contribute to the discipline of commerce and management through the research

CO5: Deliberate the details of Data analysis and methods of analysis

CO6: Specify in detail the sampling with examples

**CDE25001**

**V SEMESTER**

**PROJECT MANAGEMENT –SEC -1**

**L:T:P - 3:1:0**

On successful completion of this course the students can:

CO1: Learn in depth the classification of projects, stages in project cycle, identification, formulation and implementation.

CO2: Understand and able to report about the role and responsibilities of project manager.

CO3: Understand the details of Project formulation, formulation stages and feasibility report

CO4: Identify the Administrative agencies for project approval, Ministry of Finance, Bureau of public enterprises planning commission Public Investment Board.

CO5: Understand and able to Estimate the Project Cost

CO6: Understand and able to prepare the project report.



**CDE26001**

**V SEMESTER**

**Marketing Management – DSE -1**

**Elective I - Principles of Marketing**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of the course students can:

CO1: Learn in depth characteristics of marketing

CO2: Write down the characteristics of a new product and able to launch a new product

CO3: Learn in depth and apply the strategies for pricing the product

CO4: Deliberate the factors influencing the consumer behavior

CO5: Understand the characteristics of online marketing and able to practice online marketing

CO6: Identify the future prospect and able to forecast demand for the products

**CDE27001**

**V SEMESTER**

**HUMAN RESOURCE MANAGEMENT – DSE -1**

**Elective I - Human Resource Management**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth the Evolution and Development of HRM.

CO2: Understand the trade union movement era; social responsibility era; Human relations Era; behavioural Science Era; systems approach era and contingency approach era.

CO3: Understand the details of need for and Importance of HRP- Human Resource Planning process; Human Resource information system and Barriers to HRP.

CO4: Identify the Recruitment practices in India

CO5: Understand the Selection process

CO6: Understand the ability tests, Aptitude tests, Achievement tests, Intelligence tests, Personality tests- interviews objectives.

**CDE28001**

**V SEMESTER**

**FINANCIAL MANAGEMENT– DSE -1**

**Elective I - Financial Management**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth the concepts of Profit Maximization and Wealth Maximization.

CO2: Understand and able to identify the Sources of finance.

CO3: Understand the concepts of Cost of Debt, Cost of Preference Capital, Cost of Equity, Cost of Equity under CAPM, Cost of Retained Earnings, -Weighted Cost of Capital.

CO4: Understand the theories of Capital Structure-Net Income approach, Net operating Income theory, Traditional Approach, MM Hypothesis.

CO5: Understand and identify the Factors influencing Dividend decision

CO6: Understand the relevance of Dividend Policy.

**CDE29001**

**V SEMESTER**  
**BANKING AND INSURANCE– DSE -1**  
**Elective I - Indian Banking System**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth the structure of commercial banks in India.

CO2: Understand and identify the changing face of commercial banks,

CO3: Understand the classification of financial markets.

CO4: Understand and identify the obligations of a banker

CO5: Understand of types of accounts

CO6: Understand and identify the Special types of customers

**CDE30001**

**V SEMESTER**  
**TOURISM MANAGEMENT– DSE -1**  
**Elective I - Fundamentals of Tourism**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand and identify the types of Tourism

CO2: Understand in depth the History of Tourism and Tourism in India

CO3: Able to identify the Infrastructure in Tourism

CO4: Learn in depth and identify the factors affecting tourism

CO5: Able to identify the trends in tourist statistics with respect to Karnataka and India

CO6: Understand the impact of tourism in India

**CDE26201**

**V SEMESTER**

**MARKETING MANAGEMENT – DSE -2**

**Elective II - Rural Marketing and Consumer Behaviour**

**L: T: P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand and identify the factors affecting rural consumer behaviour

CO2: Understand in depth the Product branding and promotion in rural market

CO3: Able to identify the importance of consumer behaviour in marketing decisions

CO4: Learn in depth and identify the influence of culture on consumer behaviour

CO5: Understand the concepts of Consumer reference groups and group dynamics

CO6: Able to identify the Consumer decision making process

**CDE27201**

**V SEMESTER**

**HUMAN RESOURCE MANAGEMENT - DSE -2**

**Elective II - Human Resource Development**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth the techniques to manage Human Resources at work place and able to occupy a position of H R Manager

CO2: Specify the details of identifying causes and able to settle problems

CO3: Deliberate the methods and techniques of training to train the Human Resources and create assets for the organisation

CO4: Identify methods of wage payment and incentives and able to adopt different methods of wage payments and incentive plans

CO5: Understand the details of becoming a motivator and counsellor



**CDE28201**

**V SEMESTER**

**FINANCIAL MANAGEMENT – DSE -2**

**Elective II – Working Capital Management**

**L: T: P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand and identify the nature and types of Working Capital

CO2: Understand in depth the approaches to Financing of Current assets and Working Capital Estimation

CO3: Able to identify the objectives of Cash Management

CO4: Learn in depth and identify Cost and Benefits of receivables

CO5: Able to identify the types of inventories

CO6: Understand the concept of Financing of Working Capital

**CDE29201**

**V SEMESTER**

**BANKING INSURANCE - DSE -2**

**ELECTIVE II - Banking Information Technology**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth the concept of bank mechanization

CO2: Understand in depth the concept of Electronic fund transfer system

CO3: Able to identify the objectives of Electronic Clearing System, procedure, cyber trading and mechanism

CO4: Learn in depth and identify Cyber crime and cyber laws, penalty for damage to computer and computer system, hacking with computer system

CO5: Able to identify the MICR based national clearing system and Code allotment under MICR,

CO6: Understand the concept of Security considerations

**CDE30201**

**V SEMESTER**

**TOURISM MANAGEMENT– DSE -2**

**ELECTIVE II – Tourism Planning and Organization**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth the concept of Planning approaches for different forms of Tourism

CO2: Understand the concept of Travel organization

CO3: Able to identify the Functions of a Travel Agency

CO4: Learn in depth and identify Evolution of Tour operation business – Functions of Tour Operators, Sources of Income of Travel Agency and Tour Operator

CO5: Able to identify the Duties and Responsibilities - Tour guiding - Tour escort - Tour managers –Tour guides

CO6: Understand the Procedure for setting up of Travel Agency and Tour Operating Enterprises

**CDF21001**

**VI SEMESTER**

**ENTREPRENEURSHIP DEVELOPMENT – DSC -17**

**L: T: P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth qualities of an entrepreneur and able to become an entrepreneur

CO2: Write down the details of financial schemes offered by banks and government agencies and able to access them easily

CO3: Learn the details of mobilization of resources

CO4: Learn in depth the characteristics of customer and able to identify the customer

**CDF22001**

**VI SEMESTER  
BUSINESS STATISTICS - II – DSC -18**

**L:T:P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth the components of time series analysis and measurement of trend

CO2: Learn in detail the features of linear programming and apply to solve business problem

CO3: Understand the statistical decision making process under certainty and uncertainty

CO4: Learn in detail the theories of probability

CO5: Understand in depth the properties of theoretical distributions and their application to business problem

**CDF23001**

**VI SEMESTER  
TAX MANAGEMENT – II – DSC -19**

**L:T:P - 3:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the concept of Depreciation and rates of depreciation

CO2: Understand and identify the types of Capital Assets.

CO3: Understand in detail the concept of Income from other Sources

CO4: Learn in depth the computation of Total Income and Tax Liability

CO5: Learn in depth the concept of Tax deducted at Source

CO6: Understand in detail the concept of Goods and Service Tax

**CDF24001****VI SEMESTER****BUSINESS POLICY –SEC – 2****L:T:P - 3:1:0****Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the concept of Business policy and Strategic Management

CO2: Understand and identify the Strategic planning in Organisation

CO3: Understand in detail the concept of Strategy Formulation. Strategic & Situational Analysis

CO4 :Learn in depth the concept of SWOT Analysis

CO5: Learn in depth the concept of Financial Strategy and Production Strategy

CO6: Understand in detail the Human Resource Strategy

**CDF25001****VI SEMESTER****Project Report– SEC - 2****L: T: P–1:0:3**

C1 – Proposal of Project Work - 15 Marks

C2 – Progress of Project Work - 15 Marks

Viva - 20 Marks

Valuation of Report – 50 Marks

**Course Outcome:**

On successful completion of the project work the students are able to:

CO1: Understand in depth the gap between theory and practical through internship

CO2: Understand in detail with examples the procedure and able to write a report on the various issues of an organisation

CO3: Specify the details in depth and able to communicate effectively

CO4: Learn in detail and able to absorb as an employee by the employer

CO5: Specify and analyse the components of project report and prepare the report effectively

**CDF26401**

**VI SEMESTER**  
**MARKETING MANAGEMENT– DSE -3**  
**Elective III – Advertising**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the objectives, Scope and Growth of Modern Advertising

CO2: Understand and identify types of Advertising

CO3: Understand in detail the concept of Elements of Advertisement

CO4: Learn in depth the essentials of good advertisement copy

CO5: Understand and identify the Factors influencing the choice of an Advertising agency –  
Types of agencies

CO6: Understand in detail the Advertising ethics

**CDF27401**

**VI SEMESTER**  
**HUMAN RESOURCE MANAGEMENT– DSE -3**  
**Elective III –Performance Appraisal and Compensation Management**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand and identify the objectives, principles, factors influencing wage and salary  
Administration

CO2: Understand the concept of wage policy in India

CO3: Learn in depth the objectives of fringe benefits.

CO4: Learn in depth the Methods of performance appraisal

CO5: Understand and identify the essentials of an effective appraisal system

CO6: Understand in detail the concept of **motivation**

**CDF28401**

**VI SEMESTER**  
**FINANCIAL MANAGEMENT– DSE -3**  
**Elective III – Financial Services**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand and identify the features, importance, contribution of financial service in promoting industry and service

CO2: Understand the concept of money market and capital market.

CO3: Learn in depth the growth of merchant banking in India

CO4: Learn in depth the Scope of merchant banking services

CO5: Understand the concept of Mutual Funds

CO6: Understand in detail the concept of Factoring

**CDF29401**

**VI SEMESTER**  
**BANKING AND INSURANCE– DSE -3**  
**Elective III –Principles of Insurance**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand and identify the nature of business risk, causes of business risk, types of business risk and methods of handling risk,

CO2: Understand and identify the characteristics, purpose, need and benefits of insurance

CO3: Learn in depth the principles of insurance

CO4: Understand the concept of Life insurance

CO5: Understand the concept of Structure and operation of insurance business

CO6: Understand in detail the concept of Life Insurance Agency

**CDF30401**

**VI SEMESTER**

**TOURISM MANAGEMENT– DSE -3**

**Elective III –Tourism Management**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the concept of Managing of Services in tourism

CO2: Understand the concept of Front Office organization structure

CO3: Learn in depth the Role of State Tourism Development Corporation in the development of tourism in Karnataka.

CO4: Understand the concept of increasing competitiveness for globalization

CO5: Understand and identify the National Parks and Wildlife sanctuaries,

CO6: Understand and identify the types of Accommodation



**CDF26601**

**VI SEMESTER**

**MARKETING MANAGEMENT– DSE -4**

**Elective VI –Retail and Supply Chain Management**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the concept of evolution of Retailing in India

CO2: Understand the concept of Emerging Trends in Retailing,

CO3: Learn in depth the Role of Design & Layout, Location Planning and its importance,

CO4: Understand the concept of Floor Space Management

CO5: Understand and identify the Elements/Components of Retail Store Operation

CO6: Understand the Concepts and importance of a Supply Chain

**CDF27601**

**VI SEMESTER**

**Human Resource Management– DSE -4**

**Elective VI – Employee Empowerment and Industrial Relations**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand and identify conditions necessary for employee empowerment

CO2: Understand the concept of Quality circles

CO3: Learn in depth the types of social Security

CO4: Understand the concept of trade unions and problems of Trade Union.

CO5: Understand and identify the measures to strengthen trade Union movement in India

CO6: Understand the concept of Strategic HRM

**CDF28601**

**VI SEMESTER**

**FINANCIAL MANAGEMENT– DSE -4**

**Elective IV – Investment Analysis and Portfolio Management**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the concept of Investment

CO2: Understand the concept of Portfolio Management Process- Approaches to Investment Decision making  
Portfolio Management Process- Approaches to Investment Decision making

CO3: Learn in depth the Capital Market instruments

CO4: Understand the concept of Risk and Return

CO5: Understand the concept of Portfolio Return and Risk-Measurement

CO6: Understand the concept of Markowitz model.

**CDF29601**

**VI SEMESTER**  
**BANKING AND INSURANCE– DSE -4**  
**Elective IV – General Insurance**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the concept of General Insurance business in India

CO2: Understand the concept of GIC of India and its subsidiaries

CO3: Learn in depth the Classification of General Insurance

CO4: Understand the concept of Marine Insurance

CO5: Understand and identify the Types of marine insurance policies

CO6: Understand the concept of Health insurance

**CDF30601**

**VI SEMESTER**  
**TOURISM MANAGEMENT– DSE -4**  
**Elective IV – TOURISM MARKETING**

**L:T:P - 4:1:0**

**Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand the concept of Tourism Marketing

CO2: Understand the concept of State tourism offices and Local Bodies, Private Organizations, Non-Governmental Organizations in Tourism

CO3: Learn in depth the Tourism Marketing Environment

CO4: Understand the concept of Tourism Pricing and Promotion

CO5: Understand and identify the factors influencing Tourism Pricing, Methods of Price fixation, Pricing Strategies

CO6: Understand and identify the Promotional Tools in Tourism





**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
(Autonomous)

Ooty Road, Mysuru-570025

**Model Curriculum Structure for  
Bachelor of Computer Applications (BCA) Programme  
(Basic and Honours degree),  
Model Syllabus for I and II Semesters  
and  
Open Elective Courses in Computer Applications**

**As per  
NATIONAL EDUCATION POLICY - 2020  
(NEP-2020)**

**2021-22 & 2022-23 on words  
(Revised)**

**DEPARTMENT OF COMPUTER SCIENCE**



## **The objectives of the BCA Program**

1. The primary objective of this program is to provide a foundation of computing principles and business practices for effectively using/managing information systems and enterprise software
2. It helps students analyze the requirements for system development and exposes students to business software and information systems
3. This course provides students with options to specialize in legacy application software, system software or mobile applications
4. To produce outstanding IT professionals who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem- solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

## Program Outcomes: BCA (3 Years) Degree

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems and acquiring a minimum knowledge on statistics and optimization problems. Establishing excellent skills in applying various design strategies for solving complex problems.
4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.
5. **Application Systems Knowledge:** Possessing a sound knowledge on computer application software and ability to design and develop app for applicative problems.
6. **Modern Tool Usage:** Identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.
7. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.
8. **Project Management:** Practicing of existing projects and becoming independent to launch own project by identifying a gap in solutions.
9. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrity in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
10. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
11. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.



## **Additional Program Outcomes: BCA Degree (Hons)**

The Bachelor of Computer Application (BCA (Hons)) program enables students to attain following additional attributes besides the afore-mentioned attributes, by the time of graduation:

1. Apply standard Software Engineering practices and strategies in real -time software project development
2. Design and develop computer programs/computer -based systems in the areas related to AI, algorithms, networking, web design, cloud computing, IoT and data analytics.
3. Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems
4. The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
5. The ability to work independently on a substantial software project and as an effective team member.



**I-C. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka**  
**Bachelor of Computer Applications (Basic/Hons.) with Computer Applications as core subject**

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC),		Skill Enhancement Courses (SEC)			Total Credits
					Skill based credits (L+T+P)	Value based (Credits) (L+T+P)		
I	CA C-1 (3+2) CA C-2 (3+2) CA C-3 (3)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)	Environmental Studies (3)		Physical Education for fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	26
II	CA C-4 (3+2) CA C-5 (3+2) CA C-6 (3)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)		SEC-1: Alternative SEC in place of digital Fluency (2) (1+0+2)	Physical Education - Yoga (1) (0+0+2)	NCC/NSS/R&R(S &G) / Cultural (1) (0+0+2)	26
Exit option with Certificate in Computer Applications (50 credits)								
III	CA C-7 (3+2) CA C-8 (3+2) CA C-9 (3)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs each)	Constitution of India (3)		Physical Education-Sports (1)(0+0+2)	NCC/NSS/R&R(S &G)/Cultural (1) (0+0+2)	26
IV	CA C-10 (3+2) CA C-11 (3+2) CA C-12 (3)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs each)		SEC-2: Alternative SEC in place of AI (2) (1+0+2)	Physical Education - Games (1) (0+0+2)	NCC/NSS/R&R(S &G)/Cultural (1) (0+0+2)	26
Exit option with Diploma in Computer Applications (100 credits)								
V	CA C-13 (3+2) CA C-14 (3+2) CA C-15 (3)	CA E-1 (3) Vocational-1 (3)			SEC-4: Professional Communication (3)			23
VI	CA C-16 (3+2) CA C-17 (3+2) CA C-18 (3)	CA E-2 (3) Vocational-2 (3)			SEC-3: Alternative SEC in place of Cyber(2) (1+0+2)			23
Exit Option with Bachelor of Computer Applications Degree, BCA Degree (142 credits)								
VII	CA C-19(3+2) CA C-20(3+2) Internship (2)	CA E-3 (3) Vocational-3 (3) Res. Methodology (3)						21
VIII	CA C-21 (3+2) CA C-22 (3)	CA E-4 (3) Vocational-4 (3) Research Project(6)*						20
Award of Bachelor of Computer Applications Honours Degree, BCA (Hons.) Degree (183 credits)								

## NEP 2020 Model Syllabus - BCA. for 2021-22 onwards

Year	Sem	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
				L	T	P	L	T	P	Th. IA		Pr. IA		Exam			
										C1	C2	C1	C2	Th.	Pr.		
I	I	FAA410 [CAC 01]	Fundamentals of Computers	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAA410 [CAC 01P]	LAB: Information Technology	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAA420 [CAC 02]	Programming in C	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAA420 [CAC 02P]	LAB: C Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAA430 [CAC 03 A/B]	Mathematical Foundation / Accountancy	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
	OE – 1	OPEN ELECTIVE – 1	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100	
	II	FAB410 [CAC 04]	Data Structures using C	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAB410 [CAC 04P]	LAB: Data Structure	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAB420 [CAC 05]	Object Oriented Concepts using JAVA	3	0	0	0	0	2	20	20	-	-	60	-	2½ Hours	100
		FAB420 [CAC 05P]	LAB: JAVA Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAB430 [CAC 06]	Discrete Mathematical Structures	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
	OE – 2	OPEN ELECTIVE – 2	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100	
	#FAB210 [SEC – 1]	DIGITAL FLUENCY	1	0	2	1	0	1	-	-	10	15*	25	-	1 Hour	50	
<b>Exit option with Certificate in Computer Applications (50 credits)</b>																	

#Syllabus & Details Refer BSc in Computer Science Syllabus copy

Year	Sem	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
				L	T	P	L	T	P	Th. IA		Pr. IA		Exam			
										C1	C2	C1	C2	Th.	Pr.		
II	III	FAC410 [CAC 07]	Data Base Management Systems	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAC410 [CAC 07P]	DBMS LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAC420 [CAC 08]	C# and DOT NET Framework	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAC420 [CAC 08P]	C# and DOT NET Framework LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAC430 [CAC 09]	Computer Communication and Networks	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		OE – 3	OPEN ELECTIVE – 3	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
			Constitution of India	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
	IV	FAD410 [CAC10]	Python Programming	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAD410 [CAC10P]	Python programming LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAD420 [CAC11]	Computer Multimedia and Animation	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAD420 [CAC11P]	Multimedia and Animation LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAD430 [CAC12]	Operating System Concepts	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		OE – 4	OPEN ELECTIVE – 4	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAD210 [SEC – 2]	Artificial Intelligence or some other	1	0	2	1	0	1	-	-	10	15*	25	-	1 Hour	50
<b>Exit option with Diploma in Computer Applications (100 credits)</b>																	

Year	Sem	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
				L	T	P	L	T	P	Th. IA		Pr. IA		Exam			
										C1	C2	C1	C2	Th.	Pr.		
III	V	FAE410 [CAC13]	Internet Technologies	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAE410 [CAC13P]	JAVA Script, HTML and CSS LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAE420 [CAC14]	Statistical Computing and R Programming	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAE420 [CAC14P]	R Programming LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAE430 [CAC15]	Software Engineering	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAE440 [CAE-1A]	DISCIPLINE SPECIFIC ELECTIVE - 1	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAE450 [VOC-1]	VOCATIONAL 1 (Anyone from table -IA)	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
	FAE210 [SEC – 4]	Professional Communication	2	0	0	2	0	0									
	VI	FAF410 [CAC 16]	PHP and MySQL	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAF410 [CAC 16P]	LAB: PHP and MySQL	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		FAF410 [CAC 17]	Artificial Intelligence and Applications	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		FAC410 [CA -P1]	PROJECT Work	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAE 2A	DISCIPLINE SPECIFIC ELECTIVE – 2	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		VOC-2	VOCATIONAL 2 (Anyone from table -IA)	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
FAD210 [SEC – 3]		Cyber Security or some other SEC	1	0	2	1	0	1	-	-	10	15*	25	-	1 Hour	50	
<b>Exit Option with Bachelor of Computer Applications Degree, BCA Degree (142 credits)</b>																	

Year	Sem	Corse Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
				L	T	P	L	T	P	Th. IA		Pr. IA		Exam			
										C1	C2	C1	C2	Th.	Pr.		
IV	VII	CAC 18	Analysis and Design of Algorithms	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		CAC 18P	Algorithms LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC 19	Data Mining and KnowledgeManagement	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		CAC 19P	Data Mining and KnowledgeManagement LAB	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAI 01	Internship	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAE 2A	<b>DISCIPLINE SPECIFIC ELECTIVE – 3</b>	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		Research Methodology	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100	
	VIII	CAC 20	Automata Theory and CompilerDesign	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		CAC 20P	Compiler Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		CAC 21	Cryptography and Network Security	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
		CA-P2	<b>Research Project</b>	0	0	12	0	0	6	-	-	20	20	-	60	3 Hours	100
		CAE 4A	<b>DISCIPLINE SPECIFIC ELECTIVE – 4</b>	3	0	0	3	0	0	20	20	-	-	60	-	2½ Hours	100
<b>Award of Bachelor of Computer Applications Honours Degree, BCA (Hons.) Degree (183 credits)</b>																	
<b>Note: 15* is spilt 10 marks for Practical's C2 + 5 marks for practical Record/Report</b>																	

Table - IA

Course-Type	Course Code	Compulsory/ Elective	List of option of elective courses. (A suggestive list)	
<b>DISCIPLINE SPECIFIC ELECTIVE COURSES</b>	<b>DSE 1A</b>	<b>Elective</b>	Cyber Law and CyberSecurity	
			Cloud Computing	
			Business Intelligence	
	<b>DSE 2A</b>	<b>Elective</b>	Fundamentals of DataScience	
			Mobile ApplicationDevelopment	
			Embedded Systems	
	<b>DSE 3A</b>	<b>Elective</b>	Data Compression	
			IoT	
			Data Analytics	
	<b>CAE 4A</b>	<b>Elective</b>	Open-Source Programming	
			Storage Area Networks	
			Pattern Recognition	
			Machine Learning	
<b>VOCATIONAL</b>	<b>VOC 1 VOC 2 VOC 3 VOC 4</b>	<b>Elective</b>	DTP, CAD and Multimedia	
			Hardware and Server Maintenance	
			Web Content Management Systems	
			Computer Networking	
			Health Care Technologies	
			Digital Marketing	
			Office Automation	
<b>OPEN ELECTIVE OFFER TO OTHER PROGRAMME STUDENTS (L: T: P) = (3: 0:0)</b>				
<b>OPEN ELECTIVE</b> (For BA, BSc, BCom, BSW, BBA, BBM students studying Core Courses other than Computer Science/ Computer Applications)	<b>OE - 1 OE - 2 OE - 3 OE - 4</b>	<b>Elective</b>	Business Intelligent	
			Big Data Analytics	
<b>SKILL ENHANCEMENT COURSE (L: T: P) = (1: 0:1)</b>				
<b>SEC</b>	<b>SEC-2</b>	<b>Compulsory</b>	Open-Source Tools	



## NEP2020 Model Course Content for BCA, Semesters I and II

### Semester: I

Course Code: <b>CAC01 [FAA410]</b>	Course Title: <b>Fundamentals of Computers</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

#### Course Outcomes (COs):

- Introduction to computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers
- Operating systems, functions of operating systems, classification of operating systems, kernel, shell, basics of Unix, shell programming, booting
- Databases, why databases are used, users, SQL, data types in SQL, introduction of queries - select, alter, update, delete, truncate, using where, and or in not in
- Internet basics, features, applications, services, internet service providers, domain name system, browsing, email, searching
- Web Programming basics, introduction of HTML and CSS programming
- Introduction of computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers.

Course Content	Hours
<b>Unit - 1</b>	
<p><b>Fundamentals of Computers:</b> Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level &amp; High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples.</p> <p><b>Introduction to computers:</b> Characteristics of computers, Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Super computers.</p>	14
<b>Unit-2</b>	
<p>Anatomy of Computer: Introduction, Functions &amp; Components of a Computer, Central Processing Unit, Microprocessor, Storage units, Input and output Devices. How CPU and memory works. Program execution with illustrative examples. Introduction to microcontrollers.</p> <p><b>Operating System Fundamentals:</b> Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix Operating System, Basic Unix commands, Microkernel Based Operating System, Booting.</p>	14
<b>Unit-3</b>	
<p><b>Introduction to Database Management Systems:</b> Database, DBMS, Why Database -File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL, TCL</p> <p><b>Internet Basics:</b> Introduction, Features of Internet, Internet application, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System.</p> <p><b>Web Basics:</b> Introduction to web, web browsers, http/https, URL, HTML5, CSS</p>	14

**Text Books:**

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. David Riley and Kenny Hunt, Computational thinking for modern solver, Chapman & Hall/CRC,

**Reference:**

1. J. Glenn Brook shear, " Computer Science: An Overview", Addison-Wesley, Twelfth Edition,
2. R.G. Dromey, "How to solve it by Computer", PHI,

Course Code: <b>CAC01P [FAA410]</b>	Course Title: <b>Information Technology Lab</b>
Course Credits: <b>02</b>	Hours/Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

**Part A: Hardware**

1. Identification of the peripherals of a computer, components in a CPU and their functions.
2. Assembling and disassembling the system hardware components of personal computer.
3. Basic Computer Hardware Trouble shooting.
4. LAN and WiFi Basics.
5. Operating System Installation – Windows OS, UNIX/LINUX, Dual Booting.
6. Installation and Uninstallation of Software – Office Tools, Utility Software (like Anti-Virus, System Maintenance tools); Application Software - Like Photo/Image Editors, Audio Recorders/Editors, Video Editors ...); Freeware, Shareware, Payware and Trialware; Internet Browsers, Programming IDEs,
7. System Configuration – BIOS Settings, Registry Editor, MS Config, Task Manager, System Maintenance, Third-party System Maintenance Tools (Similar to CCleaner and Jv16 PowerTools ...)

**Part B: Software**

1. Activities using Word Processor Software
2. Activities using Spreadsheets Software
3. Activities using Presentation Software
4. Activities involving Multimedia Editing (Images, Video, Audio ...)
5. Tasks involving Internet Browsing
6. Flow charts: Installation and using of flowgraphs software for different arithmetic tasks like sum, average, product, difference, quotient and remainder of given numbers, calculate area of Shapes (Square, Rectangle, Circle and Triangle), arrays and recursion.

NOTE: In addition to the ones listed above, universities can include other activities so as for the student to become proficient in using personal computers for multiple purposes for which modern computers can be put to use.

**Reference:**

1. Computational Thinking for the Modern Problem Solver, By Riley DD, Hunt K.A CRC press, 2014
2. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer

**Web References:**

<http://www.flowgorithm.org/documentation/>

**Evaluation Scheme for Lab Examination**

Assessment Criteria		Marks
Activity – 1 from Part A	Write up on the activity/ task	5
	Demonstration of the activity/ task	5
Activity-2 from Part B	Write up on the activity/ task	5
	Demonstration of the activity/ task	5
Viva Voice based on Lab Activities		05
<b>Total</b>		<b>25</b>

Course Code: <b>CAC02 [FAA420]</b>	Course Title: <b>Programming in C</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

Course Content	Hours
<b>Unit - 1</b>	
<p><b>Introduction to C Programming:</b> Overview of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C.</p> <p><b>C Programming Basic Concepts:</b> C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration &amp; initialization of variables; Symbolic constants.</p> <p><b>Input and output with C:</b> Formatted I/O functions - <i>printf</i> and <i>scanf</i>, control stings and escape sequences, output specifications with <i>printf</i> functions; Unformatted I/O functions to read and display single character and a string - <i>getchar</i>, <i>putchar</i>, <i>gets</i> and <i>puts</i> functions.</p> <p><b>C Operators &amp; Expressions:</b> Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment &amp; Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associativity; Evaluation of arithmetic expressions; Type conversion.</p>	14
<b>Unit - 2</b>	
<p><b>Control Structures:</b> Decision making Statements - <i>Simple if, if_else, nested if_else, else_if ladder, Switch Case, goto, break &amp; continue</i> statements; Looping Statements - Entry controlled and exit controlled statements, <i>while, do-while, for</i> loops, Nested loops.</p> <p><b>Derived data types in C:</b> Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.</p> <p><b>Strings:</b> Declaring &amp; Initializing string variables; String handling functions - <i>strlen, strcmp, strcpy and strcat</i>; Character handling functions - <i>toascii, toupper, tolower, isalpha, isnumeric</i> etc.</p>	14
<b>Unit - 3</b>	
<p><b>Pointers in C:</b> Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers;</p> <p><b>User Defined Functions:</b> Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.</p> <p><b>User defined data types:</b> Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions.</p>	14

**Text Books:**

1. C: The Complete Reference, By Herbert Schildt.
2. C Programming Language, By Brain W. Kernighan
3. Kernighan & Ritchie: The C Programming Language (PHI)

**Reference Books:**

1. P. K. Sinha & Priti Sinha: Computer Fundamentals (BPB)
2. E. Balaguruswamy: Programming in ANSI C (TMH)
3. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
4. V. Rajaraman: Programming in C (PHI – EEE)
5. S. Byron Gottfried: Programming with C (TMH)
6. Yashwant Kanitkar: Let us C
7. P.B. Kottur: Programming in C (Sapna Book House)

Course Code: <b>CAC02P [FAA420]</b>	Course Title: <b>C Programming Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

**Programming Lab****Part A:**

1. Program to read radius of a circle and to find area and circumference
2. Program to read three numbers and find the biggest of three
3. Program to demonstrate library functions in math.h
4. Program to check for prime
5. Program to generate n primes
6. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
7. Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
8. Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder)
9. Program to find the roots of quadratic equation (demonstration of switch Case statement)
10. Program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
11. Program to remove Duplicate Element in a single dimensional Array
12. Program to perform addition and subtraction of Matrices

**Part B:**

1. Program to find the length of a string without using built in function
2. Program to demonstrate string functions.
3. Program to demonstrate pointers in C
4. Program to check a number for prime by defining isprime() function
5. Program to read, display and to find the trace of a square matrix
6. Program to read, display and add two m x n matrices using functions
7. Program to read, display and multiply two m x n matrices using functions
8. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Program to Reverse a String using Pointer
10. Program to Swap Two Numbers using Pointers
11. Program to demonstrate student structure to read & display records of n students.
12. Program to demonstrate the difference between structure & union.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

**Evaluation Scheme for Lab Examination**

<b>Assessment Criteria</b>		<b>Marks</b>
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on Lab Activities		05
<b>Total</b>		<b>25</b>

Course Code: <b>CAC03(A) [FAA430]</b>	Course Title: <b>Mathematical Foundation</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

**Course Outcomes (COs):**

- Study and solve problems related to connectives, predicates and quantifiers under different situations.
- Develop basic knowledge of matrices and to solve equations using Cramer’s rule.
- Know the concept of Eigen values.
- To develop the knowledge about derivatives and know various applications of differentiation.
- Understand the basic concepts of Mathematical reasoning, set and functions

Course Content	Hours
<b>Unit - 1</b>	
<b>Basic concepts of set theory:</b> Mathematical logic introduction-statements Connectives-negation, conjunction, disjunction- statement formulas and truth tables- conditional and bi Conditional statements- tautology contradiction- equivalence of formulas-duality law-Predicates and Quantifiers, Arguments.	14
<b>Unit - 2</b>	
<b>Operations on sets:</b> power set- Venn diagram Cartesian product-relations - functions- types of functions - composition of functions. <b>Matrix algebra:</b> Introduction-Types of matrices-matrix operations- transpose of a matrix -determinant of matrix - inverse of a matrix- Cramer’s rule	14
<b>Unit - 3</b>	
<b>Matrix:</b> finding rank of a matrix - normal form-echelon form cayley Hamilton theorem-Eigen values <b>Differential calculus:</b> Functions and limits - Simple Differentiation of Algebraic Functions – Evaluation of First and Second Order Derivatives – Maxima and Minima	14

**Text Books:**

- P. R. Vittal-Business Mathematics and Statistics, Margham Publications, Chennai,

**Reference Books:**

- B. S. Vatsa-Discrete Mathematics –New Age International Limited Publishers, New Delhi

Course Code: <b>CAC03(B) [FAA440]</b>	Course Title: <b>Accountancy</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

**Course Outcomes (COs):**

- Study and understand Accounting, systems of Book, Branches of accounting advantage and limitations
- Know the concept of accounting, financial accounting process and Journalization
- Maintenance different account book and reconciliations
- Preparations of different bills, and trial balance.
- Understand the basic concepts of Mathematical reasoning, set and functions

Course Content	Hours
<b>Unit - 1</b>	
<p><b>Introduction:</b> History and Development of Accounting, Meaning, Objectives and functions of Accounting, Book keeping V/s Accounting, Users of accounting data, systems of book keeping and accounting, branches of accounting, advantages and limitations of accounting</p> <p><b>Accounting Concepts and Convention:</b> Meaning, need and classification, accounting standards meaning, need and classification of Indian accounting standards. Accounting principles V/s accounting standard</p>	14
<b>Unit - 2</b>	
<p><b>Financial Accounting Process:</b> Classification of accounting transactions and accounts, rules of debit and credit as per Double Entry System. Journalization and Ledger posting.</p> <p><b>Preparation of Different Subsidiary Books:</b> Purchase Day book Sales Day Book, Purchase Returns Day Book, Sales Returns Day Book, Cash Book.</p> <p>Bank Reconciliation Statement: Meaning, Causes of Difference, Advantages, Preparation of Bank Reconciliation Statements.</p>	14
<b>Unit - 3</b>	
<p><b>Account Procedure:</b> Honor of the Bill, Dishonor of the Dill, Endorsement, Discounting, Renewal, Bill for collection, Retirement of the Bill, Accommodation Bills, Bill Receivable Book and Payable Book.</p> <p>Preparation of Trial Balance: Rectification of errors and Journal Proper</p> <p><b>Preparation of Final Accounts:</b> Meaning, need and classification, Preparation of Manufacturing, Trading, Profit and loss account and Balance – Sheet of sale-traders and partnership firms.</p>	14

**Text Books:**

1. S. Ramesh, B.S. Chandrashekar, A Text Book of Accountancy.
2. V.A. Patil and J.S. Korihalli, Book – keeping and accounting, (R. Chand and Co. Delhi).
3. R. S. Singhal, Principles of Accountancy, (Nageen Prakash pvt. Lit. Meerut).
4. M. B. Kadkol, Book – Keeping and Accountancy, (Renuka Prakashan, Hubil)
5. Vithal, Sharma:Accounting for Management, Macmillan Publishers, Mumbai.

**Reference Books:**

1. B.S. Raman, Accountancy, (United Publishers, Mangalore).
2. Tulsian, Accounting and Financial Management – I: Financial Accounting – Person Education.

**Semester: II**

Course Code: <b>CAC04 [FAB410]</b>	Course Title: <b>Data Structures using C</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

**Course Outcomes (COs):**

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

Course Content	Hours
<b>Unit - 1</b>	
<p><b>Introduction to data structures:</b> Definition; Types of data structures - Primitive &amp; Non-primitive, Linear and Non-linear; Operations on data structures.</p> <p>Dynamic memory allocation: Static &amp; Dynamic memory allocation; Memory allocation and de-allocation functions - <i>malloc</i>, <i>calloc</i>, <i>realloc</i> and <i>free</i>.</p> <p>Algorithm Specification, Performance Analysis, Performance Measurement</p> <p>Recursion: Definition; Types of recursions; Recursion Technique Examples - GCD, Binomial coefficient <math>nCr</math>, Towers of Hanoi; Comparison between iterative and recursive functions.</p> <p><b>Arrays:</b> Basic Concepts – Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory;</p>	14
<b>Unit - 2</b>	
<p><b>Traversing linear arrays;</b> Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Selection sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices.</p> <p><b>Linked list:</b> Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly linked list, Header linked list, Circular linked list; Representation of Linked list in Memory;</p> <p>Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection,</p>	14
<b>Unit - 3</b>	
<p><b>Stacks:</b> Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls.</p> <p><b>Queues:</b> Basic Concepts – Definition and Representation of queues; Types of queues - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues;</p> <p><b>Trees:</b> Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal &amp; non-terminal nodes, degree of a node, level, edge, path, depth;</p> <p><b>Binary tree:</b> Type of binary trees - strict binary tree, complete binary tree, binary search</p>	14



tree and heap tree; Array representation of binary tree. Traversal of binary tree; preorder, inorder and postorder traversal;	
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### Text Books

1. Ellis Horowitz and Sartaj Sahni: Fundamentals of Data Structures

### References

1. Tanenbaum: Data structures using C (Pearson Education)
2. Kamathane: Introduction to Data structures (Pearson Education)
3. Y. Kanitkar: Data Structures Using C (BPB)
4. Kottur: Data Structure Using C
5. Padma Reddy: Data Structure Using C
6. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007)

Course Code: <b>CAC04P [FAB410]</b>	Course Title: <b>Data Structures Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

### Programming Lab

#### Part A:

1. Program to find GCD using recursive function
2. Program to display Pascal Triangle using binomial function
3. Program to generate n Fibonacci numbers using recursive function.
4. Program to implement Towers of Hanoi.
5. Program to implement dynamic array, find smallest and largest element of the array.
6. Program to create two files to store even and odd numbers.
7. Program to create a file to store student records.
8. Program to read the names of cities and arrange them alphabetically.
9. Program to sort the given list using selection sort technique.
10. Program to sort the given list using bubble sort technique.

#### Part B:

1. Program to sort the given list using insertion sort technique.
2. Program to sort the given list using quick sort technique.
3. Program to sort the given list using merge sort technique.
4. Program to search an element using linear search technique.
5. Program to search an element using recursive binary search technique.
6. Program to implement Stack.
7. Program to convert an infix expression to postfix.
8. Program to implement simple queue.
9. Program to implement linear linked list.
10. Program to display traversal of a tree.

### Evaluation Scheme for Lab Examination

Assessment Criteria		Marks
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
<b>Total</b>		<b>25</b>

Course Code: <b>CAC05 [FAB420]</b>	Course Title: <b>Object Oriented Concepts using JAVA</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Understand the features of Java and the architecture of JVM
- Write, compile, and execute Java programs that may include basic data types and control flow constructs and how type casting is done
- Identify classes, objects, members of a class and relationships among them needed for a specific problem and demonstrate the concepts of polymorphism and inheritance
- The students will be able to demonstrate programs based on interfaces and threads and explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language
- Write, compile, execute Java programs that include GUIs and event driven programming and also programs based on files

Course Content	Hours
<b>Unit - 1</b>	
<b>Introduction to Java:</b> Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. <b>Objects and Classes:</b> Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.	14
<b>Unit - 2</b>	
<b>Inheritance and Polymorphism:</b> Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package. <b>Event and GUI programming:</b> Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing, Exceptional handling mechanism.	14
<b>Unit - 3</b>	
<b>I/O programming:</b> Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. <b>Multithreading in java:</b> Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.	14

### Text Books

1. Programming with Java, By E Balagurusamy – A Primer, Fourth Edition, Tata McGraw Hill Education Private Limited.
2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall
3. Object Oriented Programming with Java: Somashekara, M.T., Guru, D.S., Manjunatha, K.S

### Reference Books:

1. Java 2 - The Complete Reference – McGraw Hill publication.
2. Java - The Complete Reference, 7th Edition, By Herbert Schildt– McGraw Hill publication.

Course Code: <b>CAC05P [FAB410]</b>	Course Title: <b>JAVA Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

### Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Implement Object Oriented programming concept using basic syntaxes of control Structures
- Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
- Demonstrates how to achieve reusability using inheritance
- Demonstrate understanding and use of interfaces, packages, different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.
- Identify and describe common user interface components to design GUI in Java using Applet & AWT along with response to events

### Practice Lab

1. Program to print the following triangle of numbers

```

1
1 2
1 2 3
1 2 3 4
1 2 3 4 5

```

2. Program to simple java application, to print the message, "Welcome to java"

3. Program to display the month of a year. Months of the year should be held in an array.

4. Program to find the area of rectangle.

5. program to demonstrate a division by zero exception

6. Program to create a user defined exception say Pay Out of Bounds.

### Programming Lab

#### PART A: Java Fundamentals OOPs in Java

1. Program to assign two integer values to X and Y. Using the 'if' statement the output of the program should display a message whether X is greater than Y.

2. Program to list the factorial of the numbers 1 to 10. To calculate the factorial value, use while loop. (Hint Fact of 4 = 4\*3\*2\*1)

3. Program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.

4. Program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.

5. Program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values.

6. Program

a. To find the area and circumference of the circle by accepting the radius from the user.

b. To accept a number and find whether the number is Prime or not

7. Program to create a student class with following attributes;

Enrollment No: Name, Mark of sub1, Mark of sub2, mark of sub3, Total Marks. Total of the three marks must be calculated only when the student passes in all three subjects. The

pass mark for each subject is 50. If a candidate fails in any one of the subjects his total mark must be declared as zero. Using this condition write a constructor for this class. Write separate functions for accepting and displaying student details. In the main method create an array of three student objects and display the details.

8. In a college first year class are having the following attributes Name of the class (BCA, BCom, BSc), Name of the staff No of the students in the class, Array of students in the class

9. Define a class called first year with above attributes and define a suitable constructor. Also write a method called best Student () which process a first-year object and return the student with the highest total mark. In the main method define a first-year object and find the best student of this class

10. Program to define a class called employee with the name and date of appointment. Create ten employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority.

11. Create a package 'student. Fulltime. BCA 'in your current working directory

a. Create a default class student in the above package with the following attributes: Name, age, sex.

b. Have methods for storing as well as displaying

### **PART B: Exception Handling & GUI Programming**

1. Program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.

2. Program to handle Null Pointer Exception and use the "finally" method to display a message to the user.

3. Program which create and displays a message on the window

4. Program to draw several shapes in the created window

5. Program to create an applet and draw grid lines

6. Program which creates a frame with two buttons father and mother. When we click the father button the name of the father, his age and designation must appear. When we click mother similar details of mother also appear.

7. Create a frame which displays your personal details with respect to a button click

8. Create a simple applet which reveals the personal information of yours.

9. Program to move different shapes according to the arrow key pressed.

10. Program to create a window when we press M or m the window displays Good Morning, A or a the window displays Good After Noon E or e the window displays Good Evening, N or n the window displays Good Night

11. Demonstrate the various mouse handling events using suitable example.

12. Program to create menu bar and pull-down menus.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

### **Evaluation Scheme for Lab Examination**

<b>Assessment Criteria</b>		<b>Marks</b>
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on <b>Object Oriented Programming with JAVA</b>		05
<b>Total</b>		<b>25</b>

Course Code: <b>CAC06 [FAA430]</b>	Course Title: <b>Discrete Mathematical Structures</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- To understand the basic concepts of Mathematical reasoning, set and functions.
- To understand various counting techniques and principle of inclusion and exclusions.
- Understand the concepts of various types of relations, partial ordering and equivalence relations.
- Apply the concepts of generating functions to solve the recurrence relations.
- Familiarize the fundamental concepts of graph theory and shortest path algorithm

Course Content	Hours
<b>Unit - 1</b>	
<b>The Foundations:</b> Logic and proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy. <b>Basic Structures:</b> Sets, Functions, Sequences, Sums, and Matrices: Sets, set operations, Functions, Sequences and Summations, matrices.	14
<b>Unit - 2</b>	
<b>Counting:</b> Basics of counting, Pigeonhole principle, Permutation and combination, Binomial Coefficient and Combination, Generating Permutation and Combination. <b>Advanced Counting Techniques:</b> Applications of Recurrence Relations, Solving Linear Recurrence, Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating functions, Inclusion-Exclusion, Applications of Inclusion-exclusion. <b>Induction and Recursion:</b> Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Corrections.	14
<b>Unit - 3</b>	
<b>Relation:</b> Properties of relation, Composition of relation, Closer operation on relation, Equivalence relation and partition. Operation on relation, Representing relation. <b>Graphs:</b> Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.	14

### Text Book:

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition, 2012.

### References:

2. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross, 2003.
3. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI 1986.
4. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5 Edition.
5. Discrete Mathematical Structures, Trembley and Manobar.

Course Code: <b>OE01</b>	Course Title: <b>Business Intelligence</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

**Course outcomes:**

- gain knowledge of Business Intelligence
- build business projects
- generate and manage BI reports
- do BI Deployment, Administration & Security.

Course Content	Hours
<b>Unit - 1</b>	
<b>Introduction to Business Intelligence:</b> Understanding the scope of today's BI solutions and how they fit into existing infrastructure Assessing new options such as SaaS and cloud-based technology. Describe BI, its components & architecture, previewing the future of BI Crafting a better experience for all business users, End User Assumptions, setting up Data for BI, The Functional Area of BI Tools, Query Tools and Reporting, OLAP and Advanced Analytics, Supporting the requirements of senior executives, including performance management.	14
<b>Unit - 2</b>	
<b>Elements of Business Intelligence Solutions:</b> Reports & ad hoc queries; Analyze OLAP data; Dashboards & Scorecards development, Metadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications. <b>Building the BI Project:</b> Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success, Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment.	14
<b>Unit - 3</b>	
<b>Reporting authoring:</b> Building reports with relational vs Multidimensional data models; Types of Reports Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms. <b>BI Deployment, Administration &amp; Security:</b> Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements and Dependencies, System Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore.	14

TEXT BOOKS

1. Business Intelligence (IBM ICE Publication).

REFERENCE BOOKS

1. [http://en.wikipedia.org/wiki/Business\\_intelligence](http://en.wikipedia.org/wiki/Business_intelligence).
2. [http://www.webopedia.com/TERM/B/Business\\_Intelligence.html](http://www.webopedia.com/TERM/B/Business_Intelligence.html).
3. [http://www.cio.com/article/40296/Business\\_Intelligence\\_Definition\\_and\\_Solutions](http://www.cio.com/article/40296/Business_Intelligence_Definition_and_Solutions).

Course Code: <b>OE 02</b>	<b>Course Title: Big Data Analytics</b>
Course Credits: <b>03</b>	<b>Hour of Teaching / Week: 03 Hours</b>
Formative Assessment Marks: <b>40</b>	<b>Total Contact Hours: 42 Hours</b>
Exam Marks: <b>60</b>	<b>Exam Duration: 2½ Hours</b>

### Course outcomes:

- Explain the importance of data and data analysis.
- Interpret the probabilistic models for data.
- Illustrate hypothesis, uncertainty principle.
- Demonstrate the regression analysis

Course Content	Hours
<b>Unit - 1</b>	
<b>Overview Of Big Data:</b> History of big data, its elements, career related knowledge, advantages, disadvantages. Using Big Data in Businesses: Focus on the application perspective of Big Data covering, using big data in marketing, analytics, retail, hospitality, consumer good, defense etc. Technologies for Handling Big Data: Introduction to Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) etc	14
<b>Unit - 2</b>	
<b>Understanding Hadoop Ecosystem:</b> Hadoop and its ecosystem which includes HDFS, Map Reduce, YARN, HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie etc. Dig Deep to understand the fundamental of Map Reduce and HBase: framework of Map Reduce and uses of map reduce. Understanding Big Data Technology Foundations: big data stack i.e. data source layer, ingestion layer, source layer, security layer, visualization layer, visualization approaches etc.	14
<b>Unit - 3</b>	
Databases And Data Warehouses: Databases, polygot persistence and their related introductory knowledge. Using Hadoop to store data: Module of HDFS, HBase and ways to store and manage data along with their commands. Learn to Process Data using Map Reduce: Emphasizes on developing simple map reduce framework and the concept applied.	14

### Text Books:

1. Big Data Now: 2014 Edition by “Raymond I Morrison”
2. [Analytics in a Big Data World: The essential guide to data science and its application](#)

### References:

1. Hadoop For Dummies, Dirk deRoos, For Dummies, 2014
2. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning by Raj Kamal Preeti Saxena.
3. Big Data Analytics: A Hands-On Approach Paperback – 7 Sep 2018, by Arshdeep Bahga, Vijay Madiseti.

## NEP2020 Model Course Content for BCA, Semesters III and IV

### Semester: III

Course Code: <b>CAC07 [FAC410]</b>	Course Title: <b>Database Management Systems</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the various database concepts and the need for database systems.
- Identify and define database objects, enforce integrity constraints on a database using DBMS.
- Demonstrate a Data model and Schemas in RDBMS.
- Identify entities and relationships and draw ER diagram for a given real-world problem.
- Convert an ER diagram to a database schema and deduce it to the desired normal form.
- Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.
- Explain the transaction processing and concurrency control techniques.

Course Content	Hours
<b>Unit - 1</b>	
Database Architecture: Introduction to Database system applications. Characteristics and Purpose of database approach. People associated with Database system. Data models. Database schema. Database architecture. Data independence. Database languages, interfaces, and classification of DBMS. E-R Model: Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute. Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E -R diagram.	14
<b>Unit – 2</b>	
Relational Data Model: Relational model concepts. Characteristics of relations. Relational model constraints: Domain constrains, key constraints, primary & foreign key constraints, integrity constraints and null values Relational Algebra: Basic Relational Algebra operations. Set theoretical operations on relations. JOIN operations Aggregate Functions and Grouping. Nested Sub Queries-Views.	14
<b>Unit – 3</b>	
Data Normalization: Anomalies in relational database design. Decomposition. Functional dependencies – Axioms, minima and maxima cover. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form. Query Processing Transaction Management: Introduction Transaction Processing. Single user & multiuser systems. Transactions: read & write operations. Need of concurrency control: The lost update problem, Dirty read problem. Types of failures. Transaction states. Desirable properties (ACID properties) of Transactions.	14



**References:**

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7th Edition, Pearson, 2015
2. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
3. Introduction to Database System, C J Date, Pearson, 1999.
4. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6<sup>th</sup> Edition, McGraw Hill, 2010.
5. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3<sup>rd</sup> Edition, McGraw Hill, 2002

Course Code: <b>CAC07P [FAC410]</b>	Course Title: <b>DBMS Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

**Course Outcomes (COs):**

Student would be able to create tables, execute queries

- Execute a single line query and group functions.
- Execute DDL Commands.
- Execute DML Commands
- Execute DCL and TCL Commands.
- Implement the Nested Queries.
- Implement Join operations in SQL
- Create views for a particular table
- Implement Locks for a particular table

**Activity 1:**

**Database: Student (DDL, DML Statements)**

**Table: Student**

Name	RegNo	Class	Major
Smith	17	1	CS
Brown	8	2	CS

**Table: Course**

CourseName	CourseNumber	CreditHours	Department
Introduction to Computer Science	CS1310	4	CS
Data Structure	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database Management Systems	CS3380	3	CS

**Table: Section**

Section_Identifier	CourseNumber	Year	Instructor
85	MATH2410	98	King
92	CS1310	98	Andreson
102	CS3320	99	Knuth
112	MATH2410	99	Chang
119	CS1310	99	Andreson
135	CS3380	99	Stone

**Table: Grade\_Report**

RegNo	Section_Identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

- Create Tables using create statement
- Insert rows to individual tables using insert statement
- Alter table section add new field section and update the records Delete brown's grade report
- Drop the table section

**Activity 2: (Select clause, Arithmetic Operators)**

**Database: Employee**

Create Following **tables** and insert **tuples** with suitable constraints

**Table: Employee**

Emp_Id	First_Name	Last_Name	Hire_Date	Address	City
1001	George	Smith	11-May-06	83 first street	Paris
1002	Mary	Jones	25-Feb-08	842 Vine Ave	Losantiville
1012	Sam	Tones	12-Sep-05	33 Elm St.	Paris
1015	Peter	Thompson	19-Dec-06	11 Red Road	Paris
1016	Sarath	Sharma	22-Aug-07	440 MG Road	New Delhi
1020	Monika	Gupta	07-Jun-08	9 Bandra	Mumbai

**Table: Empsalary**

Emp_Id	Salary	Benefits	Designation
1001	10000	3000	Manager
1002	8000	1200	Salesman
1012	20000	5000	Director
1015	6500	1300	Clerk
1016	6000	1000	Clerk
1020	8000	1200	Salesman

**Write queries for the following**

1. To display FIRSTNAME, LASTNAME, ADDRESS AND CITY of all employees living in PARIS.
2. To display the content of employee table in descending order of FIRSTNAME
3. Select FIRSTNAME and SALARY of salesman
4. To display the FIRSTNAME, LASTNAME, AND TOTAL SALARY of all employees from the table EMPLOYEE and EMPSALARY. Where TOTAL SALARY is calculated as SALARY+BENEFITS
5. List the Names of employees, who are more than 1 year old in the organization
6. Count number of distinct DESIGNATION from EMPSALARY
7. List the employees whose names have exactly 6 characters
8. Add new column PHONE\_NO to EMPLOYEE and update the records
9. List employee names, who have joined before 15-Jun-08 and after 16-Jun-07
10. Generate Salary slip with Name, Salary, Benefits, HRA-50%, DA-30%, PF-12%, Calculate gross. Order the result in descending order of the gross.

### Activity 3: (Logical, Relational Operators)

#### Database: Library

Create Following tables and insert tuples with suitable constraints

**Table: Books**

Book_Id	Book_Name	Author_Name	Publishers	Price	Type	Quantity
C0001	The Klone	Lata Kappor	EPP	355	Novel	5
F0001	The Tears	William Hopkins	First Publ	650	Fiction	20
T0001	My First	Brain & Brooke	ERP	350	Text	10
T0002	C++	A.W.Rossaine	TDH	350	Text	15
F0002	Thunderbolts	Ana Roberts	First Publ.	750	Fiction	50

**Table: Issued**

Book_Id	Quantity_Issued
T0001	4
C0001	5
F0001	2
T0002	5
F0002	8

#### Write queries for the following

1. To show Book name, Author name and price of books of **First Publ.** publisher
2. Display Book id, Book name and publisher of books having quantity more than 8 and price less than 500
3. Select Book id, book name, author name of books which is published by other than ERP publishers and price between 300 to 700
4. Generate a Bill with Book\_id, Book\_name, Publisher, Price, Quantity, 4% of VAT "Total"
5. Display book details with book id's C0001, F0001, T0002, F0002 (Hint: use IN operator)
6. Display Book list other than, type Novel and Fiction
7. Display book details with author name starts with letter "A"
8. Display book details with author name starts with letter "T" and ends with "S"
9. Select Book\_Id, Book\_Name, Author Name , Quantity Issued where Books.Books\_Id = Issued.Book\_Id
10. List the book\_name, Author\_name, Price. In ascending order of Book\_name and then on descending order of price

### Activity 4: (Date Functions)

#### Database: Lab

Create Following table and insert tuples with suitable constraints

**Table: Equipment\_Details**

No.	ItemName	Costperitem	Quantity	Dateofpurchase	Warranty	Operational
1	Computer	30000	9	21/5/07	2	7
2	Printer	5000	3	21/5/06	4	2
3	Scanner	8000	1	29/8/08	3	1
4	Camera	7000	2	13/6/05	1	2
5	UPS	15000	5	21/5/08	1	4
6	Hub	8000	1	31/10/08	2	1
7	Plotter	25000	2	11/1/09	2	2

(Use date functions and aggregate functions)

1. To select the ItemName purchase after 31/10/07
2. Extend the warranty of each item by 6 months
3. Display ItemName , Dateof purchase and number of months between purchase date and present date
4. To list the ItemName in ascending order of the date of purchase where quantity is more than 3.
5. To count the number, average of costperitem of items purchased before 1/1/08
6. To display the minimum warranty, maximum warranty period
7. To Display the day of the date, month, year of purchase in characters
8. To round of the warranty period to month and year format.
9. To display the next Sunday from the date "07-JUN-96"
10. To list the ItemName, which are within the warranty period till present date

**Activity 5: (Numeric, character functions) Use Functions for the following**

1. Find the mod of 165,16
2. Find Square Root of 5000
3. Truncate the value 128.3285 to 2 and -1 decimal places
4. Round the value 92.7683 to 2 and -1 decimal places
5. Convert the string "Department" to uppercase and lowercase
6. Display your address convert the first character of each word to uppercase and rest are in lowercase
7. Combine your first name and last name under the title Full name
8. A) Take a string length maximum of 15 displays your name to the left. The remaining space should be filled with "\*"
9. Take a string length maximum of 20 displays your name to the right. The remaining space should be filled with "#"
10. Find the length of the string "JSS College, Mysore"
11. Display substring "BASE" from "DATABASE"
12. Display the position of the first occurrence of character "o" in Position and Length
13. Replace string Database with Data type
14. Display the ASCII value of " " (Space)
15. Display the Character equivalent of 42

**Activity 6:**

**Database: Subject**

Create Following **table** and insert **tuples** with suitable constraints

**Table - Physics**

Regno	Name	Year	Combination
AJ00325	Ashwin	First	PCM
AJ00225	Swaroop	Second	PMCs
AJ00385	Sarika	Third	PME
AJ00388	Hamsa	First	PMCs

**Table – Computer Science**

Regno	Name	Year	Combination
AJ00225	Swaroop	Second	PMCs
AJ00296	Tajas	Second	BCA
AJ00112	Geetha	First	BCA
AJ00388	Hamsa	First	PMCs

1. Select all students from physics and Computer Science
2. Select student common in physics and Computer Science
3. Display all student details those are studying in second year

4. Display student those who are studying both physics and computer science in second year
5. Display the students studying only physics
6. Display the students studying only Computer Science
7. select all student having PMCs combination
8. select all student having BCA combination
9. select all student studying in Third year
10. Rename table Computer Science to CS

**Activity 7: (views)**

**Database: Railway Reservation System**

Create Following **table** and insert **tuples** with suitable constraints

**Table: Train Details**

Train_No	Train_Name	Start_Place	Destination
RJD16	Rajdhani Express	Bangalore	Mumbai
UDE04	Udhyan Express	Chennai	Hyderabad
KKE55	Karnataka Express	Bangalore	Chennai
CSE3	Shivaji Express	Coimbatore	Bangalore
JNS8	Janashatabdi	Bangalore	Salem

**Table: Availability**

Train_No	Class	Start_Place	Destination	No_of_seats
RJD16	Sleeper Class	Bangalore	Mumbai	15
UDE04	First Class	Chennai	Hyderabad	22
KKE55	First Class AC	Bangalore	Chennai	15
CSE3	Second Class	Coimbatore	Bangalore	8
JNS8	Sleeper Class	Bangalore	Salem	18

1. Create view **sleeper** to display train no, start place, destination which have sleeper class and perform the following
  - a. insert new record
  - b. update destination =" Manglore" where train no=" RJD16"
  - c. delete a record which have train no =" KKE55"
2. Create view **details** to display train no, train name, class
3. Create view **total\_seats** to display train number, start place, use count function to no of seats, group by start place and perform the following
  - a. insert new record
  - b. update start place= "Hubli" where train no= "JNS8"
  - c. delete last row of the view
4. Rename view sleeper to class
5. Delete view details

### Activity 8 (group by, having clause)

#### Database: Bank system

Create Following **table** and insert **tuples** with suitable constraints

**Table: Account**

Account_No	Cust_Name	Brach_ID
AE0012856	Reena	SB002
AE1185698	Akhil	SB001
AE1203996	Daniel	SB004
AE1225889	Roy	SB002
AE8532166	Sowparnika	SB003
AE8552266	Anil	SB003
AE1003996	Saathwik	SB004
AE1100996	Swarna	SB002

**Table: Branch**

Branch_ID	Branch_Name	Branch_City
SB001	Malleswaram	Bangalore
SB002	MG Road	Bangalroe
SB003	MG Road	Mysore
SB004	Jainagar	Mysore

**Table: Depositor**

Account_No	Branch_Id	Balance
AE0012856	SB002	12000
AE1203996	SB004	58900
AE8532166	SB003	40000
AE1225889	SB002	150000

**Table: Loan**

Account_No	Branch_Id	Balance
AE1185698	SB001	102000
AE8552266	SB003	40000
AE1003996	SB004	15000
AE1100996	SB002	100000

1. Display Total Number of accounts present in each branch
2. Display Total Loan amount in each branch
3. Display Total deposited amount in each branch by descending order
4. Display max, min loan amount present in each city.
5. Display average amount deposited in each branch, each city
6. Display maximum of loan amount in each branch where balance is more than 25000
7. Display Total Number of accounts present in each city
8. Display all customer details in ascending order of brachid
9. Update Balance to 26000 where accno=AE1003996
10. Display Customer Names with their branch Name

#### Evaluation Scheme for Lab Examination:

Assessment Criteria	Marks
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

Course Code: <b>CAC08 [FAC420]</b>	Course Title: <b>C# and .Net Technologies</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

At the end of the course, students will be able to:

- Describe Object Oriented Programming concepts like Inheritance and Polymorphism in C# programming language.
- Interpret and Develop Interfaces for real-time applications.
- Build custom collections and generics in C#.

Course Content	Hours
<b>Unit - 1</b>	
Introduction to .Net Technologies: Introduction to Web Technologies. HTML Basics, Scripts. Sample Programs. Advantages and Disadvantages of Client-side and Server-side Scripts. Overview of Client-side Technologies and Server-side Technologies. Introduction to C#: Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Control Structures-Methods, Arrays, Strings, Structures, Enumerations.	14
<b>Unit – 2</b>	
OOPS with C#: Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading Delegates, Events, Errors and Exceptions. Introduction to VB.NET: Introduction VB.NET -IDE – Creating a shortcut to start VB.NET. Maneuverings the Toolbar Auto-hide, Docking and Undocking, Placing and Resizing the Windows, Forms, Properties Window and Solution Explorer. Writing and Event Procedure. Execution Basic Keywords. Data Types. VB.NET statements. Conditional statements: If Else, Select Case, Switch and Choose Loops: Do, For Next, For Each Next, While loop. Arrays.	14
<b>Unit – 3</b>	
Application Development on .NET: C#.NET: Building Windows Applications, VB.NET: Windows Forms. Working with Controls, Timer, Picture-box, Group-box, Combo-box, Horizontal and Vertical Scrollbar, Numeric-up-down, Track-bar, and Progress-bar. Subroutines and Functions in VB.NET. Database applications ADO.NET Connectivity: Introduction to ADO.NET, ADO vs ADO.NET. Architecture: Data reader, Data adopter, Accessing Data with ADO.NET. Programming Web Applications with Web Forms. ASP .NET applications with ADO.NET	14

### References:

1. "Programming in C#", E. Balagurusamy, 4<sup>th</sup> Edition, Tata McGraw-Hill, 2017.
2. "Visual [Basic.NET](#)", Shirish Chavan, 3<sup>rd</sup> Edition, Pearson Education, 2009.
3. "[ASP.NET](#) and [VB.NET](#) Web Programming", Matt J. Crouch, Edition 2012.
4. "Computing with C# and the .NET Framework", Arthur Gittleman, 2<sup>nd</sup> Edition, Jones & Bartlett Publishers, 2011

Course Code: <b>CAC08P [FAC420]</b>	Course Title: <b>C# and .Net Technologies Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

### Practicals:

1. Develop a C# .NET console application to demonstrate the conditional statements.
2. Develop a C# .NET console application to demonstrate the control statements.
3. Develop an application in C#.NET that demonstrates the windows controls
4. Demonstrate Multithreaded Programming in C#.NET
5. Demonstrate subroutines and functions in C#.NET
6. Develop an application for deploying various built-in functions in [VB.NET](#)
7. Develop an MDI application for Employee Pay-roll transactions in [VB.NET](#)
8. Construct a console application to demonstrate the OOP Concepts
9. Develop a web application in [VB.NET](#) for dynamic Login Processing
10. Develop a Windows application with database connectivity for core-banking transactions

### Evaluation Scheme for Lab Examination:

Assessment Criteria	Marks
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25



Course Code: <b>CAC09 [FAC430]</b>	Course Title: <b>Computer Networks</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Apply the basics of data communication and various types of computer networks in real world applications.
- Compare the different layers of protocols.
- Compare the key networking protocols and their hierarchical relationship in the conceptual model like TCP/IP and OSI.

Course Content	Hours
<b>Unit - 1</b>	
Introduction: Computer Networks and its applications, Network structure, network architecture, Topologies, LAN, WAN, MAN, The OSI reference model, The TCP/IP reference model. The Physical Layer: Transmission Media – Twisted pair, coaxial cable, optical fiber, radio transmission, microwaves and infrared transmission, Switching – message switching, Multiplexing.	14
<b>Unit – 2</b>	
The Data Link Layer: Data Link Layer design issues, Error detection – Single parity checking, Checksum, polynomial codes – CRC, Error correction- Hamming code, Elementary data link protocols, sliding window protocols The Network Layer: Network layer design issues, Routing algorithms – Flooding, Distance vector routing, Hierarchical routing, Link state routing, Congestion, control algorithms – Leaky bucket, token bucket algorithm, admission control, Hop by Hop choke packets.	14
<b>Unit – 3</b>	
The Transport Layer, Presentation Layer and Application Layer: Elements of Transport service, Elements of Transport, protocols, Internet transport protocols (TCP & UDP), Presentation Layer – Introduction, protocol, Application Layer DNS, Electronic Mailing, and World Wide Web.	14

### References:

1. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education, 2010.
2. Data Communication & Networking, Behrouza A Forouzan, 3rd Edition, Tata McGraw Hill, 2001.
3. Data and Computer Communications, William Stallings, 10th Edition, Pearson Education, 2017.
4. Data Communication and Computer Networks, Brijendra Singh, 3rd Edition, PHI, 2012.
5. Data Communication & Network, Dr. Prasad, Wiley Dreamtech.
6. <http://highered.mheducation.com/sites/0072967757/index.htmls>

## Semester: IV

Course Code: <b>CAC10 [FAD410]</b>	Course Title: <b>Python Programming</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving file handling.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Develop the emerging applications of relevant fields using Python.

Course Content	Hours
<b>Unit - 1</b>	
Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Python Basics: Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples. Python Control Flow: Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range () and exit () functions. Exception Handling: Types of Errors; Exceptions; Exception Handling using try, except and finally. Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions.	14
<b>Unit – 2</b>	
Strings: Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods. Lists: Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists. Dictionaries: Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries. Tuples and Sets: Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods File Handling: File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator.	14

<b>Unit – 3</b>	
<p>Object Oriented Programming: Classes and Objects; Creating Classes and Objects; Constructor Method; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Inheritance- Single and Multiple Inheritance, Multilevel and Multipath Inheritance; Encapsulation- Definition, Private Instance Variables; Polymorphism- Definition, Operator Overloading.</p> <p>GU Interface: The tkinter Module; Window and Widgets; Layout Management- pack, grid and place.</p> <p>Python SQLite: The SQLite3 module; SQLite Methods- connect, cursor, execute, close; Connect to Database; Create Table; Operations on Tables- Insert, Select, Update. Delete and Drop Records.</p> <p>Data Analysis: NumPy- Introduction to NumPy, Array Creation using NumPy, Operations on Arrays; Pandas- Introduction to Pandas, Series and DataFrames, Creating DataFrames from Excel Sheet and .csv file, Dictionary and Tuples. Operations on DataFrames.</p> <p>Data Visualisation: Introduction to Data Visualisation; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart and Histogram and Pie chart.</p>	14

#### References:

1. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, Green Tea Press.  
Freely available online@<https://www.greenteapress.com/thinkpython/thinkCSpy.pdf>, 2015.
2. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
3. Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language, Fabio Nelli, Apress®, 2015
4. Advance Core Python Programming, MeenuKohli, BPB Publications, 2021.
5. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, Prentice Hall, 2012.
6. Automate the Boring Stuff, Al Sweigart, No Starch Press, Inc, 2015.
7. Data Structures and Program Design Using Python, D Malhotra et al., Mercury Learning and Information LLC, 2021.
8. <http://www.ibiblio.org/g2swap/byteofpython/read/>
9. <https://docs.python.org/3/tutorial/index.html>

Course Code: <b>CAC10P [FAD410]</b>	Course Title: <b>Python Programming Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

#### Programs for Practical Component:

##### Part-A

1. Check if a number belongs to the Fibonacci Sequence
2. Solve Quadratic Equations
3. Find the sum of n natural numbers
4. Display Multiplication Tables
5. Check if a given number is a Prime Number or not
6. Implement a sequential search
7. Create a calculator program

8. Explore string functions
9. Implement Selection Sort
10. Implement Stack
11. Read and write into a file

**Part-B**

1. Demonstrate usage of basic regular expression
2. Demonstrate use of advanced regular expressions for data validation.
3. Demonstrate use of List
4. Demonstrate use of Dictionaries
5. Create SQLite Database and Perform Operations on Tables
6. Create a GUI using Tkinter module
7. Demonstrate Exceptions in Python
8. Drawing Line chart and Bar chart using Matplotlib
9. Drawing Histogram and Pie chart using Matplotlib
10. Create Array using NumPy and Perform Operations on Array
11. Create DataFrame from Excel sheet using Pandas and Perform Operations on DataFrames

**Note: A minimum of 10 Programs should be done in each Part.**

**Evaluation Scheme for Lab Examination:**

<b>Assessment Criteria</b>	<b>Marks</b>
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

Course Code: <b>CAC11 [FAD420]</b>	Course Title: <b>Multimedia Animation</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

At the end of the course, students will be able to:

- Write a well-designed, interactive Web site with respect to current standards and practices.
- Demonstrate in-depth knowledge of an industry-standard multimedia development tool and its associated scripting language.
- Determine the appropriate use of interactive versus standalone Web applications.

Course Content	Hours
<b>Unit - 1</b>	
Web Design: Origins and evolution of HTML, Basic syntax, Basic text markup, Images, Lists, Tables, Forms, Frame, Overview and features of HTML5. CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The <span> and <div> tags; Overview and features of CSS3. JavaScript: Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input. Introduction to Animation: Definition, The Start and End States, Interpolation, Animations in HTML.	14
<b>Unit – 2</b>	
CSS Animations, creating a Simple Animation, CSS Animation Property, Keyframes, Declaring Multiple Animations, Wrap-up. CSS Transitions, Adding a Transition, Transitions in Detail, The Longhand Properties, Longhand Properties vs. Shorthand Properties, Working with Multiple Transitions. HTML5 – SVG: Viewing SVG Files, Embedding SVG in HTML5, HTML5– SVG Circle, HTML5 – SVG Rectangle, HTML5 – SVG Line, HTML5 – SVG Ellipse, HTML5 – SVG Polygon, HTML5 – SVG Polyline, HTML5 – SVG Gradients, HTML5 – SVG Star.	14
<b>Unit – 3</b>	
HTML5–CANVAS: The Rendering Context, Browser Support, HTML5 Canvas Examples, Canvas - Drawing Rectangles, Canvas - Drawing Paths, Canvas - Drawing Lines, Canvas - Drawing Bezier Curves, Canvas - Drawing Quadratic Curves, Canvas - Using Images, Canvas - Create Gradients, HTML5 - Styles and Colors, Canvas - Text and Fonts, Canvas - Pattern and Shadow, Canvas - Save and Restore States, Canvas - Translation, Canvas - Rotation, Canvas - Scaling, Canvas - Transforms, HTML5 Canvas - Composition, Canvas – Animations.	14

### References:

1. The Complete Reference HTML and CSS, 5th Edition, Thomas A Powell, 2017
2. Animation in HTML, CSS, and JavaScript, Kirupa Chinnathambi, Createspace Independent Pub, 2013.
3. <https://www.w3.org/Style/CSS/current-work#CSS3>
4. <http://bedford-computing.co.uk/learning/cascading-style-sheets-css/>

Course Code: <b>CAC11P [FAD420]</b>	Course Title: <b>Multimedia Animation Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04 Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52 Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03 Hours</b>

## List of Lab programs

### Part-A

1. Write an HTML program to create and display navigation menus using list tags and anchor tag
2. Write an HTML program to display Multi-media data (text, images, audios, videos, gifs, etc) on a webpage
3. Write an HTML program to create student Registrations form on submitting the form check whether fields are empty or not using JavaScript. If any fields are empty display an error message
4. Write an HTML program to create bio-data (CV or Resume) and to change the following CSS properties
  - Font
  - Text
  - Background
5. Write an HTML program to create div and apply the following CSS properties on created div
  - Margin
  - Padding
  - Border
  - Box shadow
6. Write an HTML program to create a box and using CSS transform and transition properties move the box to the center of the web page on loading web-page
7. Write an HTML program to create a circle and create an animation of bouncing of the circle for 10 sec
8. Write an HTML program to create page loading animations

### Part-B

1. Write an HTML program to draw line, polyline and rectangle and fill rectangle with red color using svg tag.
2. Write an HTML program to draw star and multiple circle and with different color using svg tag Write an HTML program to create logo with linear gradient properties using svg tag.
3. Write an HTML program to draw Square and Rectangle using canvas tag and JavaScript
4. Write an HTML program to draw bezier curve using canvas tag and JavaScript
5. Write an HTML Program to import an external image into a canvas and then to draw on that image
6. Write an HTML program to draw a rectangle box using canvas and to change background color to red, scale of the rectangle to 2 on move-over (hover) properties.
7. Write an html program to draw a circle using canvas and to apply the rotations animations on loading the page

### Evaluation Scheme for Lab Examination:

Assessment Criteria	Marks
Writing 2 Programs	10
Execution of 1 Program	10
Viva and Record	05
Total	25

Course Code: <b>CAC12 [FAD430]</b>	Course Title: <b>Operating System Concepts</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03 Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>42 Hours</b>
Exam Marks: <b>60</b>	Exam Duration: <b>2½ Hours</b>

### Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the fundamentals of the operating system.
- Comprehend multithreaded programming, process management, process synchronization, memory management and storage management.
- Compare the performance of Scheduling Algorithms
- Identify the features of I/O and File handling methods.

Course Content	Hours
<b>Unit - 1</b>	
Introduction to Operating System: Definition, History and Examples of Operating System; Computer System organization; Types of Operating Systems; Functions of Operating System; Systems Calls; Operating System Structure. Process Management: Process Concept- Process Definition, Process State, Process Control Block, Threads; Process scheduling- Multiprogramming, Scheduling Queues, CPU Scheduling, Context Switch; Operations on Processes- Creation and Termination of Processes; Inter process communication (IPC)- Definition and Need for Inter process Communication; IPC Implementation Methods- Shared Memory and Message Passing; CPU Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling; Multiprocessor Scheduling; Real-Time CPU Scheduling.	14
<b>Unit – 2</b>	
Multithreaded Programming: Introduction to Threads; Types of Threads; Multithreading- Definition, Advantages; Multithreading Models; Thread Libraries; Threading Issues. Process Synchronization: Introduction; Race Condition; Critical Section Problem and Peterson’s Solution; Synchronization Hardware, Semaphores; Classic Problems of Synchronization- Readers and Writers Problem, Dining Philosophers Problem; Monitors. Deadlocks: System Model; Deadlocks Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection; and Recovery from Deadlock.	14
<b>Unit – 3</b>	
Memory Management: Logical and Physical Address Space; Swapping; Contiguous Allocation; Paging; Segmentation; Segmentation with Paging. Virtual Memory: Introduction to Virtual Memory; Demand Paging; Page Replacement; Page Replacement Algorithms; Allocation of frames, Thrashing. File System: File Concepts- Attributes, Operations and Types of Files; File System; File Access methods; Directory Structure; Protection; File System Implementation- File System Structure, Allocation Methods, Free Space Management	14

**References:**

1. Operating System Concepts, Silberschatz et al., 10<sup>th</sup> Edition, Wiley, 2018.
2. Operating System Concepts - Engineering Handbook, Ghosh PK, 2019.
3. Understanding Operating Systems, McHoes A et al., 7<sup>th</sup> Edition, Cengage Learning, 2014.
4. Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson.
5. Operating Systems – A Concept Based Approach, Dhamdhere, 3<sup>rd</sup> Edition, McGraw Hill Education India.
6. Modern Operating Systems, Andrew S Tanenbaum, 4<sup>th</sup> Edition, Pearson.



## Skill Enhancement Courses (SEC) for BCA Semester: IV

Course Code: <b>SEC-2 [FAD210]</b>	Course Title: <b>Open-Source Tools</b>
Course Credits: 1 + 1 = <b>02</b>	Hour of Teaching / Week: Theory ( <b>1Hour</b> ) + Practical ( <b>2 Hours</b> )
Formative Assessment Marks: <b>25</b>	Total Contact Hours: ( <b>13 T + 26 P Hours</b> )
Exam Marks: <b>25</b>	Exam Duration: <b>1 Hours</b>

### Course Outcomes (COs):

- Recognize the benefits and features of Open Source Technology and to interpret, contrast and compare open source products among themselves
- Use appropriate open source tools based on the nature of the problem
- Write code and compile different open-source software.

Course Content	Hours
<b>Module 1: Open-Source Software's</b>	
I. Introduction to Open sources, Need of Open Sources, Open Source – Principles, Standard Requirements, Advantages of Open Sources.	06
II. Free Software – FOSS	
III. Licenses – GPL, LGPL, Copyrights, Patents, Contracts & Licenses and Related Issues	
IV. Application of Open Sources. Open Source Operating Systems : FEDORA, UBUNTU	
<b>Module 2: Programming with case studies</b>	
I. Usage of design Tools like Argo UML or equivalent	07
II. Version Control Systems like Git or equivalent	
III. Bug Tracking Systems (Trac, BugZilla)	
IV. BootStrap	
V. Apache	
VI. Berkeley Software Distribution	
VII. Mozilla (Firefox)	
VIII. Wikipedia	
IX. Joomla	
X. GNU Compiler Collection	
XI. Libre Office	

### Text Book:

1. Kailash Vadera, Bhavyesh Gandhi, “Open Source Technology”, Laxmi Publications Pvt. Ltd 2012, 1<sup>st</sup> Edition.

### Reference Book:

1. Fadi P. Deek and James A. M. McHugh, “Open Source: Technology and Policy”, Cambridge Universities Press 2007.

**ECE21001****V SEMESTER****DSE 1A: Elective: Data Communication and Computer Networks****Credit (L: T: P = 4: 0: 0)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn in depth Elements of Data Communications and network Systems
- CO2. Learn in depth Transmission Media
- CO3. Understanding the various classifications and characteristics of Signals
- CO4. Understand in details with examples Network Models
- CO5. Learn in depth Error Detection and Corrections Algorithms
- CO6. Deliberate in details with examples Switching Concepts
- CO7. Deliberate the classification and characteristics of networking and internetworking Devices

**Unit - 1****15 Hours****Data Communications:** Components, Data Representation, Dataflow**Networks:** Network criteria, Physical Structures, Topology (Mesh, Star, Tree, Bus, Ring, Hybrid)**Categories of Network:** LAN, MAN, WAN**History of Network:** Protocols and Standards: Protocols (Standards organization),**Addressing:** Physical, Logical, Port Specific.**Unit - 2****15 Hours****Transmission Media:** Guided Media – Twisted pair cable, co-axial cable, optical fibre, Unguided Media – Radio waves, microwaves, Infrared.**Signals:** Analog and Digital Data, Analog and Digital Signals, periodic and non periodic signals. Analog Signals – Sine wave, Peak Amplitude, Period and frequency, Phase, wave length, composite signals. Digital Signals – Band width, Bit length, Bit rate, base band transmission, Digital v/s Analog. Transmission Impairment, Data rate limits (Noisy and noiseless channel)**Unit - 3****15 Hours****Network Models:** Layered tasks, OSI model (peer – to – peer), Layered Architecture. Functions of Layers (OSI), TCP / IP Protocol suite**Multiplexing:** FDM (MUX and DEMUX process, Application of FDM), WDM, TDM (Interleaving, synchronizing, bit padding)**Switching Concept:** Working principle of circuit switching and packet switching. Circuit switched networks, three phases' efficiency, delay. Data grams network, routing table, delay efficiency, virtual.**Error Detection and Correction:** Types of Errors, Redundancy, Error detection virus Error Correction.**Error Detection:** Parity check, Cyclic Redundancy Check (CRC), Check Sum. Error Correction - Retransmission, Forward Error Correction, Burst error Correction.

**Unit - 4****15 Hours**

**Networking And Internetworking Devices:** Connecting Devices - Hubs, Repeaters, Amplifiers, Bridges – LAN bridges, transparent bridges, Source-route bridges, Routers, Gateways, 2 layer and 3 layers switches.

**Routing Concepts:** Types, Shortest path, flooding.

**Wireless Lan's:** Blue tooth - Architecture, Blue tooth layers.

**Network Layer:** IPV4, IPV6 addresses

**Transport Layer:** UDP – user datagram, operations, Application. TCP - Services, TCP segment, SCTP - Services, packet format.

**Application Layer:** - SMTP, SNMP, HTTP, FTP

**Reference Books:**

1. Data Communication and Networking – Forouzan
2. Computer Network – Tanenbaurn – 3rd Editions
3. Computer Network – Larry L. Peterson & Bruce S. Davie

**ECE21101****V SEMESTER****DSE 1A: Elective: Data Communication and Computer Networks Lab****Credit (L: T: P = 0: 0: 2)**

1. Program for Identifying well known Ports
2. Program for Data Retrieval from Remote Database.
3. Program for Simulating SMTP Client.
4. Program for Simulating Telnet Client
5. Program for Simple file transfer between two systems, (without using Protocols)
6. Program for implementing HTTP.
7. Program for Downloading Image files.
8. Simulate Checksum Algorithm.
9. Simulate Stop & Wait Protocol.
10. Simulate Go-Back-N Protocol.
11. Simulate Selective Repeat Protocol.
12. Take an example subnet of hosts. Obtain broaECAST tree for it.
13. Network address with automatic subnet address generation:

ECE21201

## V SEMESTER

**DSE 1B: Elective: Computer Graphics****Credit (L: T: P = 4: 0: 0)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn the classification and characteristics of Elements of Graphics Systems
- CO2. Learn in depth Graphics Algorithms
- CO3. Deliberate the classification and characteristics of 2D Graphics
- CO4. Understand the characteristics of 3D Graphics
- CO5. Deliberate the details of Transformation and Viewing Techniques
- CO6. Learn the details of Illumination and Color Models

**Unit - 1****15 Hours**

**INTRODUCTION:** Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

**Unit - 2****15 Hours**

**TWO DIMENSIONAL GRAPHICS:** Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**Unit - 3****15 Hours**

**THREE DIMENSIONAL GRAPHICS:** Three dimensional concepts; Three dimensional object representations – Polygon surfaces Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces.

**TRANSFORMATION AND VIEWING:** Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

**Unit - 4****15 Hours**

**ILLUMINATION AND COLOUR MODELS:** Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive color concepts – RGB color model – YIQ color model – CMY colour model – HSV color model – HLS color model; Color selection.

**Reference Books:**

1. Computer Graphics C Version by Donald Hearn & M. Pauline Baker Pearson Education, New Delhi, 2004
2. Procedural Elements for Computer Graphics by David F. Rogers, Tata McGraw Hill Book Company, New Delhi, 2003
3. Computer Graphics: Principles & Practice in C by J. D. Foley, S. K. Van Dam, F. H. John, Pearson Education, 2004
4. Computer Graphics using Open GL by Francis S Hill Jr Pearson Education, 2004.

**ECE21301****V SEMESTER****DSE 1B: Elective: Computer Graphics Lab****Credit (L: T: P = 0: 0: 2)**

1. Implementation of Bresenham's Algorithm – Line, Circle, Ellipse.
2. Implementation of Line, Circle and ellipse attributes
3. Two Dimensional transformations - Translation, Rotation, Scaling, Reflection, Shear.
4. Composite 2D Transformations
5. Cohen Sutherland 2D line clipping and Windowing
6. Sutherland – Hodgeman Polygon clipping Algorithm
7. Three dimensional transformations - Translation, Rotation, Scaling
8. Composite 3D transformations
9. Drawing three dimensional objects and Scenes
10. Generating Fractal images

**ECE21401****V SEMESTER****DSE 1C: Elective: Multimedia Systems and Applications****Credit (L: T: P = 4: 0:0)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Understand the details of Components of Multimedia with applications
- CO2. Identify in details with examples Text, Images, Sound and Videos
- CO3. Learn in depth Animation Techniques
- CO4. Understand the details of Multimedia in internet
- CO5. Deliberate the characteristics of Making Multimedia
- CO6. Deliberate in depth Multimedia Making Tools

**Unit - 1****15 Hours**

**Multimedia:** Introduction to multimedia, components, uses of multimedia, multimedia applications, virtual reality.

**Text:** Fonts & Faces, Using Text in Multimedia, Font Editing & Design Tools, Hypermedia & Hypertext.

**Images:** Still Images – bitmaps, vector drawing, 3D drawing & rendering, natural light & colours, computerized colours, colour palettes, image file formats.

**Unit - 2****15 Hours**

**Sound:** Digital Audio, MIDI Audio, MIDI vs Digital Audio, Audio File Formats.

**Video:** How video works, analog video, digital video, video file formats, video shooting and editing.

**Unit - 3****15 Hours**

**Animation:** Principle of animations, animation techniques, animation file formats.

**Internet and Multimedia:** www and HTML, multimedia on the web – web servers, web browsers, web page makers and site builders.

**Unit - 4****15 Hours**

**Making Multimedia:** Stages of a multimedia project, Requirements to make good multimedia, Multimedia Hardware - Macintosh and Windows production Platforms, Hardware peripherals - Connections, Memory and storage devices, Multimedia software and Authoring tools.

**Reference Books:**

1. Tay Vaughan, “Multimedia: Making it work”, TMH, Eighth edition.
2. Ralf Steinmetz and KlaraNaharstedt, “Multimedia: Computing, Communications Applications”, Pearson.
3. Keyes, “Multimedia Handbook”, TMH.
4. K. Andleigh and K. Thakkar, “Multimedia System Design”, PHI.

**ECE21501****V SEMESTER****DSE 1C: Elective: Multimedia Systems and Applications Lab****Credit (L: T: P = 0: 0: 2)**

Practical exercises based on concepts listed in theory using Presentation tools in office automation tool/ GIMP/Blender / Audacity/ Animation Tools/ Image Editors/ Video Editors.

Implement the followings using Blender -

1. Create an animation using the tools panel and the properties panel to draw the following – Line, pie, oval, circle, rectangle, square, pencil, brush and lasso tool
2. Create an animation using text tool to set the font, size, colour etc.
3. Create an animation using free transform tool that should use followings-
  - Move Objects
  - Skew Objects
  - Stretch Objects
  - Rotate Objects
  - Stretch Objects while maintaining proportion
  - Rotate Objects after relocating the centre dot
4. Create an animation using layers having following features- Insert layer, Delete layer, guide layer, Mask layer.
5. Modify the document (changing background color etc. )using the following tools
  - Eraser tool
  - Hand tool
  - Ink bottle tool
  - Zoom tool
  - Paint Bucket tool
  - Eyedropper tool
6. Create an animation for bus car race in which both starts from the same point and car wins the race.
7. Create an animation in which text Hello gets converted into Good Bye (using motion/shape tweening).
8. Create an animation having five images having fade-in fade-out effect.
9. Create an scene to show the sunrise (using multiple layers and motion tweening)
10. Create an animation to show the ripple effect.
11. Create an animation (using Shape tweening and shape hints) for transforming one shape into another.
12. Create an animation for bouncing ball (you may use motion guide layer).

**OR****Project:**

Design a minimum 10 page interactive website using Joomla or WordPress.

**ECE22001****V SEMESTER****DSE 2A: Elective: ASP.Net****Credit (L: T: P = 4: 0: 0)****Course Outcome:**

After successful completion of the course, the student is able to

CO 1. Learn the details of ASP.NET Framework

CO 2. Learn the details of ASP.NET working Environment

CO 3. Deliberate in details with examples Standard Control of ASP.NET

CO 4. Understand the details of Developing Simple Websites Using ASP.NET Controls

CO 5. Deliberate in depth Developing Simple Web Application Using ASP.NET Controls

CO 6. Learn the details of Database Access Controls

CO 7. Identify in details with examples Database Access Controls

**Unit - 1****15 Hours**

**Overview of the ASP.NET:** Introduction of different Web Technology, What is Asp.Net, How Asp.Net Works, Use of visual studio, Different Languages used in ASP.Net. Summary.

**Framework:** Common Language Runtime (CLR), .NET Framework Class Library, Summary

**Unit - 2****15 Hours**

**Setting up and Installing ASP.NET:** Installing Internet Information Server, Installation of Asp.Net, virtual directory, Application Setting in IIS, Summary.

**Unit - 3****15 Hours**

Asp.Net Standard Controls, Displaying information, Label Controls, Literal Controls, Bulleted List, Accepting User Input, Textbox controls, Radio Button and Radio Button List Controls, Checkbox and Checkbox List Controls, Button controls, Link Button Control, Image Button Control, Using Hyperlink Control, Dropdown List, List Box, Displaying Images, Image Control, Image Map Control, Using Panel Control, Using Hyperlink Control, Asp.Net, Page & State Management, Overview of events in page, Summary.

**Unit - 4****15 Hours**

Designing Websites with master pages, creating master pages, Creating default contents, nesting master pages, registering master pages in web configuration, Summary.

**ASP.Net Theme:** ASP.NET Website Theme, Named Skin and Default Skin in ASP.NET Theme, Style Sheet Theme and Theme Attributes of a Page Directive

**Using the Rich Controls:** Accepting File Uploads, Saving files to file system, Calendar Control, Displaying advertisements, Displaying Different Page view, Displaying a Tabbed Page View, Wizard Control, Summary.

**Reference Books:**

1. Mathew Mac Donald, ASP. Net The Complete Reference, McGraw –Hill, 2002.



**ECE22101**

**V SEMESTER**  
**DSE 2A: Elective: ASP.Net Lab**  
**Credit (L: T: P = 0: 0: 2)**

**LAB MANUAL:**

1. Write a Program to generate the factorial operation.
2. Write a Program to perform Money Conversion.
3. Write a Program to generate the Quadratic Equation.
4. Write a Program to generate the Login control.
5. Write a Program to perform Asp.Net state.
6. Write a Program to perform validation operation.
7. Write a Program to perform Tree view operation.
8. Write a Program to display the phone no of an author using database.
9. Write a Program to insert the data in to database using Execute-Non Query.
10. Write a Program to bind data using template in data list.
11. Write a Program to bind data using Hyperlink column in data grid.

ECE22201

**V SEMESTER**  
**DSE 2B: Elective: Visual Programming**  
**Credit (L: T: P = 4: 0:0)**

{**Note:** Use any open source alternative such as Tkinter with Python /SharpDevelop/GAMBAS/OPENXAVA with JAVA}

**Course Outcome:**

After successful completion of the course, the student is able to

CO 1. Learn in details with examples Basic concept Of GUI Environment

CO 2. Deliberate the details of GUI Controls

CO 3. Learn in details with examples Data types and Operations in Visual Programming

CO 4. Learn in details with examples Control statements in Visual Programming

CO 5. Write down in details with examples Modular Programming

CO 6. Learn the details of Forms Handling in Visual Programming

CO 7. Understand in depth Database Connectivity in Visual Programming

**Unit - 1****15 Hours**

**GUI Environment:** Introduction to graphical user interface (GUI), programming language (procedural, object oriented, event driven), the GUI environment, compiling, debugging, and running the programs.

**Controls:** Introduction to controls textboxes, frames, check boxes, option buttons, images, setting borders and styles, the shape control, the line control, working with multiple controls and their properties, designing the user interface, keyboard access, tab controls, default & cancel property, coding for controls.

**Operations:** Data types, constants, named & intrinsic, declaring variables, scope of variables, val function, arithmetic operations, formatting data.

**Unit - 2****15 Hours**

**Decision Making:** If statement, comparing strings, compound conditions (and, or, not), nested if statements, case structure, using if statements with option buttons & check boxes, displaying message in message box, testing whether input is valid or not.

**Modular programming:** Menus, sub-procedures and sub-functions defining / creating and modifying a menu, using common dialog box, creating a new sub-procedure, passing variables to procedures, passing argument by value or by reference, writing a function/procedure.

**Unit - 3****15 Hours**

**Forms Handling:** Multiple forms creating, adding, removing forms in project, hide, show method, load, unload statement, me keyword, referring to objects on a different forms

**Iteration Handling:** Do/loops, for/next loops, using msg box function, using string function

**Arrays and Grouped Data Control:** Arrays - 1-dimension arrays, initializing an array using for each, user-defined data types, accessing information with user-defined data types, using list boxes with array, two dimensional arrays.

**Unit - 4****15 Hours**

lists, loops and printing list boxes & combo boxes, filling the list using property window / add item method, clear method, list box properties, removing an item from a list, list box/ combo box operations.

**Database Connectivity:** Database connectivity of forms with back end tool like mysql, populating the data in text boxes, list boxes etc. searching of data in database using forms. Updating/ editing of data based on a criterion.

**Reference Books:**

1. Reference: Programming in Visual Basic 6.0 by Julia Case Bradley, Anita C. Millispangh (Tata Mcgraw Hill Edition 2000 (Fourteenth Reprint 2004))

**ECE22301****V SEMESTER****DSE 2B: Elective: Visual Programming Lab****Credit (L: T: P = 0: 0: 2)**

1. Print a table of numbers from 5 to 15 and their squares and Cubes.
2. Print the largest of three numbers.
3. Find the factorial of a number n.
4. Enter a list of positive numbers terminated by zero. Find the sum and average of these numbers.
5. A person deposits Rs. 1000 in a fixed account yielding 5% interest. Complete the amount in the account at the end of each year for n years.
6. Read n numbers. Count the number of negative numbers, positive numbers and zeros in the list.
7. Read n numbers. Count the number of negative numbers, positive numbers and zeroes in the list. Use of arrays.
8. Read a single dimension array. Find the sum and average of these numbers.
9. Read a two dimension array. Find the sum of two 2D Array.
10. Create a database Employee and Make a form to allow data entry to Employee Form with the following command buttons:

**ECE22401****V SEMESTER****DSE2C: PHP Programming with MySQL****Credit (L: T: P = 4: 0: 0)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn in depth Elements of PHP
- CO2. Learn in depth Interaction Methods Between HTML and PHP
- CO3. Understand in depth PHP function
- CO4. Understand in depth String Manipulation
- CO5. Learn the characteristics of Regular Expression
- CO6. Learn the details of Developing PHP Web Application

**Unit - 1****15 Hours**

Introduction Basic PHP Development Control Structure: Introduction to www, History, Understanding client/server roles Apache, PHP, MySQL, XAMPP Installation PHP Basic syntax, PHP data Types, PHP Variables PHP Constants, PHP Expressions, PHP Operators Control Structures & Loop

**Unit - 2****15 Hours**

Working With the File System Working With Regular Expressions, Opening a File, Reading from a File, Writing to a File, File Locking, Uploading Files via an HTML Form, Getting File Information, Directory Functions, Getting a Directory Listing, The basic regular expressions, Matching patterns, Finding matches, Replace patterns

**WORKING WITH FORMS:** PHP Form handling, PHP GET/POST, PHP Form Validation, Accessing user input, Combine HTML and PHP code using hidden fields, Redirecting the user, File upload

**Unit - 3****15 Hours**

**CLASSES AND OBJECTS:** Object oriented concepts, Define a class, attributes, Object, Object properties, methods, constructors and destructors, Class constants, Static method, Class inheritance, Abstract classes, Final keyword, Implementing Interface, Object serialization

Using Cookies: What are Cookies? – Setting Cookies – Using Cookie variables – Session Basics: What's a session? – Understanding Session variables – Managing User preferences with Sessions – Graphics: Drawing functions.

**Unit - 4****15 Hours**

**INTRODUCTION TO DATABASE:** What is RDBMS technology?, Introduction to SQL, Connecting to the MYSQL, Selecting a database, Adding data to a table, Displaying returned data on Web pages ,Finding the number of row, Inserting, Deleting , Entering and updating data, Executing multiple queries, Understanding Primary and Foreign Key, Understanding Database Normalization, Dealing with Dates and Times

**Reference Books:**

1. Complete Beginner's Guide to PHP: Programming & Web Development by Cedric Palmer (22 February 2014)
2. PHP and MySQL Web Development by Laura Thomson and Luke Welling
3. PHP Reference: Beginner to Intermediate PHP5 by Mario Lurig
4. PHP 4: A Beginner's Guide by William Mccarty
5. Julie Meloni and Matt Telles, PHP 6, Course Technology, CENGAGE Learning, India Edition, 2008.
6. Kevin Tatroe, Peter MacIntyre and RasmusLerdorf, Programming PHP, O'REILLY media, 3rd edition, 2013.

**ECE22501****V SEMESTER****DSE2C: PHP Programming with MySQL Lab****Credit (L: T: P = 0: 0: 2)**

1. Write a PHP program to find the factorial of a number.
2. Write a PHP program using Conditional Statements.
3. Write a PHP program to find the maximum value in a given multi-dimensional array.
4. Write a PHP program to find the GCD of two numbers using user-defined functions.
5. Design a simple web page to generate multiplication table for a given number using PHP.
6. Design a web page that should compute one's age on a given date using PHP.
7. Write a PHP program to download a file from the server.
8. Write a PHP program to store the current date and time in a COOKIE and display the 'Last Visited' date and time on the web page.
9. Write a PHP program to store page views count in SESSION, to increment the count on each refresh and to show the count on web page.
10. Write a PHP program to draw the human face.
11. Write a PHP program to design a simple calculator.
12. Design an authentication web page in PHP with MySQL to check username and password.

ECE23001

## V SEMESTER

## DSE 3A: Elective: Analysis and Design of Algorithms

(Credit L: T: P = 4: 0: 0)

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn the details of Types of notion of Algorithm
- CO2. Learn in details with examples Algorithm Design Techniques
- CO3. Deliberate in depth Sorting Techniques
- CO4. Deliberate in depth of Searching Techniques
- CO5. Identify in details with examples Analysis of Graph Algorithms
- CO6. Learn the details of Dynamic Programming Methods

**Unit - 1****15 Hours**

**Introduction:** Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms Correctness of Algorithm

**Algorithm Design Techniques:** Iterative techniques Divide and conquer greedy algorithms.

**Sorting Techniques:** Selection sort, bubble sort, insertion sort, more sorting techniques-quick sort, merge sort. Radix sort,

**Unit - 2****15 Hours**

**The Greedy Method:** General Method - Container Loading - Knapsack Problem - Tree

**Searching Techniques:** Linear and Binary search, Complexity Analysis.

**Graphs:** Analysis of Graph algorithms -Depth-First Search Breadth-First Search and its applications, minimum Spanning Trees and Shortest Paths -PRIM 'S, KRUSKAL, Dijkstra's algorithm. Branching-Hamiltonian Circuit problem.

**Unit - 3****15 Hours**

**Dynamic Programming:** The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths, Single-Source Shortest Paths: The Travelling Salesperson problem.

**Unit - 4****15 Hours**

Vertex Splitting – Job Sequencing With Deadlines - Minimum Cost Spanning Trees - Optimal

Storage on Tapes – Optimal Merge Patterns - #Single Source Shortest Paths#.

Backtracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack Problem Branch and Bound: The Method - 0/1 Knapsack Problem.

**Reference Books:**

1. Analysis & design of Algorithm-Padma Reddy
2. A.V. Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education, 2006.
3. J. Kleinberg and E. Tardos, Algorithms Design, Pearson Education, 2006.
4. Ellis Horowitz, SatrajSahni and SanguthevarRajasekaran, Fundamentals of Computer Algorithms, Universities Press, Second Edition, Reprint 2009.
5. A.A.Puntambekar, Analysis and Design Of Algorithms, Technical Publications, 2008

**ECE23101****V SEMESTER****DSE 3A: Elective: Analysis and Design of Algorithms Lab****(Credit L: T: P = 0: 0: 2)**

1. Implement Insertion Sort.
2. Implement Merge Sort.
3. Implement recursive algorithm
4. Implement Randomized Quick sort.
5. Implement Radix Sort.
6. Implement Searching Techniques (linear & Binary)
7. Implement selection sort
8. Implement Bubble sort
9. Implement Prim's Algorithm
10. Implement Dijkstra's Algorithm
11. Implement Krushkal's Algorithm
12. Implement Travelling Salesperson problem
13. Implement Floyd's Algorithm
14. Implement Depth First Search
15. Implement Binary Search tree.

ECE23201

## V SEMESTER

## DSE 3B: Elective: Mobile Applications

Credit (L: T: P = 4: 0: 0)

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate the details of Concepts of Event Driven Programming
- CO2. Learn in details with examples issues of Mobile applications
- CO3. Specify the details of Mobile applications Development tools and Frameworks
- CO4. Deliberate in details with examples common Mobile device UI's
- CO5. Write down in depth Data persistence Remote data storage and communication
- CO6. Learn in details with examples Code signing

**Unit - 1****15 Hours**

**Event Driven Programming:** UI event loop, Threading for background tasks, Outlets / actions, delegation, notification, Model View Controller (MVC) design pattern.

**Mobile application issues:** limited resources (memory, display, network, file system), input / output (multi-touch and gestures), sensors (camera, compass, accelerometer, GPS)

**Unit - 2****15 Hours**

**Development tools:** Apple iOS toolchain: Objective-C, Xcode IDE, Interface Builder, Device simulator.

**Frameworks:** Objective-C and Foundation Frameworks, Cocoa Touch, UI Kit, Others: Core Graphics, Core Animation, Core Location and Maps, Basic Interaction.

**Unit - 3****15 Hours**

**Common UI's for mobile devices:** Navigation Controllers, Tab Bars, Table Views, Modal views, UI Layout.

**Data Persistence:** Maintaining state between application invocations, File system, Property Lists, SQLite, Core Data.

**Unit - 4****15 Hours**

**Remote Data-Storage and Communication:** "Back End" / server side of application, RESTful programming, HTTP get, post, put, delete, database design, server side JavaScript / JSON.

**Code signing:** security, Keychain, Developers and App Store License Agreement



**Reference:**

1. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley, 2011.
2. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
3. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009. Maximiliano
4. Firtman, Programming the Mobile Web, O'Reilly Media, 2010.
5. Christian Crumlish and Erin Malone, Designing Social Interfaces, O'Reilly Media, 2009.
6. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.

**ECE23301****V SEMESTER****DSE 3B: Elective: Mobile Applications Lab****Credit (L: T: P = 0: 0: 2)****Software Lab based on Mobile Applications:**

1. Installing Android Environment
2. Create Hello World Application
3. Sample Application about Android Resources
4. Sample Application about Layouts
5. Sample Application about Intents
6. Sample Application I about user interfaces
7. Sample Application about Animations
8. Make a Project based on above labs
9. Sample Application about Android Data
10. Sample Application about SQLite I
11. Sample Application about SQLite II
12. Project Presentation

ECE23401

## V SEMESTER

## DSE 3C: Elective: Machine Learning

Credit (L: T: P = 4: 0: 0)

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate the details of Concepts of Machine Learning
- CO2. Learn in details with examples for Machine Learning Software
- CO3. Specify the details of Linear Algebra
- CO4. Deliberate in details with examples Linear & Logistic Regression
- CO5. Write down in depth Regularization and its utility
- CO6. Learn in details with methods of Neural Networks

**Unit - 1****15 Hours**

**Introduction:** Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier

**Unit - 2****15 Hours**

**Softwares for Machine Learning and Linear Algebra Overview:** Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tool such as MATLAB.

**Unit - 3****15 Hours**

**Linear Regression:** Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection.

**Logistic Regression:** Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

**Unit - 4****15 Hours**

**Regularization:** Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

**Neural Networks:** Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

**Readings**

1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

**ECE23501****V SEMESTER****DSE 3C: Elective: Machine Learning Lab****Credit (L: T: P = 0: 0: 2)**

For practical Labs for Machine Learning, students may use software like MABLAB/Octave or Python. For later exercises, students can create/use their own datasets or utilize datasets from online repositories like UCI Machine Learning Repository (<http://archive.ics.uci.edu/ml/>).

1. Perform elementary mathematical operations in Octave/MATLAB like addition, multiplication, division and exponentiation.
2. Perform elementary logical operations in Octave/MATLAB (like OR, AND, Checking for Equality, NOT, XOR).
3. Create, initialize and display simple variables and simple strings and use simple formatting for variable.
4. Create/Define single dimension / multi-dimension arrays, and arrays with specific values like array of all ones, all zeros, array with random values within a range, or a diagonal matrix.
5. Use command to compute the size of a matrix, size/length of a particular row/column, load data from a text file, store matrix data to a text file, finding out variables and their features in the current scope.
6. Perform basic operations on matrices (like addition, subtraction, multiplication) and display specific rows or columns of the matrix.
7. Perform other matrix operations like converting matrix data to absolute values, taking the negative of matrix values, adding/removing rows/columns from a matrix, finding the maximum or minimum values in a matrix or in a row/column, and finding the sum of some/all elements in a matrix.
8. Create various type of plots/charts like histograms, plot based on sine/cosine function based on data from a matrix. Further label different axes in a plot and data in a plot.
9. Generate different subplots from a given plot and color plot data.
10. Use conditional statements and different type of loops based on simple example/s.
11. Perform vectorized implementation of simple matrix operation like finding the transpose of a matrix, adding, subtracting or multiplying two matrices.
12. Implement Linear Regression problem. For example, based on a dataset comprising of existing set of prices and area/size of the houses, predict the estimated price of a given house.
13. Based on multiple features/variables perform Linear Regression. For example, based on a number of additional features like number of bedrooms, servant room, number of balconies, number of houses of years a house has been built – predict the price of a house.
14. Implement a classification/ logistic regression problem. For example based on different features of students' data, classify, whether a student is suitable for a particular activity. Based on the available dataset, a student can also implement another classification problem like checking whether an email is spam or not.
15. Use some function for regularization of dataset based on problem 14.
16. Use some function for neural networks, like Stochastic Gradient Descent or backpropagation - algorithm to predict the value of a variable based on the dataset of problem 14.

**ECE24101****V SEMESTER****SEC 2A: Elective: Object Oriented Modelling& Design with UML****Credit (L: T: P = 0: 0: 2)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate in details with examples Object Oriented Development
- CO2. Write down the details of OO Modeling Concepts
- CO3. Learn the details of OO process Overview
- CO4. Identify in depth Design of System Using OO Model
- CO5. Specify the details of Steps for Implementation of OO Modeling
- CO6. Learn the details of Design a System Using UML Tool

**Object Oriented Modeling& Design with UML Lab****Term Work / Assignment**

Each candidate will submit an approximately 10-page written report on a case study or mini project. Students have to do OO analysis & design for the project problem, and develop use case model, analysis model and design model for it, using UML.

**Practical assignment**

Nine assignments, one on each of the diagrams learnt in UML.

**Reference Books:**

1. Object –oriented modeling and design- Michael R Blaha and James R Rumbaugh
2. Object Technology- David A.Taylor
3. Designing Flexible Object Oriented systems with UML – Charles Ritcher
4. Object Oriented Analysis & Design, Satisfier. Jackson, BurdThomson
5. Object Oriented Modeling and Design - James Rumbaugh
6. Teach Yourself UML in 24 Hours - Joseph Schmuilers

**ECE24301****V SEMESTER****SEC 2B: Elective: JQuery****Credit (L: T: P = 0: 0: 2)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate in details with examples JQuery
- CO2. Learn the details of JQuery Overview
- CO3. Specify the details of Steps for Implementation of JQuery
- CO4. Learn the details of Design and use of JQuery

**JQuery Lab**

1. Test if jQuery is loaded.
2. Scroll to the top of the page with jQuery.
3. Disable right click menu in html page using jquery.
4. Blink text using jQuery.
5. Create a Zebra Stripes table effect.
6. Print a page using jQuery.
7. Limit character input in the text area including count.
8. Create a div using jQuery with style tag.
9. Move one DIV element inside another using jQuery.
10. Add a list element within an unordered list element.
11. Remove all the options of a select box and then add one option and select it.
12. How to get the value of a textbox using jQuery?
13. Remove style added with .css() function using jQuery.
14. Distinguish between left and right mouse click with jQuery.
15. Check if an object is a jQuery object.
16. How to detect whether the user has pressed 'Enter Key' using jQuery.
17. How to get textarea text using jQuery.
18. Access form input fields using jQuery.
19. Convert a jQuery object into a string.
20. How to detect a textbox's content has changed using jQuery?
21. Remove a specific value from an array using jQuery.
22. Add options to a drop-down list using jQuery.
23. Delete all table rows except first one using jQuery.
24. Count Child elements using jQuery.
25. Restrict "number"-only input for textboxes including decimal points.
26. Set value in input text using jQuery.
27. Set a value in a span using jQuery.
28. Find the class of the clicked element.
29. Set href attribute at runtime using jquery.
30. Find the total width of an element (including width, padding, and border) in jQuery.
31. Change options of select using jQuery.
32. Access HTML form data using jQuery.

**ECE24501****V SEMESTER****SEC 2B: Elective: MongoDB****Credit (L: T: P = 0: 0: 2)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate in details with examples MongoDB
- CO2. Learn the details of MongoDB Overview
- CO3. Specify the details of Steps for Implementation of MongoDB
- CO4. Learn the details of Design and use of MongoDB

**MongoDB Lab**

1. Write a MongoDB query to display all the documents in the collection restaurants.
2. Write a MongoDB query to display the fields restaurant\_id, name, borough and cuisine for all the documents in the collection restaurant.
3. Write a MongoDB query to display the fields restaurant\_id, name, borough and cuisine, but exclude the field \_id for all the documents in the collection restaurant.
4. Write a MongoDB query to display the fields restaurant\_id, name, borough and zip code, but exclude the field \_id for all the documents in the collection restaurant.
5. Write a MongoDB query to display all the restaurant which is in the borough Bronx.
6. Write a MongoDB query to display the first 5 restaurant which is in the borough Bronx.
7. Write a MongoDB query to display the next 5 restaurants after skipping first 5 which are in the borough Bronx.
8. Write a MongoDB query to find the restaurants who achieved a score more than 90.
9. Write a MongoDB query to find the restaurants that achieved a score, more than 80 but less than 100.
10. Write a MongoDB query to find the restaurants which locate in latitude value less than -95.754168.
11. Write a MongoDB query to find the restaurants that do not prepare any cuisine of 'American' and their grade score more than 70 and latitude less than -65.754168.
12. Write a MongoDB query to find the restaurants which do not prepare any cuisine of 'American' and achieved a score more than 70 and located in the longitude less than -65.754168.  
Note : Do this query without using \$ and operator.
13. Write a MongoDB query to find the restaurants which do not prepare any cuisine of 'American ' and achieved a grade point 'A' not belongs to the borough Brooklyn. The document must be displayed according to the cuisine in descending order.
14. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which contain 'Wil' as first three letters for its name.
15. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which contain 'ces' as last three letters for its name.

16. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which contain 'Reg' as three letters somewhere in its name.
17. Write a MongoDB query to find the restaurants which belong to the borough Bronx and prepared either American or Chinese dish.
18. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which belong to the borough Staten Island or Queens or Bronx or Brooklyn.
19. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which are not belonging to the borough Staten Island or Queens or Bronx or Brooklyn.
20. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which achieved a score which is not more than 10.
21. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which prepared dish except 'American' and 'Chinese' or restaurant's name begins with letter 'Wil'.
22. Write a MongoDB query to find the restaurant Id, name, and grades for those restaurants which achieved a grade of "A" and scored 11 on an ISODate "2014-08-11T00:00:00Z" among many of survey dates..
23. Write a MongoDB query to find the restaurant Id, name and grades for those restaurants where the 2nd element of grades array contains a grade of "A" and score 9 on an ISODate "2014-08-11T00:00:00Z".
24. Write a MongoDB query to find the restaurant Id, name, address and geographical location for those restaurants where 2nd element of coord array contains a value which is more than 42 and upto 52..
25. Write a MongoDB query to arrange the name of the restaurants in ascending order along with all the columns.
26. Write a MongoDB query to arrange the name of the restaurants in descending along with all the columns.
27. Write a MongoDB query to arrange the name of the cuisine in ascending order and for that same cuisine borough should be in descending order.
28. Write a MongoDB query to know whether all the addresses contains the street or not.
29. Write a MongoDB query which will select all documents in the restaurants collection where the coord field value is Double
30. Write a MongoDB query which will select the restaurant Id, name and grades for those restaurants which returns 0 as a remainder after dividing the score by 7
31. Write a MongoDB query to find the restaurant name, borough, longitude and latitude and cuisine for those restaurants which contains 'mon' as three letters somewhere in its name.
32. Write a MongoDB query to find the restaurant name, borough, longitude and latitude and cuisine for those restaurants which contain 'Mad' as first three letters of its name.

ECF21001

## VI SEMESTER

## DSE 4A: Elective: Operation Research

Credit (L: T: P = 4: 0: 0)

**Course Outcome**

After successful completion of the course, the student is able to

- CO1. Write down the details of Origin and Development of Operation Research
- CO2. Understand the characteristics of Linear Programming Problems and Methods
- CO3. Deliberate in depth Transportation Problems
- CO4. Deliberate in depth Assignment Problem
- CO5. Identify in details with examples Network Analysis
- CO6. Learn in depth Application of Operation Research

**Unit - 1****15 Hours**

**Linear Programming Problems:** Origin and development of operations research, formulation of Linear Programming problem, Graphical solution.

Theory of simplex method, Use of artificial variables and their solution.

**Unit - 2****15 Hours**

**Transportation Problem:** Mathematical formulation of transportation problem, Initial basic Feasible solution, North West corner rule, Matrix minima method, Vogel's approximation method, MODI method to find optimal solution.

**Unit - 3****15 Hours**

**Assignment Problem:** Mathematical formulation of an Assignment problem, Assignment algorithm, Hungarian Method to solve Assignment Problem.

**Unit - 4****15 Hours**

**Network Analysis:** Basic components of Network, Rules for drawing Network diagram Time calculation in Networks. Critical Path Method and PROJECT Evaluation and Review Techniques. Algorithm and flow chart for CPM and PERT.

**Reference Books:**

1. Taha, "Operations Research", 7th edition, Pearson Education, 2007.
2. Billey E. Gillett, "Introduction to Operations Research", Himalaya Publishing House, Delhi, 1979.
3. Hamady A. Taha "Operations Research", Collin Mac Millan, 1982



**ECF21101**

**VI SEMESTER**

**DSE 4A: Elective: Operation Research Lab**

**Credit (L: T: P = 0: 0:2)**

**Lab based on Operation Research**

1. LPP
2. Simplex
3. Dual Simplex
4. Big – M
5. Vogel's
6. Maxima and Minima
7. North West corner
8. Sequencing Problems
9. Modi Method
10. Hugarian Method
11. Assignment Problem

**ECE21201****VI SEMESTER****DSE 4B: Elective: Enterprise Resource Planning****Credit (L: T: P = 4: 0: 0)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate the details of ERP
- CO2. Learn in depth Models of ERP
- CO3. Write down in depth Business Process Mapping for ERP
- CO4. Understand in details with applications of ERP and Related Technologies
- CO5. Deliberate the details of ERP Modules
- CO6. Specify in details with examples SAP

**Unit - 1****15 Hours**

Introduction to ERP, Evolution of ERP, What is ERP? Reasons for the growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, Advantage of ERP and Disadvantage of ERP.

**Unit - 2****15 Hours**

An overview of Enterprise, Integrated Management Information, Business Modeling, ERP for Small Business, ERP for make to order companies, Business Process Mapping for ERP Module Design, Hardware Environment and its Selection for ERP Implementation.

**Unit - 3****15 Hours**

ERP and Related Technologies, Business Process Reengineering (BPR), Management Information System (MIS), Executive Information System (EIS), Decision support System (DSS), Supply Chain Management (SCM) (With Example)

**Unit - 4****15 Hours**

ERP Modules, Introduction to Finance, Plant Maintenance, Quality Management, Materials Management, ERP Market, Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Company, System Software Associates.

**Reference Books:**

1. C.S. V Murthy Enterprise Resource Planning
2. R.G. Saha – Enterprise Resource Planning - HPH
3. Alexis Leon, Leon Publishers: Enterprise Resource Planning
4. Ravi Anupindi, Sunil Chopra, Pearson Education”. “Managing Business Process Flows
5. Altekar, PHI. Enterprise Resource Planning
6. Srivatsava, I.K. International Publishers, Enterprise Resource Planning
7. P. Diwan Vinod Kumar Garg and N.K. Venkitakrishnan, PHI. Enterprise Resource Planning
8. Introduction to SAP, an Overview of SD: MM, PP, FI/CO Modules of SAP. 10. Zaveri Jyotindra Enterprise Resource Planning

**ECE21301**

**VI SEMESTER**

**DSE 4B: Elective: Enterprise Resource Planning Lab**

**Credit (L: T: P = 0: 0: 2)**

Students should be Prepare ERP Solution Report for his / her Case Study under the supervision of Teacher/ Lecturer

ECF21401

**VI SEMESTER****DSE 4C: Elective: E-Commerce Technologies****Credit (L: T: P = 4: 0: 0)****Course Outcome:**

After successful completion of the course, the student is able to

CO1. Understand the details of E-Commerce

CO2. Learn the details of Basic Concepts Of Internet and WWW

CO3. Identify in depth Internet Security Methods

CO4. Learn in details with examples Concepts of Electronic Data Exchange and applications

CO5. Learn in details with examples Planning For E-Commerce

CO6. Understand in depth Features of Internet Marketing

**Unit - 1****15 Hours**

**An introduction to Electronic commerce:**What is E-Commerce (Introduction And Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, 9 Electronic Commerce and Electronic Business(C2C)(C2G,G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C)

**The Internet and WWW:**Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.) , Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner, Exchange, Shopping Bots.

**Unit - 2****15 Hours**

**Internet Security:** Internet Security Issues Overview –Computer Security Classifications- Intellectual Property threats- Threats to the security of client computers-Threats to the security of communication channels- Threats to the security of Server computers- digital Certificates

Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime( Laws , Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus(How it spreads, Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature( How it Works)

**Unit - 3****15 Hours**

**Electronic Data Exchange:**Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash. Online payment basics- Payment cards-E-cash-Holding Electronic cash: online and offline

Cash-Advantages and disadvantages of electronic cash system-electronic wallets-  
Microsoft.NET passport-yahoo Wallet-EGML standard-stored value cards-magnetic strip  
Cards-smart cards.

**Unit - 4****15 Hours**

**Planning for Electronic Commerce:** Planning Electronic Commerce initiates, linking objectives to business strategies, measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites.

**Internet Marketing:**The PROS and CONS of online shopping, The cons of online shopping, Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.

**Technologies for Electronic Commerce:** Web Server Hardware and Software- Web server Basics- Types of web sites- web clients and web servers-Software for Web servers-website and utility programs-Web server hardware-Web Hosting Choices.

**Reference Books:**

1. G.S.V.Murthy, E-Commerce Concepts, Models, Strategies- :- Himalaya Publishing House, 2011.
2. Kamlesh K Bajaj and DebjaniNag , E- Commerce , 2005.
3. Gray P. Schneider , Electronic commerce, International Student Edition, 2011,
4. HENRY CHAN, RAYMOND LEE, THARAM DILLON, ELIZABETH CHANG E COMMERCE, FUNDAMENTALS AND APPLICATIONS, Wiely Student Edition, 2011

**ECF21501****VI SEMESTER****DSE 4C: Elective: E-Commerce Technologies Lab****Credit (L: T: P = 0: 0: 2)**

Software Lab based on E-Commerce Technologies

E-commerce concepts are to be implemented in developing a website using a combination of following technologies:

1. HyperText Markup Language (HTML)
2. Cascading Style Sheets (CSS)
3. JavaScript
4. ASP
5. PHP
6. XML
7. Joomla

ECF22001

## VI SEMESTER

## DSE 5A: Cloud Computing

Credit (L: T: P = 4: 0: 0)

**Course Outcome**

After successful completion of the course, the student is able to

CO1. Learn in depth Fundamentals of Cloud Computing

CO2. Understand the details of Cloud Services and File System

CO3. Learn in depth Concept of Collaborating with Cloud

CO4. Understand the details of Virtualization in cloud

CO5. Learn the classification and characteristics of Security challenges in Cloud Computing

CO6. Specify the classification and characteristics of Security challenges in Cloud Computing

CO7. Understand the details of Security challenges in Cloud Computing

CO8. Understand the Common standards of Cloud Computing

CO9. Deliberate in details with examples Various Application of Cloud Computing

**Unit - 1****15 Hours**

**Cloud Introduction:** Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing , usage scenarios and Applications , Business models around Cloud– Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus - Open Nebula, CloudSim.

**Cloud Services and File System:** Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services.

**Unit - 2****15 Hours**

Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force.

**Collaborating With Cloud:** Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing, Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.

**Unit - 3****15 Hours**

**Virtualization For Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.

**Unit - 4****15 Hours**

**Security, Standards, And Applications:** Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium –The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud.

**Reference Books:**

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz “Cloud Computing” Wiley India Edition,2010
2. John Rittinghouse& James Ransome, “Cloud Computing Implementation Management and Strategy”, CRC Press, 2010
3. Antohy T Velte,Cloud Computing: “A Practical Approach”, McGraw Hill,2009
4. Michael Miller, Cloud Computing: “Web-Based Applications That Change the Way You Work and Collaborate Online”, Que Publishing, August 2008.
5. James E Smith, Ravi Nair, “Virtual Machines”, Morgan Kaufmann Publishers, 2006.

**Online Reading/Supporting Material**

1. Haley Beard, “Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing”, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008
2. Webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.pptop ennebula.org,
3. www.cloudbus.org/cloudsim/, <http://www.eucalyptus.com/>
4. [hadoop.apache.org](http://hadoop.apache.org)
5. [http://hadoop.apache.org/docs/stable/hdfs\\_design.html](http://hadoop.apache.org/docs/stable/hdfs_design.html)
6. [http://static.googleusercontent.com/external\\_content/untrusted\\_dlcp/research.google.com/en//archive/mapreduce-osdi04.pdf](http://static.googleusercontent.com/external_content/untrusted_dlcp/research.google.com/en//archive/mapreduce-osdi04.pdf)

**ECF22101****VI SEMESTER****DSE 5A: Cloud Computing Lab****Credit (L: T: P = 0: 0: 2)****Software Lab based on Cloud Computing:**

1. Create virtual machines that access different programs on same platform.
2. Create virtual machines that access different programs on different platforms.
3. Exploring Google cloud for the following
  - a) Storage
  - b) Sharing of data
  - c) Manage your calendar, to-do lists,
  - d) A document editing tool
4. Exploring Open source cloud (Any two)

ECF22201

**VI SEMESTER**  
**DSE 5B: Elective: Data Mining and Data Warehousing**  
**Credit (L: T: P = 4: 0: 0)**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Understand the characteristics of Data Warehousing
- CO2. Understand the details of Data Warehousing Architecture
- CO3. Deliberate in depth Data Mining
- CO4. Learn in details with examples Association Rule Mining
- CO5. Specify the details of Classification and Prediction Techniques
- CO6. Learn in depth Clustering Methods
- CO7. Write down in depth Application of Data Mining

**Unit - 1****15 Hours**

**Data Warehousing:** Introduction- Definition and description need for data ware housing need `for strategic information, failures of past decision support systems, OLTP v/s DWH- DWH requirements-trends in DWH-Application of DWH.

**Data Warehousing Architecture:** Reference architecture- Components of reference architecture - Data warehouse building blocks, implementation, physical design process and DWH deployment process.

**Unit - 2****15 Hours**

A Multidimensional Data, Model Data Warehouse Architecture.

**Data Mining:** Data mining tasks-Data mining vs KDD- Issues in data mining, Data Mining metrics, Data mining architecture - Data cleaning- Data transformation- Data reduction - Data mining primitives.

**Unit - 3****15 Hours**

**Association Rule Mining:** Introduction - Mining single dimensional Boolean association rules from transactional databases - Mining multi-dimensional association rules.

**Classification and Prediction:** Classification Techniques - Issues regarding classification and prediction - decision tree - Bayesian classification –Classifier accuracy.

**Unit - 4****15 Hours**

**Clustering:** Clustering Methods - Outlier analysis.

**Applications and Other Data Mining Methods:** Distributed and parallel Data Mining Algorithms, Text mining- Web mining.

**Reference Books:**

1. Jiawei Han and MichelineKamber,” Data Mining Concepts and Techniques”, Morgan Kaufmann Publishers, USA, 2006.
2. Berson,”DataWarehousing, Data Mining and OLAP”, Tata McGraw Hill Ltd, New Delhi, 2004.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, , Pearson Education.



4. Arun K Pujari, "Data mining techniques", Oxford University Press, London, 2003.
5. Dunham M H, "Data mining: Introductory and Advanced Topics". Pearson Education, New Delhi, 2003.
6. Mehmed Kantardzic, "Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003.
7. Soman K. P., Diwakar Shyam, Ajay V., Insight into Data mining: Theory and Practice, PHI 2006

**ECF22301****VI SEMESTER****DSE 5B: Elective: Data Mining and Data Warehousing Lab****Credit (L: T: P = 0: 0: 2)****Software Lab based on Data Mining:**

**Practical List:** Practical are to be done using Weka, and a report prepared as per the format\*. The operations are to be performed on built-in dummy data sets of weka and/or the downloadable datasets mentioned in references below. Also wherever applicable, the parameter values are to be varied (upto 3 distinct values). The 'Visualize' tab is to be explored with each operation.

1. Pre-processing: Apply the following filters –
  - a. weka>filter>supervised>attributed> AddClassification, AttributeSelection, Discretize, NominalToBinary
  - b. weka>filter>supervised>instance: StratifiedRemoveFolds, Resample
  - c. weka>filter>unsupervised>attribute>Add, AddExpression, AddNoise, Center, Discretize, MathExpression, MergeTwoValues, NominalToBinary, NominalToString, NormalizeNumericToBinary, NumericToNominal, NumericTransform, PrincipalComponent, RandomSubset, Remove, RemoveType, ReplaceMissingValues, Standardize
  - d. weka>filter>unsupervised>instance>Normalize, Randomize, Standardize, RemoveFrequentValues, RemoveWithValues, Resample, SubsetByExpression
2. Explore the 'select attribute' as follows  
weka>attributeSelection>, FilteredSubsetEval, WrapperSubsetEval
3. Association mining  
weka>associations>, Apriori, FPGrowth
4. Classification\*\*  
weka>classifiers>bayes>, NaïveBayes, weka>classifiers>lazy>: IB1, IBkweka>classifiers>trees, SimpleCart, RandomTree, ID3
5. Clustering\*\*  
weka>clusters>, SimpleKMeans, FarthestFirst algorithm, DBSCAN, hierarchicalClusterer

ECF22401

**VI SEMESTER****DSE 5C: Elective: Artificial Intelligence and Expert Systems****Credit (L: T: P = 4: 0: 0)****Course Outcome**

After successful completion of the course, the student is able to

- CO1. Deliberate in details with examples Artificial intelligence system
- CO2. Learn the characteristics of Concepts of Representation of knowledge
- CO3. Understand in details with examples Concepts of Representation of knowledge
- CO4. Understand the details of knowledge inference methods
- CO5. Understand in details with examples Concepts of Machine Learning Techniques
- CO6. Learn the details of Expert System

**Unit - 1****15 Hours**

**INTRODUCTION TO AI AND PRODUCTION SYSTEMS:** Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system-Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

**REPRESENTATION OF KNOWLEDGE:**Game playing - Knowledge representation, Knowledge representation using Predicate logic

**Unit - 2****15 Hours**

Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

**KNOWLEDGE INFERENCE:** Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster -Shafer theory.

**Unit - 3****15 Hours**

**PLANNING AND MACHINE LEARNING:** Basic plan generation systems - Strips - Advanced plan generation systems - Kstrips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

**Unit - 4****15 Hours**

**EXPERT SYSTEMS:** Expert systems - Architecture of expert systems, Roles of expert systems -Knowledge Acquisition -Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

**Reference Books:**

1. Kevin Night, Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, McGraw Hill- 2008. (Unit-1,2,4,5)
2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007. (Unit-III)
3. Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007.
4. Stuart Russel, Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.

**ECF22501****VI SEMESTER****DSE 5C: Elective: Artificial Intelligence and Expert Systems Lab****Credit (L: T: P = 0: 0: 2)**

1. Implement Breadth First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
2. Implement Depth First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
3. Implement Best First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
4. Implement Single Player Game (Using Heuristic Function)
5. Implement Two Player Game (Using Heuristic Function)
6. Implement A\* Algorithm
7. Implement Propositional calculus related problem
8. Implement First order propositional calculus related problem
9. Implement Certainty Factor problem
10. Implement Syntax Checking of English sentences-English Grammar
11. Develop an Expert system for Medical diagnosis.
12. Develop any Rule based system for an application of your choice.

**ECF23001****VI SEMESTER****DSE 6: Elective: Dissertation / Project**  
**Credit (L: T: P = 0: 0: 6) 12 Hours/Week****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Identify in details with examples Problem identification
- CO2. Write down in depth System Analysis
- CO3. Understand and Develop SRS for selected System Problem
- CO4. Understand and Develop System Design for selected System Problem
- CO5. Learn in details and Develop a Code and Test the System
- CO6. Understand the details of Presentation and Demo of Project Work

- ✓ This option is to be offered only in 6th Semester.
- ✓ The students will be allowed to work on any project based on the concepts studied in
- ✓ Core/elective or skill based elective courses.
- ✓ The group size should be maximum of THREE (03) students.
- ✓ Each group will be assigned a teacher as a supervisor who will handle both their theory as Well as lab classes.
- ✓ A maximum of Four (04) projects would be assigned to one teacher.

**ECF24101****VI SEMESTER****SEC 3A: Elective: AJAX****Credit (L: T: P = 0: 0: 2)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate in details with examples AJAX
- CO2. Learn the details of AJAX Overview
- CO3. Specify the details of Steps for Implementation of AJAX
- CO4. Learn the details of Design and use of AJAX

**Term work:** Design & Develop Small web application using AJAX

**Reference Books:**

1. Steven Holzner, “Ajax A Beginner’s Guide”, The McGraw-Hill Companies.
2. Edmond Woychowsky, “Ajax: Creating Web Pages with Asynchronous JavaScript and XML”, Pearson Education, Inc.
3. Thomas A. Powell, “Ajax: The Complete Reference”, McGraw-Hill Companies.

**ECF24301****VI SEMESTER****SEC 3B: Elective: Angular JS****Credit (L: T: P = 0: 0: 2)****Course Outcome:**

After successful completion of the course, the student is able to

- CO5. Deliberate in details with examples Angular JS
- CO6. Learn the details of Angular JS Overview
- CO7. Specify the details of Steps for Implementation of Angular JS
- CO8. Learn the details of Design and use of Angular JS

**Term work:** Design & Develop Small web application using AngularJS

**Reference Books:**

1. Valeri Karpov, Diego Netto, “Professional AngularJS”, WROX
2. Sheppard, Miller, Liptak, “Sams Teach Yourself-AngularJS for .NET Developer in 24 Hours”, Pearson Education India; First edition

**ECF24501**

**VI SEMESTER**

**SEC 3C: Elective: Wordpress**

**Credit (L: T: P = 0: 0: 2)**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate in details with examples Word press
- CO2. Learn the details of Word press Overview
- CO3. Specify the details of Steps for Implementation of Word press
- CO4. Learn the details of Design and use of Word press

**Term work:** Design & Develop Small Web Site using Word press

**Reference Books:**

1. Lisa Sabin-Wilson, Cory Miller, Kevin Palmer, Andrea Rennick, and Michael Torbert, "WordPress® All-in-One For Dummies®", Wiley Publishing, Inc.
2. Tris Hussey, "WordPress Absolute Beginner's Guide", Que Publishing

ECF25101

**VI SEMESTER****SEC 4A: Elective: Python Programming****Credit (L: T: P = 0: 0: 2)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn the details of Python Programming Structure
- CO2. Deliberate the characteristics of Python Programming
- CO3. Understand in details with examples - Python Programming Languages
- CO4. Specify in depth OOPs, Event Driven and GUI features in Python

**Software Lab using Python****Section: A (Simple programs)**

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria
  - Grade A: Percentage  $\geq 80$
  - Grade B: Percentage  $\geq 70$  and  $< 80$
  - Grade C: Percentage  $\geq 60$  and  $< 70$
  - Grade D: Percentage  $\geq 40$  and  $< 60$
  - Grade E: Percentage  $< 40$
3. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
4. WAP to display the first n terms of Fibonacci series.
5. WAP to find factorial of the given number
6. WAP to find sum of the following series for n terms:  $1 - 2/2! + 3/3! - \dots - n/n!$
7. WAP to calculate the sum and product of two compatible matrices.

**Section: B (Visual Python)**

All the programs should be written using user defined functions, wherever possible.

1. Write a menu-driven program to create mathematical 3D objects
  - I. Curve
  - II. Sphere
  - III. Cone
  - IV. Arrow
  - V. Ring
  - VI. Cylinder.
2. WAP to read n integers and display them as a histogram.
3. WAP to display sine, cosine, polynomial and exponential curves.

4. WAP to plot a graph of people with pulse rate  $p$  vs. height  $h$ . The values of  $p$  and  $h$  are to be entered by the user.
5. WAP to calculate the mass  $m$  in a chemical reaction. The mass  $m$  (in gms) disintegrates according to the formula  $m=60/(t:2)$ , where  $t$  is the time in hours. Sketch a graph for  $t$  vs.  $m$ , where  $t \geq 0$ .
6. A population of 1000 bacteria is introduced into a nutrient medium. The population  $p$  grows as follows:  
$$P(t) = (15000(1:t))/(15: e)$$
Where the time  $t$  is measured in hours. WAP to determine the size of the population at given time  $t$  and plot a graph for  $P$  vs  $t$  for the specified time interval.
7. Input initial velocity and acceleration, and plot the following graphs depicting equations of motion:
  - I. Velocity wrt time ( $v=u:at$ )
  - II. Distance wrt time ( $s=u*t:0.5*a*t*t$ )
  - III. Distance wrt velocity ( $s=(v*v-u*u)/2*a$ )

**Reference Books:**

1. P. K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. T. Budd, Exploring Python, TMH, 1st Ed, 2011
4. Python Tutorial/Documentation [www.python.org](http://www.python.org) 2010
5. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist : learning with Python, Freely available online. 2012



**ECF25301****VI SEMESTER****SEC 4B: Elective: R Programming****Credit (L: T: P = 0: 0: 2)****Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn the details of R Programming Structure
- CO2. Deliberate the characteristics of R Programming
- CO3. Understand in details with examples - R Programming Languages

**Software Lab Based on R Programming**

1. Write a program that prints 'Hello World' to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Write a function that tests whether a string is a palindrome.
7. Implement the following sorting algorithms: Selection sort, Insertion sort, Bubble Sort
8. Implement linear search.
9. Implement binary search.
10. Implement matrices addition, subtraction and Multiplication

**Reference Books:**

1. William N. Venables and David M. Smith, An Introduction to R. 2nd Edition. Network Theory Limited.2009
2. Norman Matloff, the Art of R Programming - A Tour of Statistical Software Design, No Starch Press.2011

**ECF25501**

**VI SEMESTER**

**SEC 4C: Elective: CodeIgniter**

**Credit (L: T: P = 0: 0: 2)**

**Course Outcome:**

After successful completion of the course, the student is able to

CO1. Learn the details of CodeIgniter - Application Development Framework

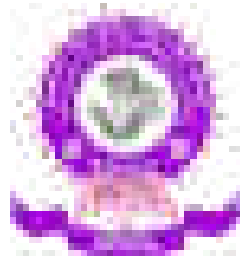
CO2. Deliberate the Features of CodeIgniter

**Term work:** Design & Develop Small web application using CodeIgniter framework

**Reference Books:**

<https://www.guru99.com/codeigniter-tutorial.html>

<https://www.javatpoint.com/codeigniter-preventing-enabling-from-csrf>



**JSS COLLEGE OF ARTS COMMERCE &  
SCIENCE**

**(Autonomous)**

**Ooty Road, Mysuru – 25**

**DEPARTMENT OF COMMERCE AND  
MANAGEMENT**

**B.COM Programme**

**( II & II Year)**

**Syllabus as per NEP**

**(Modified)**

**w.e.f**

**2023-24**

## B.Com. First & Second Semester Programme Structure

First Semester								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
1	Lang.1.1	Language - I	AECC	3+1+0	60	40	100	3
2	Lang.1.2	Language - II	AECC	3+1+0	60	40	100	3
3	B.Com.1.1	Financial Accounting	DSC-1	3+2+0	60	40	100	4
4	B.Com.1.2	Management Principles and Applications	DSC-2	4+0+0	60	40	100	4
5	B.Com.1.3	Principles of Marketing	DSC-3	4+0+0	60	40	100	4
6	B.Com.1.4	Digital Fluency	SEC-SB	1+0+2	60	40	100	2
7	B.Com.1.5	1.5 a. Accounting for Everyone or 1.5b. Financial Literacy	OEC	3+0+0	60	40	100	3
8	B.Com. 1.6	Yoga	SEC- VB	0+0+2	-	100	100	1
9	B.Com. 1.7	Health & Wellness	SEC - VB	0+0+2	-	100	100	1
<b>Total</b>					<b>420</b>	<b>480</b>	<b>900</b>	<b>25</b>

Second Semester								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L + T + P)	SEE	CIE	Total Marks	Credits
10	Lang.2.1	Language - I	AECC	3+1+0	60	40	100	3
11	Lang.2.2	Language - II	AECC	3+1+0	60	40	100	3
12	B.Com.2.1	Advanced Financial Accounting	DSC	3+2+0	60	40	100	4
14	B.Com.2.2	2.2a Business Mathematics or 2.2b Corporate Administration	DSC	3+2+0	60	40	100	4
15	B.Com.2.3	Law & Practice of Banking	DSC	4+0+0	60	40	100	4
16	B.Com.2.4	2.4a Health Wellness or 2.4b Social & Emotional Learning	SEC-VB	1+0+2	-	100	100	2
17	B.Com.2.5	Environmental Studies	AECC	2+0+0	60	40	100	2
18	B.Com.2.6	2.6a. Financial Environment or 2.6b. Investing in Stock Markets	OEC	3+0+0	60	40	100	3
<b>Total</b>					<b>420</b>	<b>380</b>	<b>800</b>	<b>25</b>

**B.Com.**

First Semester

**2023-24**

**Name of the Program:** Bachelor of Commerce (B.Com.)

**Course Code:** B.Com. 1.1

**Name of the Course:** Financial Accounting

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>

**Pedagogy:** Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- Understand the theoretical framework of accounting as well accounting standards.
- Demonstrate the preparation of financial statement of manufacturing and non-manufacturing entities of sole proprietors.
- Exercise the accounting treatments for consignment transactions & events in the books of consignor and consignee.
- Understand the accounting treatment for royalty transactions & articulate the Royalty agreements.
- Outline the emerging trends in the field of accounting.

**Syllabus:**

**Module No. 1: Theoretical Framework of Accounting** **10**

Introduction-Meaning and Scope of Accounting- Accounting Terminologies- Uses and Users of Accounting information-Accounting Process-Basis of Accounting: Cash and Accrual basis-Branches of Accounting-Accounting Principles-Concepts and Conventions-Accounting Standards-Indian Accounting Standards (IND AS).

**Module No. 2: Financial Statements of Sole Proprietors** **12**

Introduction-Meaning of Sole Proprietor-Financial Statements of Non-Manufacturing Entities: Trading Account-Income Statement/Profit & Loss Account-Balance Sheet; Financial Statements of Manufacturing Entities: Manufacturing Account-Trading Account-Profit & Loss account- Balance Sheet.

**Module No. 3: Consignment Accounts** **12**

Introduction-Meaning of Consignment-Consignment vs Sales-Pro-forma Invoice-Accounts Sales-Types Commission-Accounting for Consignment Transactions & Events in the books of Consignor and Consignee - Treatment of Normal & Abnormal Loss. -Valuation of Closing Stock-Goods sent at Cost Price and Invoice Price.

**Module No. 4: Royalty Accounts** **14**

Introduction-Meaning-Types of Royalty-Technical Terms: Lessee, Lessor, Minimum Rent – Short Workings –Recoupment of Short Working–Accounting Treatment in the books of Lessee and lessor – Journal Entries and Ledger Accounts including minimum rent account.

**Module No. 5: Emerging Trends in Accounting** **08**

Digital Transformation of Accounting-Big Data Analytics in Accounting-Cloud Computing in accounting- Accounting with drones- Forensic Accounting- Accounting for Planet-- Creative Accounting-Outsourced Accounting- Predictive Accounting (Theory Only).

**Skill Developments Activities:**

- Collect Annual Reports of sole proprietors and identify accounting concepts and conventions followed in the preparation of the annual reports.
- Collect Annual Reports of sole proprietors and identify the different components.
- Preparation of Proform invoice and accounts sales with imaginary figures.
- Collect Royalty Agreements and draft dummy royalty agreements with imaginary figures.

5. Identify latest innovations and developments in the field of accounting.
6. Any other activities, which are relevant to the course.

**Text Books:**

1. ICAI Study Materials on Principles & Practice of Accounting, Accounting and Advanced Accounting.
2. SP Iyengar (2005), Advanced Accounting, Sultan Chand & Sons, Vol. 1.
3. Robert N Anthony, David Hawkins, Kenneth A. Merchant, (2017) Accounting: Text and Cases, McGraw-Hill Education, 13<sup>th</sup> Edition.
4. Charles T. Horngren and Donna Philbrick, (2013) Introduction to Financial Accounting, Pearson Education, 11<sup>th</sup> Edition.
5. J.R. Monga, Financial Accounting: Concepts and Applications. Mayur Paper Backs, New Delhi, 32<sup>nd</sup> Edition.
6. S.N. Maheshwari, and. S. K. Maheshwari. Financial Accounting. Vikas Publishing House, New Delhi, 6<sup>th</sup> Edition.
7. B.S. Raman (2008), Financial Accounting Vol. I & II, United Publishers & Distributors
8. Compendium of Statements and Standards of Accounting. The Institute of Chartered Accountants of India, New Delhi.

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Commerce (B.Com.)

**Course Code:** B.Com. 1.2

**Name of the Course:** Management Principles and Applications

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- Understand and identify the different theories of organisations, which are relevant in the present context.
- Design and demonstrate the strategic plan for the attainment of organisational goals.
- Differentiate the different types of authority and chose the best one in the present context.
- Compare and chose the different types of motivation factors and leadership styles.
- Choose the best controlling techniques for better productivity of an organisation.

<b>Syllabus:</b>	<b>Hours</b>
<b>Module No. 1: Introduction to Management</b>	<b>12</b>
Introduction-Meaning and importance of Management-Managerial Functions- Essence of Mangership-Evolution of the Management thoughts: Classical organizational theories- Neo-Classical theories-Modern organizational theories.	
<b>Module No. 2: Planning</b>	<b>10</b>
Introduction-Meaning-Nature-Purpose-Types of plans-Planning process; Strategic planning: Concept-Process-Importance and Limitations; Environmental Analysis and diagnosis: Meaning-importance and Techniques (SWOT/TOWS/WOTS-UP-BCG Matrix-Competitor Analysis); Decision-making-Concept-Importance-Committee and Group decision making Process.	
<b>Module No. 3: Organizing</b>	<b>12</b>
Introduction-Meaning-Concept and Process of Organizing – An overview-Span of management-Different types of authority (line, staff and functional)-Decentralization-Delegation of authority; Formal and Informal Structure-Principles of Organizing; Network Organisation Structure.	
<b>Module No. 4: Staffing and Leading</b>	<b>12</b>
Introduction- <b>Staffing:</b> Concept of Staffing-Staffing Process; <b>Motivation:</b> Concept-Importance-extrinsic and intrinsic motivation-Major Motivation theories: Maslow’s Need-Hierarchy Theory-Hertzberg’s Two-factor Theory-Vroom’s Expectation Theory; <b>Leadership:</b> Concept- Importance-Major theories of Leadership (Likert’s scale theory, Blake and Mouten’s Managerial Grid theory, House’s Path Goal theory, Fred Fielder’s situational Leadership), Transactional leadership, Transformational Leadership, Transforming Leadership; <b>Communication:</b> Concept-purpose-process-Oral and written communication-Formal and informal communication networks-Barriers to communication-Overcoming barriers to communication.	
<b>Module No. 5: Controlling and Coordination</b>	<b>12</b>
<b>Control:</b> Concept-Process-Limitations-Principles of Effective Control-Major Techniques of control – Ratio Analysis, ROI, Budgetary Control, EVA, PERT/CPM, Emerging issues in Management; <b>Coordination:</b> Meaning-Nature-Importance-Principles of Coordination.	



**Skill Development Activities:**

1. Collect the photographs and bio-data of any three leading contributors of management thoughts.
2. Visit any business organisation and collect the information on types of planning adopted by them.
3. Visit any business organisation and collect different types of authority followed and also the draw the organizational structure.
4. Analyse the leadership styles of any select five companies of different sectors.
5. Visit any manufacturing firm and identify the controlling system followed.
6. Any other activities, which are relevant to the course.

**Text Books:**

1. Harold Koontz and Heinz Weihrich (2017), Essentials of Management: An International and Leadership Perspective, McGraw Hill Education, 10<sup>th</sup> Edition.
2. Stephen P Robbins and Madhushree Nanda Agrawal (2009), Fundamentals of Management: Essential Concepts and Applications, Pearson Education, 6<sup>th</sup> Edition.
3. James H. Donnelly, (1990) Fundamentals of Management, Pearson Education, 7<sup>th</sup> Edition.
4. B.P. Singh and A.K.Singh (2002), Essentials of Management, Excel Books
5. P C Tripathi & P N Reddy (2005), Principles of Management, TMH Publications, 3<sup>rd</sup> Edition.
6. Koontz Harold (2004), Essentials of Management, Tata McGraw Hill.

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Commerce (B.Com.)

**Course Code:** B.Com. 1.3

**Name of the Course:** Principles of Marketing

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	4 Hrs	56 Hrs

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- f) Understand the basic concepts of marketing and assess the marketing environment.
- g) Analyse the consumer behaviour in the present scenario and marketing segmentation.
- h) Discover the new product development & identify the factors affecting the price of a product in the present context.
- i) Judge the impact of promotional techniques on the customers & importance of channels of distribution.
- j) Outline the recent developments in the field of marketing.

**Syllabus:**

Module No. 1: Introduction to Marketing	Hours
12	

Introduction-Nature-Scope-Importance of Marketing; Concepts & Approaches of Marketing: Need-Want-Demand-Customer Value-Customer Creation; Evolution of marketing; Selling vs Marketing; Marketing Environment: Concept-importance-Micro and Macro Environment. Marketing Management-Meaning-importance.

Module No. 2: Consumer Behaviour & Market segmentation	Hours
12	

**Consumer Behaviour:** Nature and Importance-Consumer buying decision process; Factors influencing consumer buying behaviour; **Market segmentation:** Concept, importance and bases; Target market selection-Positioning concept-Importance and bases; Product differentiation vs. market segmentation. **Marketing Mix:** Product-Price-Place & Promotion.

Module No. 3: Product and Pricing	Hours
12	

**Product:** Concept and importance-Product classifications-Concept of product mix; Branding-packaging and labelling; Product-Support Services; Product life-cycle; New Product Development Process; Consumer adoption process. **Pricing:** Significance. Factors affecting price of a product. Pricing policies and strategies.

Module No. 4: Promotion and Distribution	Hours
12	

**Promotion:** Nature and importance of promotion; Communication process; Types of promotion: advertising, personal selling, public relations & sales promotion, and their distinctive characteristics; Promotion mix and factors affecting promotion mix decisions. **Distribution Channels and Physical Distribution:** Channels of distribution - meaning and importance; Types of distribution channels; Functions of middle man; Factors affecting choice of distribution channel; Wholesaling and retailing; Types of Retailers; e-retailing, Physical Distribution.

Module No. 5: Recent Developments in Marketing	Hours
08	

Social Marketing, online marketing, direct marketing, services marketing, green marketing, Rural marketing; Consumerism, Search Engine Marketing-Mobile Marketing- Marketing Analytics-Social Media Marketing-Email Marketing-Live Video Streaming Marketing-Network Marketing, any other recent developments in Marketing.

**Skill Development Activities:**

1. Analyse the marketing environment of your locality and identify need, wants & purchasing power of customers.

2. Collect consumer behaviour towards home appliances in your locality.
3. Visit any organisation and collect the information towards pricing of the products.
4. Visit any wholesalers/Retailers, collect the role of them in marketing.
5. Identify the recent developments in the field of marketing.
6. Any other activities, which are relevant to the course.

**Reference Materials:**

1. Philip Kotler (2015), Principles of Marketing. 13th edition. Pearson Education.
2. Saxena Rajan, (2017) Marketing Management, Tata McGraw-Hill Publishing Company Ltd., New Delhi. Fifth Edition.
3. Kumar Arun & MeenakshiN (2016), Marketing Management, Vikas Publishing House Pvt. Ltd., New Delhi. Third Edition
4. Panda Tapan (2008), Marketing Management, Excel books, New Delhi, Second Edition.
5. Michael, J. Etzel, Bruce J. Walker, William J Stanton and Ajay Pandit. Marketing: Concepts and Cases. (Special Indian Edition)., McGraw Hill Education
6. William D. Perreault, and McCarthy, E. Jerome., Basic Marketing. Pearson Education.
7. Majaro, Simon. The Essence of Marketing. Pearson Education, New Delhi.
8. Iacobucci and Kapoor, Marketing Management: A South Asian Perspective. Cengage Learning.
9. Chhabra, T.N., and S. K. Grover. Marketing Management. Fourth Edition.

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Commerce (B.Com)

**Course Code:** B.Com. 1.5 (Open Elective Course)

**Name of the Course:** Accounting for Everyone

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	42 Hrs

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- k) Analyse various terms used in accounting;
- l) Make accounting entries and prepare cash book and other accounts necessary while running a business;
- m) Prepare accounting equation of various business transactions;
- n) Analyse information from company's annual report;
- o) Comprehend the management reports of the company.

**Syllabus:**

**Module No. 1: Introduction to Accounting** **08**

Meaning, Importance and Need, Its objectives and relevance to business establishments and other organizations, and individuals. Accounting information: meaning, users and utilities, sources of accounting information. Some Basic Terms – Transaction, Account, Asset, Liability, Capital, Expenditure & Expense, Income, Revenue, Gain, Profit, Surplus, Loss, Deficit. Debit, Credit, Accounting Year, Financial Year.

**Module No. 2: Transactions and Recording of Transactions** **08**

Features of recordable transactions and events, Basis of recording – vouchers and another basis. Recording of transactions: Personal account, Real Account and Nominal Account; Rules for Debit and Credit; Double Entry System, journalizing transactions; Preparation of Ledger, Cash Book including bank transactions. (Simple Problems)

**Module No. 3: Preparation of Financial Statements** **10**

Fundamental Accounting Equation; Concept of revenue and Capital; Preparation of financial statements. (Simple problems)

**Module No. 4: Company Accounts** **08**

Explanation of certain terms – Public Limited Company, Private Limited Company, Share, Share Capital, Shareholder, Board of Directors, Stock Exchange, Listed Company, Share Price, Sensex - BSE, NSE; Annual report, etc. Contents and disclosures in Annual Report, Company Balance Sheet and Statement of Profit and Loss. Content Analysis based on annual report including textual analysis.

**Module 5: Management Reports** **08**

Reports on Management Review and Governance; Report of Board of Directors - Management discussion analysis- Annual Report on CSR – Business responsibility report – Corporate governance report – Secretarial audit report.

**Skill Development Activities:**

1. Download annual reports of business Organisations from the websites and go through the contents of the annual report and present the salient features of the annual report using some ratios and content analysis including textual analysis.
2. Prepare accounting equation by collecting necessary data from medium sized firm.
3. Prepare financial statements collecting necessary data from small business firms.
4. Collect the management reports of any large scale organisation and analyse the same.
5. Any other activities, which are relevant to the course.

**Text Books:**

1. Hatfield, L. (2019). Accounting Basics. Amazon Digital Services LLC.
2. Horngren, C. T., Sundem, G. L., Elliott, J. A., & Philbrick, D. (2013). Introduction to Financial Accounting. London: Pearson Education.
3. Siddiqui, S. A. (2008). Book Keeping & Accountancy. New Delhi: Laxmi Publications Pvt. Ltd.
4. Sehgal, D. (2014). Financial Accounting. New Delhi: Vikas Publishing House Pvt. Ltd.
5. Tulsian, P. C. (2007). Financial Accounting. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
6. Mukharji, A., & Hanif, M. (2015). Financial Accounting. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
7. Maheshwari, S. N., Maheshwari, S. K., & Maheshwari, S. K. (2018). Financial Accounting. New Delhi: Vikas Publishing House Pvt. Ltd.
8. Khan, M.Y. and Jain, P.K. Management Accounting. McGraw Hill Education.
9. Arora, M.N. Management Accounting, Vikas Publishing House, New Delhi

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Commerce (B.Com)

**Course Code:** B.Com. 1.5 (Open Elective Course)

**Name of the Course:** Financial Literacy

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

1. Describe the importance of financial literacy and list out the institutions providing financial services;
2. Prepare financial plan and budget and manage personal finances;
3. Open, avail, and manage/operate services offered by banks;
4. Open, avail, and manage/operate services offered by post offices;
5. Plan for life insurance and property insurance & select instrument for investment in shares

**Syllabus:**

**Hours**

**Module No. 1: Introduction**

**07**

Meaning, importance and scope of financial literacy; Prerequisites of Financial Literacy – level of education, numerical and communication ability; Various financial institutions – Banks, Insurance companies, Post Offices; Mobile App based services. Need of availing of financial services from banks, insurance companies and postal services.

**Module No. 2: Financial Planning and Budgeting**

**07**

Concept of economic wants and means for satisfying these needs; Balancing between economic wants and resources; Meaning, importance and need for financial planning; Personal Budget, Family Budget, Business Budget and National Budget; Procedure for financial planning and preparing budget; Budget surplus and Budget deficit, avenues for savings from surplus, sources for meeting deficit.

**Module No. 3: Banking Services**

**10**

Types of banks; Banking products and services – Various services offered by banks; Types of bank deposit accounts – Savings Bank Account, Term Deposit, Current Account, Recurring Deposit, PPF, NSC etc.; Formalities to open various types of bank accounts, PAN Card, Address proof, KYC norm; Various types of loans – short term, medium term, long term, micro finance, agricultural etc. and related interest rates offered by various nationalized banks and post office; Cashless banking, e-banking, Check Counterfeit Currency; CIBIL, ATM, Debit and Credit Card, and APP based Payment system; Banking complaints and Ombudsman.

**Module No. 4: Financial Services from Post Office**

**08**

Post office Savings Schemes: Savings Bank, Recurring Deposit, Term Deposit, Monthly Income Scheme, Kishan Vikas Patra, NSC, PPF, Senior Citizen Savings Scheme (SCSS), Sukanya Samridhi Yojana/ Account (SSY/SSA); India Post Payments Bank (IPPB). Money Transfer: Money Order, E-Money order. Instant Money Order, collaboration with the Western Union Financial Services; MO Videsh, International Money Transfer Service, Electronic Clearance Services (ECS), Money gram International Money Transfer, Indian Postal Order (IPO).

**Module 5: Protection and Investment Related Financial Services**

**10**

**Insurance Services:** Life Insurance Policies: Life Insurance, Term Life Insurance, Endowment Policies, Pension Policies, ULIP, Health Insurance and its Plans, Comparison of

policies offered by various life insurance companies. Property Insurance: Policies offered by various general insurance companies. Post office life Insurance Schemes: Postal Life Insurance and Rural Postal Life Insurance (PLI/RPLI). Housing Loans: Institutions providing housing loans, Loans under Pradhanmantri Awas Yojana – Rural and Urban.

**Investment avenues in Equity and Debt Instruments:** Portfolio Management: Meaning and importance; Share Market and Debt Market, Sensex and its significance; Investment in Shares – selection procedure for investment in shares; Risk element; Investment Management - Services from brokers and Institutions, and self-management; Mutual Fund.

**Skill Development Activities:**

1. Visit banks, post offices, and insurance companies to collect information and required documents related to the services offered by these institutions and to know the procedure of availing of these services.
2. Fill up the forms to open accounts and to avail loans and shall attach photocopies of necessary documents.
3. Prepare personal and family budget for one/six/ twelve month on imaginary figures.
4. Try to open Demat account and trade for small amount and submit the report on procedure on opening of Demat account and factors considered for trading.
5. Any other activities, which are relevant to the course.

**Text Books:**

1. Avadhani, V. A. (2019). Investment Management. Mumbai: Himalaya Publishing House Pvt. Ltd.
2. Chandra, P. (2012). Investment Game: How to Win. New Delhi: Tata McGraw Hill Education.
3. Kothari, R. (2010). Financial Services in India-Concept and Application. New Delhi: Sage Publications India Pvt. Ltd.
4. Milling, B. E. (2003). The Basics of Finance: Financial Tools for Non-Financial Managers. Indiana: universe Company.
5. Mitra, S., Rai, S. K., Sahu, A. P., & Starn, H. J. (2015). Financial Planning. New Delhi: Sage Publications India Pvt. Ltd.
6. Zokaityte, A. (2017). Financial Literacy Education. London: Palgrave Macmillan.

**Note: Latest edition of text books may be used.**

**B.Com.**

Second Semester

**2023-24**



**Name of the Program:** Bachelor of Commerce (B.Com.)

**Course Code:** B.Com. 2.1

**Name of the Course:** Advanced Financial Accounting

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>

**Pedagogy:** Classrooms lecture, Case studies, Tutorial classes, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- p) Understand & compute the amount of claims for loss of stock & loss of Profit.
- q) Learn various methods of accounting for hire purchase transactions.
- r) Deal with the inter-departmental transfers and their accounting treatment.
- s) Demonstrate various accounting treatments for dependent & independent branches.
- t) Prepare financial statements from incomplete records.

<b>Syllabus:</b>	<b>Hours</b>
<b>Module No. 1: Insurance Claims for Loss of Stock &amp; Loss of Profit</b>	<b>10</b>
Introduction-Meaning of fire-computation of Claim for loss of stock- Computations of Claim for loss of Profit-Average Clause.	
<b>Module No. 2: Hire Purchase Accounting</b>	<b>10</b>
Introduction-Meaning of hire purchase-difference between hire purchase and instalment-Nature-features-terms used-Ascertainment of Interest-Accounting for hire purchase transactions-Repossession.	
<b>Module No. 3: Departmental Accounts</b>	<b>12</b>
Introduction-meaning-advantages and disadvantages-methods of departmental accounting-basis of allocation of common expenditure among different departments-types of departments-inter department transfer and its treatment	
<b>Module No. 4: Accounting for Branches</b>	<b>12</b>
Introduction-difference between branch accounts and departmental accounts-types of branches-Accounting for dependent & independent branches; Foreign branches: Accounts for foreign branches-Techniques for foreign currency translation. (Theory only).	
<b>Module No. 5: Conversion of Single Entry into Double Entry</b>	<b>12</b>
Introduction - Meaning-Limitations of Single Entry System-Difference between Single entry and Double entry system - Problems on Conversion of Single Entry into Double Entry.	
<b>Skill Developments Activities:</b>	
7. Identify the procedure & documentations involved in the insurance claims.	
8. Collect hire purchase agreements and draft dummy hire purchase agreements with imaginary figures.	
9. Identify the common expenditures of an organisation among various departments.	
10. Collect the procedure and documentations involved in the establishment of various branches.	
11. Visit any sole proprietor firm and identify the steps involved in the conversion of single entry into double entry system.	
12. Any other activities, which are relevant to the course.	
<b>Text Books:</b>	
1. ICAI Study Materials on Principles & Practice of Accounting, Accounting and Advanced Accounting.	

2. SP Iyengar (2005), Advanced Accounting, Sultan Chand & Sons, Vol. 1.
3. Robert N Anthony, David Hawkins, Kenneth A. Merchant, (2017) Accounting: Text and Cases, McGraw-Hill Education, 13<sup>th</sup> Edition.
4. Charles T. Horngren and Donna Philbrick, (2013) Introduction to Financial Accounting, Pearson Education, 11<sup>th</sup> Edition.
5. J.R. Monga, Financial Accounting: Concepts and Applications. Mayur Paper Backs, New Delhi, 32<sup>nd</sup> Edition.
6. S.N. Maheshwari, and. S. K. Maheshwari. Financial Accounting. Vikas Publishing House, New Delhi, 6<sup>th</sup> Edition.
7. B.S. Raman (2008), Financial Accounting Vol. I & II, United Publishers & Distributors
8. Compendium of Statements and Standards of Accounting. The Institute of Chartered Accountants of India, New Delhi.

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Commerce (B.Com.)

**Course Code:** B.Com. 2.2a

**Name of the Course:** Business Mathematics

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>

**Pedagogy:** Classrooms lecture, Case studies, Tutorial classes, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- a) Understand the number system and indices applications in solving basic business problems.
- b) Apply concept of commercial arithmetic concepts to solve business problems.
- c) Make use of theory of equation in solving the business problems in the present context.
- d) Understand and apply the concepts of Set Theory, Permutations & Combinations and Matrices solving business problems.
- e) Apply measurement of solids in solving simple business problems.

**Syllabus:**

**Module No. 1: Number System and Indices** **Hours 12**

Introduction - Meaning - Natural Numbers - Even & Odd Numbers - Prime, Rational Number and its features & Irrational Numbers - simple problems on finding sum of natural, Odd and Even numbers- HCF and LCM, problems thereon; Indices-Introduction, Laws of indices, application of laws for simplification, simple problems.

**Module No. 2: Commercial Mathematics** **Hours 10**

Introduction - Meaning of Simple and Compound interest and problems thereon,- Annuities, types & problems on present and future value of annuity; Ratios and Proportions-meaning and problems thereon-problems on speed, time and work.

**Module No. 3: Theory of Equation** **Hours 12**

Introduction - Meaning-Problems on Linear equations and solving pure and adfected quadratic equations (factor and Sridharacharya methods only), problems on Simultaneous equations (Elimination method only).

**Module No. 4: Set Theory, Permutations & Combinations and Matrices** **Hours 12**

Introduction - Meaning & types of sets-Laws of Sets-Venn diagram-problems thereon; Meaning and problems on permutations and combinations; Matrices-Meaning & types of Matrices, simple problems on addition, subtraction and multiplication.

**Module No. 5: Measurement of Solids** **Hours 10**

Introduction - Meaning and problems on Area and perimeter/circumference of Triangle, Square, Rectangle, Circle, Cone and Cylinder.

**Skill Developments Activities:**

1. Show the number of ways in which your telephone number can be arranged to get odd numbers.
2. Visit any Commercial Bank in your area and collect the information about types of loans and the rates of interest on loans.
3. Use Matrix principles to implement food requirement and protein for two families.
4. Measure your classroom with the help of a tape and find the cost of the carpet for the floor area of the classroom.
5. Any other activities, which are relevant to the course.

**Text Books:**

1. Saha and Rama Rao, Business Mathematics, HPH.
2. S.N.Dorairaj, Business Mathematics, United Publication.
3. R. Gupta, Mathematics for Cost Accountants.
4. S. P. Gupta, Business Mathematics.
5. Madappa and Sridhara Rao, Business Mathematics.
6. Padmalochana Hazarika, Business Mathematics.
7. Dr.B.H.Suresh, Quantitative Techniques, Chetana Book House.
8. Dr. Padmalochan Hazarika, A Textbook of Business Mathematics, S. Chand, NewDelhi, No. 4, 2016.
9. A. P. Verma, Business Mathematics, Asian Books Private Limited, New Delhi, No. 3, January 2007.
10. D. C. Sancheti & V. K. Kapoor, Business

**Name of the Program:** Bachelor of Commerce (B.Com.)

**Course Code:** B.Com. 2.2b

**Name of the Course:** Corporate Administration

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- u) Understand the framework of Companies Act of 2013 and different kind of companies.
- v) Identify the stages and documents involved in the formation of companies in India.
- w) Analyse the role, responsibilities and functions of Key management Personnel in Corporate Administration.
- x) Examine the procedure involved in the corporate meeting and the role of company secretary in the meeting.
- y) Evaluate the role of liquidator in the process of winding up of the company.

<b>Syllabus:</b>	<b>Hours</b>
<b>Module No. 1: Introduction to Company</b>	<b>12</b>
Introduction - Meaning and Definition – Features – Highlights of Companies Act 2013 - - Kinds of Companies – One Person Company-Private Company-Public Company- Company limited by Guarantee-Company limited by Shares- Holding Company- Subsidiary Company-Government Company-Associate Company- Small Company- Foreign Company-Global Company-Body Corporate-Listed Company.	
<b>Module No. 2: Formation of Companies</b>	<b>12</b>
Introduction - <b>Promotion Stage:</b> Meaning of Promoter, Position of Promoter & Functions of Promoter, <b>Incorporation Stage:</b> Meaning & contents of Memorandum of Association & Articles of Association, Distinction between Memorandum of Association and Articles of Association, Certificate of Incorporation, <b>Subscription Stage</b> – Meaning & contents of Prospectus, Statement in lieu of Prospects and Book Building, <b>Commencement Stage</b> – Document to be filed, e-filing, Register of Companies, Certificate of Commencement of Business; Formation of Global Companies: Meaning – Types –Features – Legal Formalities– Administration.	
<b>Module No. 3: Company Administration</b>	<b>12</b>
Introduction - Key Managerial Personnel – Managing Director, Whole time Directors, the Companies Secretary, Chief Financial Officer, Resident Director, Independent Director, Auditors – Appointment – Powers - Duties & Responsibilities. Managing Director – Appointment – Powers – Duties & Responsibilities. Audit Committee, CSR Committee. Company Secretary - Meaning, Types, Qualification, Appointment, Position, Rights, Duties, Liabilities & Removal or dismissal.	
<b>Module No. 4: Corporate Meetings</b>	<b>10</b>
Introduction - Corporate meetings: types – Importance - Distinction; Resolutions: Types – Distinction; Requisites of a valid meeting – Notice – Quorum –Proxies - Voting - Registration of resolutions; Role of a company secretary in convening the meetings.	
<b>Module No. 5: Winding Up</b>	<b>10</b>
Introduction – Meaning- Modes of Winding up –Consequence of Winding up – Official Liquidator – Role & Responsibilities of Liquidator – Defunct Company – Insolvency Code.	
<b>Skill Development Activities:</b>	
1. Collect the Companies Act 2013 from the Ministry of Corporate Affairs website and	

- prepare the highlights of the same.
2. Visit any Registrar of the Companies, find out the procedure involved in the formation of the companies.
  3. Visit any Company and discuss with Directors of the same on role and responsibilities and prepare report on the same.
  4. Collect the copy of notice of the Meeting and Resolutions, Prepare the dummy copy of Notice and resolutions.
  5. Contact any official liquidator of an organisation and discuss the procedure involved on the same and prepare report.
  6. Any other activities, which are relevant to the course.

**Text Books:**

9. S.N Maheshwari, Elements of Corporate Law, HPH.
10. Balchandran, Business Law for Management, HPH
11. Dr. P.N. Reddy and H.R. Appanaiah, Essentials of Company Law and Secretarial Practice, HPH.
12. K. Venkataramana, Corporate Administration, SHBP.
13. N.D. Kapoor: Company Law and Secretarial Practice, Sultan Chand.
14. M.C. Bhandari, Guide to Company Law Procedures, Wadhwa Publication.
15. S.C. Kuchal, Company Law and Secretarial Practice.
16. S.C. Sharm, Business Law, I.K. International Publishers

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Commerce (B.Com.)

**Course Code:** B.Com. 2.3

**Name of the Course:** Law and Practice of Banking

<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- z) Summarize the relationship between Banker & customer and different types of functions of banker.
- aa) Analyse the role, functions and duties of paying and collecting banker.
- bb) Make use of the procedure involved in opening and operating different accounts.
- cc) Examine the different types of negotiable instrument & their relevance in the present context.
- dd) Estimate possible developments in the banking sector in the upcoming days.

<b>Syllabus:</b>	<b>Hours</b>
<b>Module No. 1: Introduction to Banking</b>	<b>12</b>
Introduction- Meaning – Need – Importance – Primary, Secondary & Modern functions of banks - Origin of banking- Banker and Customer Relationship (General and special relationship) - Origin and growth of commercial banks in India – Types of Banks in India- Banks' Lending - changing role of commercial banks. RBI: History-Role & Functions.	
<b>Module No. 2: Paying and Collecting Banker</b>	<b>12</b>
<b>Paying banker:</b> Introduction - Meaning – Role – Functions - Duties - Precautions and Statutory Protection and rights - Dishonor of Cheques – Grounds of Dishonor – Consequences of wrongful dishonor of Cheques; <b>Collecting Banker:</b> Introduction - Meaning – Legal status of collecting banker - Holder for value -Holder in due course – Duties & Responsibilities - Precautions and Statutory Protection to Collecting Banker.	
<b>Module No. 3: Customers and Account Holders</b>	<b>10</b>
Introduction - Types of Customers and Account Holders - Procedure and Practice in opening and operating accounts of different customers: Minors - Joint Account Holders- Partnership Firms - Joint Stock companies - Executors and Trustees - Clubs and Associations and Joint Hindu Undivided Family.	
<b>Module No. 4: Negotiable Instruments</b>	<b>12</b>
Introduction – Meaning & Definition – Features – Kinds of Negotiable Instruments: Promissory Notes - Bills of Exchange - Cheques - Crossing of Cheques – Types of Crossing; Endorsements: Introduction - Meaning - Essentials & Kinds of Endorsement – Rules of endorsement.	
<b>Module No. 5: Recent Developments in Banking</b>	<b>10</b>
Introduction - New technology in Banking – E-services – Debit and Credit cards - Internet Banking-Electronic Fund Transfer- MICR – RTGS - NEFT –ECS- Small banks-Payment banks-Digital Wallet-Crypto currency- KYC norms – Basel Norms - Mobile banking-E- payments - E-money. Any other recent development in the banking sector.	
<b>Skill Development Activities:</b>	
<ol style="list-style-type: none"><li>1. Refer RBI website and identify the different types of banks operating in India.</li><li>2. Visit any Public sector bank &amp; discuss with the branch manager about the role and functions as a paying and collecting banker.</li><li>3. Collect and fill dummy account opening forms as different types of customer.</li><li>4. Draft specimen of Negotiable instruments: bill of exchange, Promissory Notes and Cheques.</li></ol>	

5. Identify and prepare report on pros and cons of recent development in the field of banking sector.
6. Any other activities, which are relevant to the course.

**Text Books:**

17. Gordon & Natarajan, Banking Theory Law and Practice, HPH, 24<sup>th</sup> Edition
18. S. P Srivastava ( 2016), Banking Theory & Practice, Anmol Publications
19. Maheshwari. S.N. (2014), Banking Law and Practice, Kalyani Publishers, 11 edition
20. Shekar. K.C (2013), Banking Theory Law and Practice, Vikas Publication, 21<sup>st</sup> Edition.
21. Dr. Alice Mani (2015), Banking Law and Operation, SBH.

**Note: Latest edition of text books may be used.**



**Name of the Program:** Bachelor of Commerce (B.Com)

**Course Code:** B.Com. 2.6a (Open Elective Course)

**Name of the Course:** Financial Environment

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	42 Hrs

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes: On successful completion of the course, the Students will be able to**

- ee) Understand the fundamentals of Indian Economy and its significance.
- ff) Evaluate the impact of monetary policy on the stakeholders of the Economy.
- gg) Assess the impact of fiscal policy on the stakeholders of the Economy.
- hh) Examine the status of inflation, unemployment and labour market in India
- ii) Infer the financial sector reforms in India.

**Syllabus:**

**Hours**

**Module No. 1: Fundamentals of India Economy**

**10**

Introduction - Production & Cost-Demand & Supply-Perfect & Imperfect Competition-Monopoly-National Income Accounting-Business Cycle-Open Economy-Utility theory-GDP-GNP-impact- other Macro financial indicators.

**Module No. 2: Monetary Policy**

**08**

Introduction - Meaning-objectives-qualitative & quantitative measures for credit control. Influence of policy rates of RBI: Repo-Reverse repo- Marginal standing facility and Bank rate. Influence of reserve ratios of RBI: CRR-SLR-Exchange rates-lending/deposit rates-design & issues of monetary policy-LAF - RBI Role, functions and its Governance

**Module No. 3: Fiscal Policy**

**08**

Introduction - Meanings-objectives- public expenditure-public debt-fiscal & budget deficit-Keynesian approach-fiscal policy tools-fiscal policy effects on employment-supply side approach-design & issues of fiscal policy-fiscal budget- Role of Ministry of Finance in Fiscal Policy.

**Module No. 4: Inflation, Unemployment and Labour market**

**08**

Introduction - **Inflation:** Causes of rising & falling inflation-inflation and interest rates-social costs of inflation; **Unemployment** – natural rate of unemployment-frictional & wait unemployment. **Labour market** and its interaction with production system; Phillips curve-the trade-off between inflation and unemployment-sacrifice ratio-role of expectations adaptive and rational

**Module 5: Financial Sector Reforms:**

**08**

Introduction - Financial sector reforms - Recommendation & action taken -SARFESI Act-Narasimham Committee I & II- Kelkar Committee- FRBM Act - Basel-BIS-history-need- mission-objectives-Basel norms I, II & III- criticism of Basel norms-Implementations of Basel norms in India- impact of Basel norms on Indian banks.

**Skill Development Activities:**

1. Collect last ten year GDP rate and examine the same.
2. Collect last two years monetary policy rates of RBI and analyse the impact of the

same.

3. Collect last five years fiscal policy of Indian Government and analyse the impact of the same on rural poor.
4. Collect last five year data on inflation, unemployment rate and labour market conditions and critically prepare the report.
5. Identify the recent financial sector reforms in India.
6. Any other activities, which are relevant to the course.

**Text Books:**

1. V K Puri and S K Mishra, Indian Economy, HPH.
2. Datt and Sundharam's, Indian Economy, S Chand
3. Ramesh Singh, Indian Economy, McGraw Hill education.
4. Khan and Jain, Financial Services, Mcgraw Hill Education, 8th edition
5. RBI working papers
6. Mistry of Finance, GOI of working papers
7. SEBI Guidelines Issued from time to time.

**Note: Latest edition of text books may be used.**

**Name of the Program:** Bachelor of Commerce (B.Com)

**Course Code:** B.Com. 2.6b (Open Elective Course)

**Name of the Course:** Investing in Stock Markets

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
3 Credits	3 Hrs	42 Hrs

**Pedagogy:** Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

**Course Outcomes:** On successful completion of the course, the Students will be able to

jj) Explain the basics of investing in the stock market, the investment environment as well as risk & return;

kk) Analyse Indian securities market;

ll) Examine EIC framework and conduct fundamental analysis;

mm) Perform technical analysis;

nn) Invest in mutual funds market.

Syllabus:	Hours
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<b>Module No. 1: Basics of Investing</b>	<b>10</b>
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Basics of Investment & Investment Environment. Risk and Return, Avenues of Investment - Equity shares, Preference shares, Bonds & Debentures, Insurance Schemes, Mutual Funds, Index Funds. Indian Security Markets - Primary Market, Secondary Market and Derivative Market. Responsible Investment.

<b>Module No. 2: Fundamental Analysis</b>	<b>08</b>
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Top down and bottom up approaches, Analysis of international & domestic economic scenario, Industry analysis, Company analysis (Quality of management, financial analysis: Both Annual and Quarterly, Income statement analysis, position statement analysis including key financial ratios, Cash flow statement analysis, Industry market ratios: PE, PEG, Price over sales, Price over book value, EVA), Understanding Shareholding pattern of the company.

<b>Module No. 3: Technical Analysis</b>	<b>08</b>
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Trading rules (credit balance theory, confidence index, filter rules, market breath, advances vs declines and charting (use of historic prices, simple moving average and MACD) basic and advanced interactive charts. Do's & Don'ts of investing in markets.

<b>Module No. 4: Indian Stock Market</b>	<b>08</b>
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Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India- BSE, NSE and MCX. Security Market Indices: Nifty, Sensex and Sectoral indices, Sources of financial information. Trading in securities: Demat trading, types of orders, using brokerage and analyst recommendations

<b>Module 5: Investing in Mutual Funds</b>	<b>08</b>
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Concept and background on Mutual Funds: Advantages, Disadvantages of investing in Mutual Funds, Types of Mutual funds- Open ended, close ended, equity, debt, hybrid, index funds and money market funds. Factors affecting choice of mutual funds. CRISIL mutual fund ranking and its usage, calculation and use of Net Asset Value.

**Skill Development Activities:**

1. Work on the spreadsheet for doing basic calculations in finance.
2. Learners will also practice technical analysis with the help of relevant software.
3. Practice use of Technical charts in predicting price movements through line chart, bar chart, candle and stick chart, etc., moving averages, exponential moving average.
4. Calculate of risk and return of stocks using price history available on NSE website.
5. Prepare equity research report-use of spreadsheets in valuation of securities,

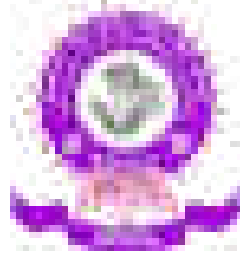
fundamental analysis of securities with the help of qualitative and quantitative data available in respect of companies on various financial websites, etc.

6. Any other activities, which are relevant to the course.

**Text Books:**

1. Chandra, P. (2017). Investment Analysis and Portfolio Management. New Delhi: Tata McGraw Hill Education.
2. Kevin, S. (2015). Security Analysis and Portfolio Management. Delhi: PHI Learning. Ranganatham,
3. M., & Madhumathi, R. (2012). Security Analysis and Portfolio Management. Uttar Pradesh: Pearson (India) Education.
4. Pandian, P. (2012). Security Analysis and Portfolio Management. New Delhi: Vikas Publishing House.

**Note: Latest edition of text books may be used.**



**JSS COLLEGE OF ARTS COMMERCE &  
SCIENCE**

**(Autonomous)**

**Ooty Road, Mysuru – 25**

**DEPARTMENT OF COMMERCE AND  
MANAGEMENT**

**B.COM Programme**

**( II Year)**

**Syllabus as per NEP**

**(Modified)**

**w.e.f**

**2023-24**

III Semester B.Com								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L+T+P)	SEE	CIE	Total Marks	Credits
16	Lang.1.1	Language-I	AECC	3+1+0	60	40	100	3
17	Lang.1.2	Language-II	AECC	3+1+0	60	40	100	3
18	B.Com.3.1	Corporate Accounting	DSC	3+0+2	60	40	100	4
19	B.Com.3.2	Business Statistics	DSC	3+0+2	60	40	100	4
20	B.Com.3.3	Cost Accounting	DSC	3+0+2	60	40	100	4
21	B.Com.3.4	Artificial Intelligence OR Financial Education. & Investment Awareness	SEC	1+0+2	60	40	100	2
23	B.Com.3.5	India and Indian Constitution OR 1. Advertising Skills/ 2. Entrepreneurial skills	AECC OR OEC	3+0+0	60	40	100	3
24	B.Com.3.6	Sports/NCC/NSS/R & R /S & /Cultural	SEC-VB	1+0+2	-	100	100	2
Sub-Total(C)					420	280	700	25

IV Semester B.Com.								
Sl. No.	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week (L+T+P)	SEE	CIE	Total Marks	Credits
25	Lang.1.1	Language-I	AECC	3+1+0	60	40	100	3
26	Lang.1.2	Language-II	AECC	3+1+0	60	40	100	3
27	B.Com.4.1	Advanced Corporate Accounting	DSC	3+0+2	60	40	100	4
28	B.Com.4.2	Costing Methods & Techniques	DSC	3+0+2	60	40	100	4
29	B.Com.4.3	Business Regulatory Framework	DSC	4+0+0	60	40	100	4
30	B.Com.4.4	Artificial Intelligence OR Financial Education. & Investment Awareness	SEC	1+0+2	60	40	100	2
31	B.Com.4.5	Sports/NCC/NSS/R & R /S & /Cultural	SEC-VB	1+0+2	-	100	100	2
32	B.Com.4.6	1. Business Ethics or/ 2. Corporate Governance OR India and Indian Constitution	OEC OR AECC	3+0+0	60	40	100	3
Sub-Total(D)					420	380	800	25

**Third Semester B.Com.  
Academic Year 2023-24**

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.) <b>Course Code:</b> B.Com.3.1 <b>Name of the Course:</b> Corporate Accounting		
Course Credits	No. of Hours per Week	Total No. of Teaching Hours
4 Credits	3+2 Hrs	56 Hrs
<b>Pedagogy:</b> Classrooms lecture, Case studies, Tutorial Classes, Group discussion, Seminar & field work etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ul style="list-style-type: none"> <li>a) Understand the treatment of underwriting of shares.</li> <li>b) Comprehend the computation of profit prior to incorporation.</li> <li>c) Know the valuation of intangible assets.</li> <li>d) Know the valuation of shares.</li> <li>e) Prepare the financial statements of companies as per companies act, 2013.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No.1: Underwriting of Shares</b>		<b>12</b>
Introduction - Meaning of Underwriting - SEBI regulations regarding underwriting; Underwriting commission. Underwriter - functions - Advantages of Underwriting, Types of underwriting - Marked and Unmarked Applications - Determination of Liability in respect of underwriting contract - when fully underwritten and partially underwritten - with and without firm underwriting problem.		
<b>Module No.2: Profit Prior to Incorporation</b>		<b>10</b>
Introduction - Meaning - calculation of sales ratio - time ratio - weighted ratio - treatment of capital and revenue expenditure - Ascertainment of pre-incorporation and post-incorporation profits by preparing statement of Profit and Loss and Balance Sheet as per schedule III of companies Act, 2013.		
<b>Module No.3 Valuation of Intangible Assets</b>		<b>10</b>
Introduction - Valuation of Goodwill - factors influencing goodwill, circumstances of valuation of goodwill - Methods of Valuation of Goodwill: Average Profit Method, Capitalization of average Profit Method, Super Profit Method, Capitalization of Super Profit Method, and Annuity Method - Problems. Brand valuation and Intellectual Property Rights (IPR).		
<b>Module No.4: Valuation of Shares</b>		<b>10</b>
Introduction - Meaning - Need for Valuation - Factors Affecting Valuation - Methods of Valuation: Intrinsic Value Method, Yield Method, Earning Capacity Method, Fair Value of shares. Rights Issue and Valuation of Rights Issue, Valuation of Warrants.		
<b>Module 5: Financial Statements of Companies</b>		<b>14</b>
Statutory Provisions regarding preparation of financial statements of companies as per schedule III of companies act, 2013 and IND AS-1 - Treatment of Special Items - Tax deducted at source - Advance payment of Tax - Provision for Tax - Depreciation - Interest on debentures - Dividends - Rules regarding payment of dividends - Transfer to Reserves - Preparation of Statement of profit and loss and Balance Sheet.		



**Skill Development Activities:**

1. Compile the list of Indian companies which have issued shares through IPO/FPO in the current financial year.
2. Determine Underwriters' Liability in case of an IPO, with imaginary figures. • Present the format of 'Statement of Profit and Loss', 'Balance Sheet' and 'Statement of Changes in Equity', with imaginary figures
3. Collect financial statement of a company and calculate intrinsic value of an equity share..
4. Collect annual report of a Company and List out its assets and Liabilities.
5. Collection of latest financial statements of a company and find out the intrinsic value of shares
6. Collect the annual reports of company and calculate the value of goodwill under different methods
7. Any other activities, which are relevant to the course.

**Text Books:**

1. J.R.Monga, Fundamentals of Corporate Accounting. Mayur Paper Backs, New Delhi.
2. M.C.Shukla, T.S.Grewal, and S.C.Gupta. Advanced Accounts. Vol.-II. S.Chand & Co., New Delhi.
3. S.N. Maheshwari, and S. K. Maheshwari. Corporate Accounting. Vikas Publishing House, New Delhi.
4. Ashok Sehgal, Fundamentals of Corporate Accounting. Taxman Publication, New Delhi.
5. V.K.Goyal and Ruchi Goyal, Corporate Accounting. PHI Learning.
6. Jain, S.P. and K.L.Narang. Corporate Accounting. Kalyani Publishers, New Delhi.
7. Bhushan Kumar Goyal, Fundamentals of Corporate Accounting, International Book House
8. P.C.Tulsian and Bharat Tulsian, Corporate Accounting, S.Chand
9. Amitabha Mukherjee, Mohammed Hanif, Corporate Accounting, McGraw Hill Education
10. Arulanandam & Raman; Corporate Accounting – II
11. Madegowda J – Advanced corporate accounting, HPH
12. Soundarajan. A & K. Venkataramana, Corporate Accounting, VBH.
13. S.P.Jain and K.L.Narang – Corporate Accounting
14. S.Bhat- Corporate Accounting.
15. S.P. Iyengar, Advanced Accountancy, Sultan Chand
16. R.L.Gupta, Advanced Accountancy.
17. Anil Kumar.S, Rajesh Kumar.V and Mariyappa.B, Corporate Accounting, HPH.

**Note: Latest edition of text books may be used.**

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.) <b>Course Code:</b> B.Com.3.2 <b>Name of the Course:</b> Business Statistics		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>3+2 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, Case studies, Tutorial Classes, Group discussion, Seminar & field work etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ol style="list-style-type: none"> <li>Familiarizes statistical data and descriptive statistics for business decision-making.</li> <li>Comprehend the measures of variation and measures of skewness.</li> <li>Demonstrate the use of probability and probability distributions in business.</li> <li>Validate the application of correlation and regression in business decisions.</li> <li>Show the use of index numbers in business.</li> </ol>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No.1: Statistical Data and Descriptive statistics.</b>		<b>14</b>
Nature and Classification of data: Univariate, bivariate and multivariate data; Measures of Central Tendency: Mathematical averages including arithmetic mean, Properties and applications. Positional Averages - Mode and Median (including graphic determination).		
<b>Module No.2: Measures of Variation: and Skewness</b>		<b>12</b>
Measures of Variation: absolute and relative. Range, quartile deviation, mean deviation, standard deviation, and their coefficients, Properties of standard deviation/variance. Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; concept of Kurtosis.		
<b>Module No.3: Probability Distributions</b>		<b>10</b>
Theory of Probability. Approaches to the calculation of probability; Calculation of event Probabilities. Addition and multiplication laws of probability (Proof not required); Conditional probability and Bayes' Theorem (Proof not required)- Expectation and variance of a random variable - Probability distributions - Binomial distribution: Probability distribution function, Constants, Shape, Fitting of binomial distribution - Poisson distribution: Probability function, (including Poisson approximation to binomial distribution), Constants, Fitting of Poisson distribution- Normal distribution: Probability distribution function, Properties of normal curve, Simple problems.		
<b>Module No.4: Correlation and Regression Analysis</b>		<b>12</b>
<b>Correlation Analysis:</b> Meaning of Correlation: - types of correlation- Positive and negative correlation-simple, partial, and multiple correlation. linear and Non-linear correlation and Scatter diagram, Pearson's co-efficient of Correlation; Correlation and Probable error; Spearman's Rank Correlation co-efficient.- problems.		

**Regression Analysis:** meaning and definition- regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients- problems.

**Module 5: Index Numbers**

**08**

Meaning and uses of index numbers; Construction of index numbers: Fisher's ideal index number with Time Reversal and Factor Reversal Tests. Construction of consumer price indices Using Aggregative Expenditure method and Family Budget method.

**Skill Development Activities:**

1. Application of MS Excel Functions in statistical decision making and students should submit output of the same.
2. Collect the age statistics of 10 new married couples calculate Correlation coefficient.
3. Recall the use of probability theory in business.
4. Identify the applicability of correlation and regression in business decision making.
5. Construct consumer price indices with imaginary figures.
6. Any other activities, which are relevant to the course.

**Text Books:**

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H M Siddiqui. Statistics for Management. 7th ed., Pearson Education.
2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P. K. Viswanathan, Business Statistics: A First Course, Pearson Education.
3. Siegel Andrew F. Practical Business Statistics. McGraw Hill Education.
4. Gupta, S.P., and Archana Agarwal. Business Statistics, Sultan Chand and Sons, New Delhi.
5. Vohra N.D., Business Statistics, McGraw Hill Education.
6. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), McGraw Hill Education.
7. Gupta, S.C. Fundamentals of Statistics. Himalaya Publishing House.
8. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning.

**Note: Latest edition of text books may be used.**

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.) <b>Course Code:</b> B.Com.3.3 <b>Name of the Course:</b> Cost Accounting		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>3+2 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, Case studies, Tutorial classes, Group discussion, Seminar & field work etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ul style="list-style-type: none"> <li>a) Understand concepts of cost accounting &amp; Methods of Costing.</li> <li>b) Outline the Procedure and documentations involved in procurement of materials &amp; compute the valuation of Inventory.</li> <li>c) Make use of payroll procedures &amp; compute idle and overtime.</li> <li>d) Discuss the methods of allocation, apportionment &amp; absorption of overheads.</li> <li>e) Prepare cost sheet &amp; discuss cost allocation under ABC.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: Introduction to Cost Accounting</b>		<b>12</b>
Introduction- Meaning and definition- Objectives, Importance and Uses of Cost Accounting, Difference between Cost Accounting and Financial Accounting; Various Elements of Cost and Classification of Cost; Cost object, Cost unit, Cost driver, cost centre; Cost reduction and Cost control; Methods and Techniques of Costing (Meanings Only); Use of IT in Cost Accounting; Limitations of Cost Accounting; Cost Sheet: Meaning and Cost heads in a Cost Sheet, Presentation of Cost Information in Cost Sheet. Problems on Cost Sheet, Tenders and Quotations.		
<b>Module No. 2: Material Cost</b>		<b>12</b>
Materials: Meaning, Importance and Types of Materials – Direct and Indirect Material Materials material control.- Inventory control Technique of inventory control, problems on level setting and EOQ. Procurement- Procedure for procurement of materials and documentation involved in materials accounting – Material Storage: Duties of Store keeper, pricing of material issues, preparation of Stores Ledger Account – FIFO, LIFO, Simple Average Price and Weighted Average Price Methods – Problems.		
<b>Module No. 3: Employee Cost</b>		<b>10</b>
Introduction – Employee Cost – types of labour cost- Labour Cost Control – time keeping and time booking and Payroll Procedure -Preparation of Payroll: Idle Time Causes and Treatment of Normal and Abnormal Idle time, Over Time Causes and Treatment- Labour Turnover- Meaning, Reasons and Effects of Labour turnover. Methods of Wage Payment: Time rates system and piece rates system, and the Incentive schemes- Halsey plan, Rowan plan and Taylor differential piece rates system- problems.		
<b>Module No. 4: Overheads Cost</b>		<b>12</b>
Introduction- Meaning and Classification of Overheads; Accounting and Control of Manufacturing Overheads: Estimation and Collection, Cost Allocation, Apportionment, Re-apportionment and Absorption of Manufacturing Overheads; Problems on Primary and Secondary overheads distribution using Reciprocal Service Methods (Repeated Distribution Method and Simultaneous Equation Method); Absorption of Overheads: Meaning and Methods of Absorption of Overheads; Problems on Machine Hour Rate.		

<b>Module No.5: Reconciliation of Cost and Financial Accounts</b>	<b>10</b>
<p>Introduction – meaning of reconciliation, Reasons for differences in Profits under Financial and Cost Accounts; Procedure for Reconciliation – Ascertainment of Profits as per Financial Accounts and Cost Accounts and Reconciliation of Profits of both set of Accounts – Preparation of Reconciliation Statement – Problems.</p>	
<p><b>Skill Developments Activities:</b></p> <ol style="list-style-type: none"> <li>1. Visit any Manufacturing entity, collect the method of inventory valuation adopted &amp; procedure involved in procuring inventory.</li> <li>2. Draw the format of five documents used for material accounting</li> <li>3. Prepare dummy Payroll with imaginary figures.</li> <li>4. Visit any large-scale organisation, identify the techniques used for controlling administrative, Selling &amp; distribution overheads.</li> <li>5. Visit any manufacturing entity and collect the cost data and prepare the cost sheet.</li> <li>6. Any other activities, which are relevant to the course.</li> </ol>	
<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan, Cost Accounting: A Managerial Emphasis, Pearson Education.</li> <li>2. Jawahar Lal, Cost Accounting, McGraw Hill Education</li> <li>3. Madegowda J, Cost Accounting, HPH.</li> <li>4. Rajiv Goel, Cost Accounting, International Book House</li> <li>5. Jain, S.P. and K.L. Narang. Cost Accounting: Principles and Methods. Kalyani Publishers</li> <li>6. Arora, M.N. Cost Accounting – Principles and Practice, Vikas Publishing House, New Delhi.</li> <li>7. Maheshwari, S.N. and S.N. Mittal. Cost Accounting: Theory and Problems. Shri Mahavir Book Depot, New Delhi.</li> <li>8. Iyengar, S.P. Cost Accounting, Sultan Chand &amp; Sons</li> <li>9. Mariyappa B Cost Accounting, HPH</li> </ol> <p><b>Note: Latest edition of text books may be used.</b></p>	

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.) <b>Course Code:</b> B.Com.3.5 (OEC) <b>Name of the Course:</b> Advertising Skills		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, Case studies, Group discussion & Seminar etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ul style="list-style-type: none"> <li>a. familiarise with advertising concepts.</li> <li>b. Able to identify effective media choice for advertising.</li> <li>c. Develop ads for different media.</li> <li>d. Measure the advertising effectiveness.</li> <li>e. Analyse the role of advertising agency.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No.1: Introduction</b>		<b>10</b>
Communication Process; Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods.		
<b>Module No.2: Media Decisions</b>		<b>07</b>
Major media types - their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices.		
<b>Module No.3: Message Development</b>		<b>08</b>
Advertising appeals, Advertising copy and elements, Preparing ads for different media		
<b>Module No.4: Measuring Advertising Effectiveness</b>		<b>10</b>
Evaluating communication and sales effects; Pre- and Post-testing techniques		
<b>Module No.5: Advertising Agency</b>		<b>07</b>
a) Advertising Agency: Role, types and selection of advertising agency. b) Social, ethical and legal aspects of advertising in India.		
<b>Skill Development Activities:</b> <ul style="list-style-type: none"> <li>1. Analyse the audience feedback on advertisement of FMCG.</li> <li>2. List out any ten products/services advertised through internet.</li> <li>3. Design any two ads for print media.</li> <li>4. Examine the legal aspects of advertising in India and submit the report.</li> <li>5. Any other activities, which are relevant to the course.</li> </ul>		

**TextBooks:**

1. George E Belch, Michael A Belch, Keyoor Purani, Advertising and Promotion .An Integrated Marketing Communications Perspective (SIE), McGraw Hill Education
2. S.Wats Dunn, and Arnold M. Barban. Advertising: It's Role in Marketing. Dryden Press
3. Burnett, Wells, and Moriatty. Advertising: Principles and Practice. 5th ed. Prentice Hall of India, New Delhi.
4. Batra, Myers and Aakers. Advertising Management. PHI Learning.
5. Terence A. Shimp. Advertising and Promotion: An IMC Approach. Cengage Learning.
6. Sharma, Kavita. Advertising: Planning and Decision Making, Taxmann Publications
7. Jaishree Jethwaney and Shruti Jain, Advertising Management, Oxford University Press, 2012
8. Chunawala and Sethia, Advertising, Himalaya Publishing House
9. Ruchi Gupta, Advertising, S.Chand & Co.
10. O'Guinn, Advertising and Promotion: An Integrated Brand Approach, Cengage Learning

**Note: Latest edition of text books may be used.**

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.)		
<b>Course Code:</b> OEC		
<b>Name of the Course:</b> Entrepreneurship Skills		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, Case studies, Group discussion & Seminar etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to		
<ul style="list-style-type: none"> <li>a. Discover their strengths and weaknesses in developing the entrepreneurial mind-set.</li> <li>b. Identify the different Government Institutions/Schemes available for promoting Entrepreneurs.</li> <li>c. Understand the various aspects to set-up an Enterprise.</li> <li>d. Familiarise Mechanism of Monitoring and maintaining an Enterprise.</li> <li>e. Know the various features for successful/unsuccessful entrepreneurs.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No.1: Introduction</b>		<b>10</b>
Need of becoming entrepreneur- ways to become a good entrepreneur-Enabling environment available to become an entrepreneur. Self-discovery, Idea Generation-Idea Evaluation-Feasibility analysis- Finding team-Preparation of business model.		
<b>Module No.2: Promoting Entrepreneur</b>		<b>08</b>
Introduction-Different Government institutions/schemes promoting entrepreneurs: Gramin banks, PMMY-MUDRA Loan, DIC, SIDA, SISI, NSIC, and SIDO, etc.,		
<b>Module No.3: Enterprise Set-up</b>		<b>08</b>
Introduction-Way to set up an enterprise and different aspects involved: legal compliances, marketing aspect, budgeting etc.,		
<b>Module No.4: Monitoring and Maintaining an Enterprise</b>		<b>10</b>
Introduction-Day to day monitoring mechanism for maintaining an enterprise-Different Government Schemes supporting entrepreneurship.		
<b>Module No.5: Caselets Discussion</b>		<b>0</b>
Examples of successful and unsuccessful entrepreneurship of MUDRA Loan, Gramin banks, SISI and NSIC etc.,		
<b>Skill Development Activities:</b>		
1. List out the discovery and evaluation of viable business ideas for new venture creation.		



2. Practice critical talents and traits required for entrepreneurs such as problem solving, creativity, communication, business math, sales, and negotiation
3. List out practical issues in setting-up of different enterprises.
4. Analyze the impact of various Government schemes in promotion of entrepreneurs.
5. Any other activities, which are relevant to the course.

**Text Books:**

1. Entrepreneurship-Starting, Developing, and Management a new Enterprise- Hisrich and Peters-Irwin
2. Fayolle A (2007) Entrepreneurship and new value creation. Cambridge, Cambridge University Press
3. Hougard S. (2005) The business idea. Berlin, Springer
4. Lowe R & S Mariott (2006) Enterprise: Entrepreneurship & Innovation. Burlington, Butterworth Heinemann

**Note: Latest edition of text books may be used.**

**Fourth Semester B.Com.  
Academic Year 2023-24**

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.) <b>Course Code:</b> B.Com.4.1 <b>Name of the Course:</b> Advanced Corporate Accounting		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>3+2 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classroom lectures, Case studies, Group discussion & Seminar etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ul style="list-style-type: none"> <li>a) Know the procedure of redemption of preference shares.</li> <li>b) Comprehend the different methods of Mergers and Acquisition of Companies</li> <li>c) Understand the process of internal reconstruction.</li> <li>d) Prepare the liquidator's final statement of accounts.</li> <li>e) Understand the recent developments in accounting and accounting standards.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: Redemption of Preference Shares</b>		<b>10</b>
Meaning – legal provisions – treatment regarding premium on redemption – creation of Capital Redemption Reserve Account – Fresh issue of shares – Arranging for cash balance for the purpose of redemption – minimum number of shares to be issued for redemption – issue of bonus shares – preparation of Balance sheet (Schedule III to Companies Act 2013) after redemption.		
<b>Module No. 2: Mergers and Acquisition of Companies</b>		<b>16</b>
Meaning of Amalgamation and Acquisition – Types of Amalgamation – Amalgamation in the nature of Merger – Amalgamation in the nature of Purchase – Methods of Calculation of Purchase Consideration (Ind AS 103), Net asset Method – Net Payment Method, Accounting for Amalgamation (Problems on pooling of interest method and purchase method) – Journal Entries and Ledger Accounts in the Books of Transferor Company and Journal Entries in the books of Transferee Company – Preparation of Balance Sheet after Merger. (Schedule III to Companies Act 2013).		
<b>Module No. 3: Internal Reconstruction of Companies</b>		<b>10</b>
Meaning of Capital Reduction; Objectives of Capital Reduction; Provisions for Reduction of Share Capital under Companies Act, 2013. Forms of Reduction. Accounting for Capital Reduction. Problems on passing Journal Entries, preparation of Capital Reduction Account and Balance sheet after reduction (Schedule III to Companies Act 2013).		
<b>Module No. 4: Liquidation of Companies</b>		<b>12</b>
Meaning of Liquidation, Modes of Winding up – Compulsory Winding up, Voluntary Winding up and winding up subject to Supervision by Court. Order of payments in the event of Liquidation. Liquidator's Statement of Account. Liquidator's remuneration. Problems on preparation of Liquidator's Statement of Account.		
<b>Module No. 5: Recent Developments in Accounting and Accounting standards.</b>		<b>08</b>

Human Resource Accounting – Environmental Accounting Discloser as per Global Reporting Initiative (GRI) Reporting of variables – Social Responsibility Accounting, IndianAccountingStandards-Meaning-objectives-SignificanceofAccountingstandards in India- Process of setting Accounting Standards in India- List of Indian accounting standards. (IND AS).

**SkillDevelopmentActivities:**

1. ListoutlegalprovisionsinrespectofRedemptionofPreferenceshares.
2. CalculationofPurchaseconsiderationwithimaginaryfigures.
3. ListanyfivecasesofamalgamationinthefutureofmergeroracquisitionofJoint Stock Companies.
4. List outlegalprovisionsinrespectofinternalreconstruction.
5. ListoutanyfiveIndianAccountingStandards.
6. Anyotheractivities,whicharerelevanttothecourse.

**TextBooks:**

1. Arulanandam&Raman;CorporateAccounting-II,HPH
2. Anil Kumar.SRajesh Kumar.Vand Mariyappa.BAdvancedCorporate Accounting, HPH
3. RoadmaptoIFRSandIndianAccountingStandardsbyCASHibaramaTripathy
4. Dr. Venkataraman.R-AdvancedCorporateAccounting
5. S.N.Maheswari,FinancialAccounting,Vikaspublishing
6. SoundarajanA&K.Venkataramana,AdvancedCorporateAccounting,SHBP.
7. RLGupta,AdvancedAccountancy,SultanChand
8. K.KVerma-CorporateAccounting.
9. JainandNarang,CorporateAccounting.
10. Tulsian,Advanced Accounting,
11. ShuklaandGrewal-AdvancedAccountancy,SultanChand
12. SrinivasPutty,AdvancedCorporateAccounting,HPH.

**Note:Latesteditionoftextbooksmaybeused.**

<b>Name of the Program: Bachelor of Commerce (B.Com.)</b>		
<b>Course Code: B.Com.4.2</b>		
<b>Name of the Course: Costing Methods and Techniques</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
4 Credits	3+2 Hrs	56 Hrs
<b>Pedagogy:</b> Classroom lectures, Case studies, Group discussion & Seminar etc.,		
<b>Course Outcomes: On successful completion of the course, the students will be able to</b>		
<ul style="list-style-type: none"> <li>a) The method of costing applicable in different industries.</li> <li>b) Determination of cost by applying different methods of costing.</li> <li>c) Prepare flexible and cash budget with imaginary figures</li> <li>d) Analyse the processes involved in standard costing.</li> <li>e) Familiarize with the Activity Based Costing and its applications.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No.1: Job and Contract Costing</b>		<b>12</b>
<p><b>Job Costing:</b> Meaning, prerequisites, job costing procedure, Features, objectives, applications, advantages and disadvantages of Job costing, Job cost sheet- simple problems.</p> <p><b>Contract Costing:</b> Meaning, features of contract costing, applications of contract costing, similarities and dissimilarities between job costing and contract costing, recording of contract costs, meaning of terms used in contract costing; treatment of profit on incomplete contracts-Problems.</p>		
<b>Module No.2: Process and Service Costing</b>		<b>12</b>
<p><b>Process costing:</b> Meaning, features and applications of Process Costing; comparison between Job Costing and Process Costing, advantages and disadvantages of process costing; treatment of process losses and gains in cost accounts; preparation of process accounts.</p> <p><b>Service costing:</b> Introduction to service costing; Application of Service costing; Service costing v/s product costing; Cost units for different service sectors; Service cost statement; Determination of costs for different service sectors - Transport services, hospitals and educational institutions-problems on preparation of service cost statements for these service sectors.</p>		
<b>Module No.3: Activity Based Costing</b>		<b>10</b>
<p>Introduction - Weakness of conventional costing system - concept of ABC - Characteristics of ABC - Kaplan and Cooper's Approach - cost drivers and cost pools - allocation of overheads under ABC -- Steps in the implementation of ABC - Benefits from adaptation of ABC system - difficulties faced by the industries in the successful implementation of ABC - Problems.</p>		
<b>Module 4: Marginal Costing</b>		<b>12</b>
<p>Meaning and Definition of marginal cost, marginal costing, features of marginal costing-terms used in marginal costing - P/V ratio, BEP, Margin of Safety, Angle of Incidence. Break Even Analysis assumptions and uses. Break Even Chart. (theory). Problems on CVP analysis.</p>		

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<b>Module 5: Budgetary Control and Standard Costing</b>	<b>10</b>
<p><b>Budgetary Control</b> Introduction – Meaning &amp; Definition of Budget and Budgetary Control–Objectives of Budgetary Control–essential requirements of budgetary control – advantages and disadvantages of budgetary control – Types of budgets- Functional Budgets- Cash budget, sales budget, purchase budget and production budget. Fixed and Flexible budgets - Problems on Flexible budget and Cash budget only.</p> <p><b>Standard Costing</b> Introduction – Uses and limitations, variance analysis- Material variances, Labour variances and Overhead variances- problems on Material and Labour variances only.</p>	
<p><b>Skill Development Activities:</b></p> <ol style="list-style-type: none"> <li>1. Naming the appropriate method of costing with justification for each of the following Industries- Paper Mill, Printing, Sugar Mill, Rice Mill, Hospital, Oil Refinery, Pickle Manufacturing, KSRTC and Hotel.</li> <li>2. List out the modern costing tools in accounting field.</li> <li>3. Prepare flexible Budget and cash budget with imaginary figures</li> <li>4. Narrate the steps involved in standard costing system.</li> <li>5. Prepare a report, which explains the conditions that are necessary for the successful implementation of a JIT manufacturing system.</li> <li>6. Explain ABC. Illustrate how ABC can be applied.</li> </ol> <p><b>Note:</b> Any other activities in addition to the above, which are relevant to the course.</p>	
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. John K Shank and Vijaya Govindarajan; Strategic Cost Management; Free Press Publication; New York</li> <li>2. SP Jain and KL Narang, Advanced Cost Accounting, Kalyani Publications,</li> <li>3. Robert S Kaplan and Anthony A Atkinson, Advanced Management Accounting, PHI, New Delhi.</li> <li>4. Shank and Govindraj, Strategic Cost Management, Simon and Schuster, 36 New York.</li> <li>5. Lin Thomas, Cases and Readings in Strategic Cost Management, McGraw Hill Publications, New York.</li> <li>6. Mariyappa B Methods and Techniques of Costing., HPH.</li> </ol> <p><b>Note:</b> Latest edition of Reference books may be used.</p>	

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.) <b>Course Code:</b> B.Com.4.3 <b>Name of the Course:</b> Business Regulatory Framework		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>4 Credits</b>	<b>4 Hrs</b>	<b>56 Hrs</b>
<b>Pedagogy:</b> Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ul style="list-style-type: none"> <li>a) Recognise the laws relating to Contracts and its application in business activities.</li> <li>b) Acquire knowledge on bailment and indemnification of goods in a contractual relationship and role of agents.</li> <li>c) Comprehend the rules for Sale of Goods and rights and duties of a buyer and a seller.</li> <li>d) Distinguish the partnership laws, its applicability and relevance.</li> <li>e) Rephrase the cyber law in the present context.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No.1: Indian Contract Act, 1872</b>		<b>12</b>
Introduction – Definition of Contract, Essentials of Valid Contract, Offer and acceptance, consideration, contractual capacity, free consent. Classification of Contract, Discharge of a contract, Breach of Contract and Remedies to Breach of Contract		
<b>Module No.2: The Sale of Goods Act, 1930</b>		<b>10</b>
Introduction - Definition of Contract of Sale, Essentials of Contract of Sale, Conditions and Warranties, Transfer of ownership in goods including sale by a non-owner and exceptions- Performance of contract of sale - Unpaid seller, rights of an unpaid seller against the goods and against the buyer		
<b>Module No.3: Competition and Consumer Laws</b>		<b>12</b>
<b>The Competition Act 2002</b> – Objectives of Competition Act, Features of Competition Act, CAT, Offences and Penalties under the Act, Competition Commission of India. <b>Consumer Protection Act 1986</b> – Definitions of the terms – Consumer, Consumer Dispute, Defect, Deficiency, Unfair Trade Practices, and Services, Rights of Consumer under the Act, Consumer Redressal Agencies – District Forum, State Commission and National Commission.		
<b>Module No.4: Economic Laws</b>		<b>12</b>
<b>WTO patent rules</b> – Indian Patent Act, 1970 – Meaning and Scope of Intellectual Property Rights (IPR), Procedure to get Patent for Inventions and Non-Inventions. <b>FEMA 1999</b> – Objectives of FEMA, Salient Features of FEMA, Definition of Important Terms – Authorized Dealer, Currency - Foreign Currency, Foreign Exchange, Foreign Security.		
<b>Module 5: Environment and Cyber Laws</b>		<b>10</b>

**Environment Protection Act 1986** – Objectives of the Act, Definitions of Important Terms – Environment, Environment Pollutant, Environment Pollution, Hazardous Substance and Occupier, Types of Pollution, Powers of Central Government to protect Environment in India.  
**Cyber Law:** Definition, Introduction to Indian Cyber Law, Cyberspace and Cybersecurity.

**Skill Development Activities:**

1. Discuss the case of “Carlill vs Carbolic Smoke Ball Company” case
2. Discuss the case of “Mohori Bibee v/s Dharmodas Ghose”.
3. Discuss any one case law relating to minor.
4. State the procedure for getting patent for ‘inventions’ and/or ‘non-inventions’.
5. List at least 5 items which can be categorized as ‘hazardous substance’ according to Environment Protection Act.
6. List out any top upcoming jobs in cybersecurity and examine the skills required for the same.
7. Any other activities, which are relevant to the course.

**Text Books:**

1. M.C. Kuchhal, and Vivek Kuchhal, Business Law, Vikas Publishing House, New Delhi.
2. Avtar Singh, Business Law, Eastern Book Company, Lucknow.
3. Ravinder Kumar, Legal Aspects of Business, Cengage Learning
4. SN Maheshwari and SK Maheshwari, Business Law, National Publishing House, New Delhi.
5. Aggarwal SK, Business Law, Galgotia Publishers Company, New Delhi
6. Bhushan Kumar Goyal and Jain Kinneri, Business Laws, International Book House
7. Sushma Arora, Business Laws, Taxmann Publications.
8. Akhileshwar Pathak, Legal Aspects of Business, McGraw Hill Education, 6th Ed.
9. PCTulsian and Bharat Tulsian, Business Law, McGraw Hill Education
10. Sharma, J.P. and Sunaina Kanojia, Business Laws, Ane Books Pvt. Ltd., New Delhi
11. K.Rama Rao and Ravi S.P., Business Regulatory Framework., HPH
12. N.D. Kapoor, Business Laws, Sultan Chand Publications
13. .K. Aswathappa, Business Laws, HPH,
14. Information Technology Act/ Rules 2000, Taxmann Publications Pvt. Ltd.
15. Chanda. P.R, Business Laws, Galgotia Publishing Company

**Note: Latest edition of text books may be used.**



4.4 Constitution of Indian curriculum will be given by KSHIC

4.5 Sports/NCC/NSS/Others (If any) – as per concerned University

<b>Name of the Program: Bachelor of Commerce (B.Com.)</b> <b>Course Code: B.Com.4.6 (OEC)</b> <b>Name of the Course: Business Ethics</b>		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classroom lectures, Case studies, Group discussion & Seminar etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ol style="list-style-type: none"> <li>a. Explain the concepts of business ethics and its approaches.</li> <li>b. Examine the business and organisational ethics in the present context.</li> <li>c. Analyse the ethical aspects in marketing and HR areas.</li> <li>d. Analyse the ethical aspects in finance and IT areas.</li> <li>e. Examine the impact of globalisation on business ethics.</li> </ol>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No. 1: Business Ethics</b>		<b>08</b>
Introduction, Concepts and theories: Introduction, definitions, importance and need for Business ethics, Values and morals. Management and ethics, Normative Theories, – Gandhian Approach, Friedman’s Economic theory, Kant’s Deontological theory, Mill & Bentham’s Utilitarianism theory.		
<b>Module No. 2: Business &amp; Organisational Ethics</b>		<b>10</b>
The Indian Business scene, Ethical Concerns, LPG & Global trends in business ethics, Business ethics rating in India. Organizations & Organisation culture, Types of Organization, Corporate code of ethics – Formulating, Advantages, implementation Professionalism and professional ethics code.		
<b>Module No. 3: Ethical Aspects in Organization - I</b>		<b>08</b>
Marketing ethics and Consumer ethics – Ethical issues in advertising, Criticisms in Marketing ethics, Ethics in HRM: Selection, Training and Development – Ethics at work place – Ethics in Performance Appraisal.		
<b>Module No. 4: Ethical Aspects in Organization - II</b>		<b>08</b>
Ethics in Finance: Insider trading - Ethical investment - Combating Frauds. Ethical issues in Information Technology: Information Security and Threats – Intellectual Property Rights – Cybercrime.		
<b>Module No. 5: Globalization and Business Ethics</b>		<b>08</b>
Growth of Global Corporations, Factors facilitating Globalisation, Impact of globalization on Indian corporate and social culture, Advantages and disadvantages of MNC’s to the Host Country, International codes of Business Conduct, Whistle blowing and its codes.		

**Skill Development Activities:**

1. The students may be asked to conduct the survey of any two organizations to study the ethical practices.
2. List out any five most ethical rating of Indian companies.
3. Collect the information on unethical practices in marketing and HR area.
4. Collect the information on unethical practices in finance and IT area.
5. Analyse and submit the report on the impact of globalization on Indian business houses in the context of ethical aspects.
6. Any other activities, which are relevant to the course.

**Text Books:**

1. Laura P. Hartman, T. Perspectives in Business Ethics, Tata McGraw Hill.
2. B. H. Agalatti & R.P. Banerjee, Business Ethics – Concept & Practice, Nirali Publication.
3. R.P. Banerjee, Ethics in Business & Management, Himalaya Publication
4. Crane, Business Ethics, Pub. By Oxford Press
5. CSVMurthy, Business Ethics, Himalaya Publishing House

**Note: Latest edition of textbooks may be used.**

<b>Name of the Program:</b> Bachelor of Commerce (B.Com.) <b>Course Code:</b> B.Com.4.6(OEC) <b>Name of the Course:</b> Corporate Governance		
<b>Course Credits</b>	<b>No. of Hours per Week</b>	<b>Total No. of Teaching Hours</b>
<b>3 Credits</b>	<b>3 Hrs</b>	<b>42 Hrs</b>
<b>Pedagogy:</b> Classroom lectures, Case studies, Group discussion & Seminar etc.,		
<b>Course Outcomes:</b> On successful completion of the course, the students will be able to <ul style="list-style-type: none"> <li>a) Identify the importance of corporate governance.</li> <li>b) Know the rights, duties and responsibilities of Directors.</li> <li>c) Analyse the legal &amp; regulatory framework of corporate governance.</li> <li>d) Outline the importance and role of board committee.</li> <li>e) Understand the major expert committees' Report on corporate governance.</li> </ul>		
<b>Syllabus:</b>		<b>Hours</b>
<b>Module No.1: Corporate Governance</b>		<b>10</b>
Introduction, Its importance, Principles of corporate governance, OECD Principles of corporate governance, Theories of corporate governance - Agency theory and stewardship theory, Models of corporate governance around the world, Need for good corporate governance - Evolution of Corporate Governance - Ancient and Modern Concept - Concept of Corporate Governance, Generation of Value from Performance - Principles of Corporate Governance.		
<b>Module No.2: Corporate and Board Management</b>		<b>10</b>
Corporate Business Ownership Structure - Board of Directors - Role, Composition, Systems and Procedures - Fiduciary relationship - Types of Directors - Promoter/Nominee/Shareholder/Independent - Rights, Duties and Responsibilities of Directors; Role of Directors and Executives - Responsibility for Leadership, Harmony between Directors and Executives - Training of Directors - need, objective, methodology - Scope and Responsibilities and competencies for directors - Executive Management Process, Executive Remuneration - Functional Committees of Board - Rights and Relationship of Shareholders and Other Stakeholders.		
<b>Module No.3: Legal and Regulatory Framework of Corporate Governance</b>		<b>08</b>
Need for Legislation of Corporate Governance - Legislative Provisions of Corporate Governance in Companies Act 1956, Securities (Contracts and Regulations) Act, 1956 (SCRA), Depositories Act 1996, Securities and Exchange Board of India Act 1992, Listing Agreement, Banking Regulation Act, 1949 and Other Corporate Laws - Legal Provisions relating to Investor Protection.		
<b>Module No.4: Board Committees and Role of Professionals</b>		<b>08</b>

Board Committees - Audit Committee, Remuneration Committee, Shareholders' Grievance Committee, other committees-Need, Functions and Advantages of Committee Management-Constitution and Scope of Board Committees-Board Committees' Charter - Terms of Reference and Accountability and Performance Appraisals - Attendance and participation in committee meetings- Independence of Members of Board Committees-Disclosures in Annual Report; Integrity of Financial Reporting Systems - Role of Professionals in Board Committees - Role of Company Secretaries in compliance of Corporate Governance.

**Module No.5: Corporate Governance- Codes and Practices**

**06**

Introduction - Major Expert Committees' Reports of India - Study of Codes of Corporate Governance - Best Practices of Corporate Governance - Value Creation through Corporate Governance-Corporate Governance Ratings.

**Skill Development Activities:**

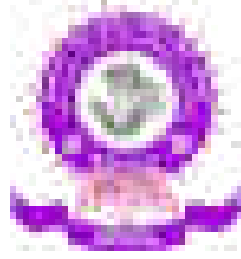
1. Collect the annual reports of any two companies, find out the corporate governance aspects in the reports.
2. Collect any two companies Board of Directors names and find out their nature of directorship.
3. Prepare report on the applicability of different models of Corporate Governance.
4. Critically compare the recommendations of various corporate governance committee.
5. Any other activities, which are relevant to the course.

**Text Books:**

1. Bairs N. and D Band, Winning Ways through Corporate Governance, Macmillan London.
2. Charkham J, Keeping Good Company: A Study of Corporate Governance in Five Countries, Oxford University Press, London.
3. Subhash Chandra Das, Corporate Governance in India – An Evaluation (Third edition), PHI Learning Private Limited.
4. Clark T. and E Monk House, Rethinking the Company, Pitman, London.
5. Fernando A.C, Corporate Governance, Pearson Education.
6. Prentice D.D. and PRJ Holland, Contemporary Issues in Governance, Clarendon Press.
7. Report of the Cadbury Committee on Financial Aspects of Corporate Governance, London Stock Exchange, London.
8. Report on Corporate Governance, Confederation of India Industries and Bombay.

**Note: Latest edition of text books may be used.**





**JSS COLLEGE OF ARTS COMMERCE &  
SCIENCE  
(Autonomous)  
Ooty Road, Mysuru – 25**

**DEPARTMENT OF COMMERCE AND  
MANAGEMENT**

**B.COM Programme  
(III Year)**

**Syllabus  
CHOICE BASED CREDIT SYSTEM**

**2019-20**

**Programme Outcomes**

***This program could provide well trained dynamic personnel and professionals for***

*P01: Industries and Multinational companies*

*P02: Banking Sectors and Insurance Companies*

*P03: Financing and Leasing Companies*

*P04: Transport Agencies and Warehousing*

*P05: Stock Markets and Foreign Trade*

**This program could provide well trained professionals to practice and work as**

P06: Chartered accountants, advocates, cost accountants and company secretaries

P07: Financial Analysts, Tax consultants, Tax Practitioners and Investment consultants

P08: Financial and management accountants

P09: Marketing Manager, Store manager, Purchase Manager and Sales Manager

P010: Human Resource Manager, Counselor

P011: Retail Manager, Middle men and Customer relation manager

P012: Decision Maker

P013: Stock broker,

P014: Official receiver and Liquidator

P015: Market researcher, supply chain manger and Franchisee

P016: Administrator of the different types of Business and Non-business organizations



**Programme Specific Outcomes**

After completing the graduation in the Bachelor of Commerce the students can become a:

PS01: Business Entrepreneur

PS02: Business Administrator

PS03: Financial Cost and Management Accounting

PS04: Business Researcher

PS05: Bank Manager

PS06: Personal secretary

PS07: Project Manager

PS08: Legal Adviser

PS09: Stock Broker

**ENA21001****SEMESTER I****DISCIPLINE SPECIFIC COURSE -1****1.4 FINANCIAL ACCOUNTING – I****L:T:P - 4:1:1****Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand in details with application of accounting software and generate financial statement

CO2: Write down the characteristics of special types of accounting transactions and able to prepare financial statement

CO3: Understand in details with application of principles of accounting

CO4: Learn the characteristic of financial statement and can prepare financial statements of all types of organisation

CO5: Learn in depth and able to work as financial accountant

**Unit 1: Introduction**

Accounting - Meaning and Definitions, objectives, functions, advantages and limitations of accounting, users of financial accounting information and their needs. Systems of Book-Keeping – Rules of double entry - preparation of Journal, Ledger and Trial Balance. Accounting Principles - Accounting Concepts and Conventions. Accounting Standards: Concept, benefits, procedure for issuing accounting standards in India. IFRS – need and procedure

**Unit 2: Final accounts**

Final accounts of sole trading concern- Preparation of Manufacturing, Trading and Profit and Loss Account and Balance sheet with adjustments.

**Unit 3: Bills of Exchange**

Meaning – Characteristics – kinds – noting, protest-Discounting, endorsement, Dishonour – Rebate & renewals of bills. Problems on trade bills only

**Unit 4: Branch Account**

Meaning and objectives. Dependent branches – concept, accounting aspects; debtors system, stock and debtors system, branch final accounts system. Independent branches: concept accounting treatment. Goods invoiced by HO at cost and invoice price.

**Unit5: Departmental accounts**

Meaning, objectives, advantages of keeping departmental accounts, basis for allocation of joint expenses, internal transfer of goods, preparation of profit and loss account and balance sheet.

**Unit 6: Computerized Accounting Systems****26 Practical Lab**

Computerized Accounting Systems: Computerized Accounts by using any popular accounting software: Creating a Company; Configure and Features settings; Creating Accounting Ledgers and Groups; Creating Stock Items and Groups; Vouchers Entry; Generating Reports – Cash Book, Ledger Accounts, Trial Balance, Profit and Loss Account, Balance Sheet, Funds Flow Statement, Cash Flow Statement. Selecting and shutting a Company; Backup and Restore data of a Company.

Note:

1. The relevant Indian Accounting Standards in line with the IFRS for all the above topics Should be covered.
2. Any revision of relevant Indian Accounting Standard would become applicable immediately.

**References:**

1. Robert N Anthony, David Hawkins, Kenneth A. Merchant, *Accounting: Text and Cases*. McGraw- Hill Education, 13th Ed. 2013.
2. Charles T. Horngren and Donna Philbrick, *Introduction to Financial Accounting*, Pearson Education.
3. J.R. Monga, *Financial Accounting: Concepts and Applications*. Mayur Paper Backs, New Delhi.
4. M.C.Shukla, T.S. Grewal and S.C.Gupta. *Advanced Accounts. Vol.-I*. S. Chand & Co., New Delhi.
5. S.N. Maheshwari, and. S. K. Maheshwari. *Financial Accounting*. Vikas Publishing House, New Delhi.
6. Deepak Sehgal. *Financial Accounting*. Vikas Publishing H House, New Delhi.
7. Bhushan Kumar Goyal and HN Tiwari, *Financial Accounting*, International Book House
8. Goldwin, Alderman and Sanyal, *Financial Accounting*, Cengage Learning.
9. Tulsian, P.C. *Financial Accounting*, Pearson Education.
10. *Compendium of Statements and Standards of Accounting*. The Institute of Chartered Accountants of India, New Delhi.

**Note: Latest edition of the text books should be used.**

**ENA22001****SEMESTER – I****DISCIPLINE SPECIFIC COURSE - 2****1.5 BUSINESS ORGANISATION AND MANAGEMENT****L:T:P – 3 :1:0****Course Outcome:**

On successful completion of this course the students are able to:

CO1: Identify the details of entrepreneurs and become themselves entrepreneurs

CO2: Understand the characteristics and classifications of leadership and able to become a good business leader

CO3: Learn in depth to work as a manager at top level or middle level Management

CO4: Write down long term as well as short term plans for the organisation

CO5: Understand and apply the principles of management for effective functioning of the organisation

CO6: Learn in depth and apply the theories of Motivation to motivate the workers for better performance

**Unit 1: Foundation of Indian Business**

Manufacturing and service sectors; Small and medium enterprises - Problems and government policy. Technological innovations and skill development. 'Make in India' Movement. Emerging opportunities in business; Franchising, Outsourcing, and E-commerce.

**Unit 2: Business Enterprises**

Forms of Business Organisation: Sole Proprietorship, Joint Hindu Family Firm, Partnership firm, Joint Stock Company, Cooperative society; Limited Liability Partnership; Forms of Public Enterprises. Multinational Corporations.

**Unit 3: Management**

The Process of Management: Planning; Decision-making; Strategy Formulation.

Organizing: - Types of Organisational Structure - Departmentation – Kinds . Delegation and Decentralisation of Authority – Groups and Teams.

**Unit 4: Leadership, Motivation and Control**

Leadership: Concept and Styles; Trait and Situational Theory of Leadership.

Motivation: Concept and Importance; Maslow Need Hierarchy Theory; Herzberg Two Factors Theory. Control: Concept and Process.

**Unit 5: Functional Areas of Management**

Marketing Management:- Meaning & Definitions, Marketing Concepts, Functions, Elements of Marketing Mix.

Financial Management: Concept and Objectives – Scope, Finance Manager- Role & Functions. Sources of Finance, Financial Decisions.

Human Resource Management: Concept and Functions. Role, Status and Competencies of HR Manager.

**References:**

1. Kaul, V.K., *Business Organisation and Management*, Pearson Education, New Delhi
2. Chhabra, T.N., *Business Organisation and Management*, Sun India Publications, New Delhi,
3. Gupta CB, *Modern Business Organisation*, Mayur Paperbacks, New Delhi
4. Koontz and Weihrich, *Essentials of Management*, McGraw Hill Education.
5. Basu, C. R., *Business Organization and Management*, McGraw Hill Education.
6. Jim, Barry, John Chandler, Heather Clark; *Organisation and Management*, Cengage Learning.
7. B.P. Singh and A.K.Singh, *Essentials of Management*, Excel Books
8. Buskirk, R.H., et al; *Concepts of Business: An Introduction to Business System*, Dryden Press, New York.
9. Burton Gene and Manab Thakur; *Management Today: Principles and Practice*; Tata McGraw Hill, New Delhi.

**Note: Latest edition of the text books should be used.**

**ENA23001****SEMESTER – I****DISCIPLINE SPECIFIC COURSE - 3****1.6 BANKING AND INSURANCE****L:T:P-3:1:0****Course Outcome:**

On successful completion of this course the students can:

CO1: Identify and analyse in depth risk and returns in banking sector

CO2: Understand in detail the banking and insurance laws and build their career

CO3: Learn in depth the functions of banking and insurance sector and able to become an adviser

CO4: Write down the classification and characteristics of digital transactions and adopt them effectively

CO5: Identify the loans and advances offered by the banks to various sectors

CO6: understand in depth the relationship between customer and banker

**Unit 1: Introduction to Banking**

Definition, Origin and growth of banks in India, Types of banks - Scheduled banks, nationalized banks, private sector banks, Regional Rural Banks, cooperative banks, foreign banks. Role and importance of banks in national economy. Central bank- Introduction, role and functions.

**Unit 2: Banker And Customer**

Relationship between banker and a customer - general and special relationship. Special type of bank customers. Types of bank accounts. Cheques- requisites, types of crossing, dishonor of cheques. Difference between cheque and bill of exchange. Paying banker and collecting banker.

**Unit 3: Loans And Advances**

Principles of bank lending - liquidity, profitability, safety and security. Types of advances- loans, cash credits, overdrafts, bill discounting and purchasing, bank guarantee, letter of credit. Secured loans- forms of securities, mortgages, Pledge, distinction between pledge and mortgage. Hypothecation - detach loans to property sector, types of loans under priority sector, loans to MSMEs and agricultural sector. Educational loans, lead bank scheme to weaker section unsecured loans, personal loans.

**Unit 4: Changed Banking Scenario in India**

Core Banking - Introduction, elements, features and advantages. Net Banking - Definition, features, services offered, advantages, virtual banking, E- payments, ATM card, debit / credit cards, SWIFT, RTGS, ECS ( credit / debit). Cheque transaction system- definition of electronic cheque, process, advantages. Cyber crimes.

**Unit 5: Risk and Insurance**

Risk – basic concept of risk, types of risks, Risk management process and objectives.

Insurance- Meaning and definition, importance, types and principles of insurance – utmost good faith, insurable interest, indemnity, subrogation, contribution and proximity cause.

Introduction to general insurance. Life insurance - Meaning and Definition- Benefits, life insurance players in India.

IRDA - Functions and role.

**References:**

1. Agarwal, O.P, Banking and Insurance, Himalaya Publishing House.
2. Satyadevi. C, Financial Services Banking and Insurance, S Chand publications.
3. Suneja H.R, Practical and Law of Banking, Himalaya Publishing House.
4. Chabra T.N, Elements of Banking Law, Dhanpatrai & Sons.
5. Arthur C James & C Williams J.R, Risk Management and Insurance, Mc. Graw Hill.
6. Sexena G.S, Legal Aspects of Banking Operations, Sultan Chand and Sons.
7. Varshney P.N, Banking Law and Practice, Sultan Chand and Sons.
8. JyotsnaSethi&Nishwan Bhatia, Elements of Banking & Insurance, PHI Learning.

**Note: Latest edition of text books may be used.**

**ENB21001****SEMESTER II****DISCIPLINE SPECIFIC COURSE - 4****2.4 COST ACCOUNTING****L:T:P-3:1:0****Course Outcome:**

On successful completion of this course the students can:

CO 1: Identify and classify different elements of cost and able to prepare cost sheet, estimation, tender and quotation

CO 2: Learn in depth characteristics of a cost accountant and help the management in decision making

CO 3: Deliberate in depth cost minimization and profit maximization

CO 4: Deliberate the details of reconciliation of cost and financial statement

CO5: Write down the characteristics of inventory, labour and overhead control techniques and apply the same in manufacturing concern

CO6: Understand in depth characteristics of process costing and able to identify process losses

**Unit 1: Introduction**

Meaning and definition of cost, costing, cost accounting and cost accountancy; objectives, advantages and limitations of cost accounting, differences between cost accounting and financial accounting. Elements of cost, classification of cost, cost centre, cost unit, problems on preparation of cost sheet, tenders and quotations.

**Unit 2: Materials**

Classification and codification of materials, functions of purchase department, stores department-stores records, techniques of inventory control-stock levels, EOQ, ABC analysis, Material losses-types and treatment, Pricing of Materials- problems on LIFO, FIFO and weighted average price

**Unit 3: Labour**

Methods of time keeping and time booking; methods of remuneration-time rate, piece rate, Halsey and Rowan Plan, Idle time-causes and treatment, overtime, labour turnover-causes, measurement and treatment; problems on Halsey method, Rowan plan, Merick differential piece rate system, FW Taylors differential piece system

**Unit 4: Overheads**

Meaning, Nature, methods of classification of overheads, allocation and apportionment-problems on primary distribution, secondary distribution, repeated distribution methods. Methods of absorption of overheads- problems on Machine Hour Rate only. Activity based costing –Meaning, purpose, benefits, stages, relevance in decision- making.



**Unit 5: Process Costing**

Meaning, Features of process Costing-Application of Process Costing – Difference between job costing and process costing – Advantages of process costing - Limitations – Elements of Production cost. Process Losses – Normal Loss – Abnormal Loss. Abnormal Gain

**References:**

1. Cost Accounting: N.K. Prasad
2. Cost Accounting: Nigam & Sharma :
3. Practical Costing: Khanna Pandey & Ahuja
- 4: Cost Accounting: M.L. Agarwal
5. Cost Accounting: Jain & Narang
6. Cost Accounting: S.P. Iyengar
7. Cost Accounting: S.N. Maheshwari

**ENB22001****SEMESTER II****DISCIPLINE SPECIFIC COURSE - 5****2.5 FINANCIAL ACCOUNTING II****L:T:P-5:1:0****Course Outcome:**

On successful completion of this course the students are able to:

CO1: Understand in depth the details of consignment transaction

CO2: Learn in depth the accounting procedure of joint venture and able to maintain the books of accounts

CO3: Identify the causes for differences between the cash balance in cash book and pass book statement

CO4: Learn the details of hire purchase and installment system

CO5: Identify and recognize the capital and revenue items and able to prepare the financial statement of nonprofit organisation

CO6: Understand the details of royalties and able to Write down the various ledger accounts

**Unit 1: Accounting for consignment transaction**

Meaning, difference between consignment and sale, proforma invoice and account sales, types of commission valuation of goods lost in transit-valuation of stock on consignment, goods sent to branch at cost price and at invoice price, problems on cost price and invoice price.

**Unit 2: Joint Venture**

Meaning – features - differences between joint venture and partnership, joint venture and consignment. Accounting procedures: Joint Bank Account, Records Maintained by Co-venturer of (a) all transactions (b) only his own transactions (Memorandum joint venture account). Problems on joint bank account method only.

**Unit 3: Accounting for Hire purchase and Instalment system**

Meaning, features, preparation of statement of analysis, ascertainment of cash price of an asset, problems on hire purchase system. Accounting for instalment system- meaning, features and differences between hire- purchase and instalment system, problems on instalment system

**Unit 4: Accounting for royalties**

Meaning and types, minimum rent, short working, and recoupment of short working-analytical table-preparation of ledger accounts in the books of both parties excluding sublease

**Unit 5: - Bank Reconciliation Statement**

Meaning and need, reasons for the differences between the cash balance shown in cash book and pass book. Problems on - Bank Reconciliation Statement

**Unit 6: - Financial statement of non-profit organization**

Meaning, recognition of capital and revenue items, receipts and payment account, income and expenditure account, preparation of income and expenditure account and balance sheet

**References:**

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Advanced Accounting; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta,S.C.: S. Chand & Co. New Delhi
4. Higher Sciences of Accountancy : . Agarwala A.N., Agarwala K.N.:Kitab Mahal, Allahabad.
5. Financial Accounts, Mishra A.K.: Sahitya Bhawan Publishers and Distributers

**ENB23001****SEMESTER II****DISCIPLINE SPECIFIC COURSE - 6****2.6 PRINCIPLES OF MARKETING****L:T:P-3:1:0****Course Outcome:**

On successful completion of the course students can:

C01: Learn in depth characteristics of marketing managers

C02: Write down the characteristics of a new product and able to launch a new product

C03: Learn in depth and apply the strategies for market segmentation

C04: Deliberate and decide effective channels of distribution.

C05: Understand the characteristics of online marketing and able to practice online marketing

C06: Identify the future prospect and able to forecast demand for the products

C07: Understand the details of promotion mix and decide effective promotion mix

**Unit 1: Introduction:**

Nature, scope and importance of marketing; Evolution of marketing; Selling v/s Marketing; Marketing environment: concept, importance, and components (Economic, Demographic, Technological, Natural, Socio-Cultural and Legal).

**Unit 2: Consumer Behaviour & Market Segmentation**

**a. Consumer Behaviour:** Nature and Importance, Consumer buying decision process; Factors influencing consumer buying behaviour.

**b. Market segmentation:** concept, importance and bases; Target market selection; Positioning concept, Product differentiation vs. market segmentation.

**Unit 3: Product**

Concept and importance, Product classifications; Concept of product mix; Branding, packaging and labelling.

**Unit 4: Pricing & Place**

**a. Pricing:** Significance. Factors affecting price of a product. Methods of pricing.

**b. Physical Distribution:** Channels of distribution - meaning and importance; Types of distribution channels; Functions of middle man; Factors affecting choice of distribution channel; Wholesaling and retailing; Types of Retailers;

**Unit 5: Promotion**

**a. Promotion:** Nature and importance of promotion; Types of promotion: advertising, personal selling, public relations & sales promotion, and their distinctive characteristics; Promotion mix and factors affecting promotion mix decisions;

**b. Recent developments in marketing:** Social Marketing, online marketing, services marketing, green marketing, Rural marketing; Consumerism.

**References:**

1. Kotler, Philip, Gary Armstrong, Prafulla Agnihotri and Ehsanul Haque. *Principles of Marketing*. 13th edition. Pearson Education.
2. Michael, J. Etzel, Bruce J. Walker, William J Stanton and Ajay Pandit. *Marketing: Concepts and Cases*. (Special Indian Edition), McGraw Hill Education
3. William D. Perreault, and McCarthy, E. Jerome., *Basic Marketing*. Pearson Education.
4. Majaro, Simon. *The Essence of Marketing*. Pearson Education, New Delhi.
5. The Consumer Protection Act 1986.
6. Iacobucci and Kapoor, *Marketing Management: A South Asian Perspective*. Cengage Learning.

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**SEMESTER III**  
**DISCIPLINE SPECIFIC COURSE - 7**  
**3.3 CORPORATE ACCOUNTING - I**

**L:T:P-3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth different sources of finance and become a corporate accountant

CO2: Understand the provision of Companies Act 2013 on dividend declaration

CO3: Identify the characteristics of intermediate in stock exchange and start career as stock Broker

CO4: Prepare the financial statement of companies as per the schedule of Companies Act 2013

CO5: Understand the details of underwriting of shares and debentures

CO6: Identify the circumstances of liquidation of companies and able to prepare liquidator's final statement of account

### **Unit 1: Accounting for Share Capital**

Meaning and types of shares-issue of shares over- subscription and prorate allotment-forfeiture of shares-reissue of forfeited shares-passing journal entries and preparing balance sheet.

### **Unit 2: Financial Statements of Limited Companies**

Preparation of financial statements as per schedule III of Companies' Act-2013. Provisions of companies Act-2013 on Declaration of Dividends.

### **Unit 3: Accounting for Redemption of Preference Shares and Issue of Bonus Shares**

Conditions for redemption of preference shares, and Accounting procedure for redemption; meaning of bonus shares and bonus issue-SEBI guidelines for bonus issue-accounting entries for issue of bonus shares.

### **Unit 4: Issue and Redemption of Debentures**

Meaning and types of debentures-methods of redemption of debentures-journal entries for issue of debentures and conditions for redemption- financing for redemption of debentures.

### **Unit 5: Liquidation of Companies**

Meaning and circumstances of liquidation- preparation of liquidator's final statement of account.

**Unit 6:** Accounting for employees stock option plan, buy-back of securities, equity shares with differential rights, under writing of shares and debentures.

### **References:**

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Advanced Accounting ; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta,S.C.: S. Chand & Co. New Delhi.
4. Higher Sciences of Accountancy : . Agarwala A.N., Agarwala K.N.:Kitab Mahal, Allahabad.
5. Financial Accounts, Mishra A.K.: Sahitya Bhawan Publishers and Distributers

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**SEMESTER III**  
**DISCIPLINE SPECIFIC COURSE - 8**  
**3.4 INCOME TAX-I**

**L:T:P-3:1:0**



**Course Outcome:**

On successful completion of this course the students able:

CO1: Learn in depth Income Tax Act of 1961 and able to practice as Tax Consultant and Tax Practitioner

CO2: Understand in detail the provisions for computation of taxable salary

CO3: Learn the provisions of IT Act relation to income from house property and able compute income from house property

CO4: Learn in detail the provisions of depreciation under IT ACT

CO5: Identify in detail the different expenses allowable and inadmissible for computation of Business income

CO6: Compute Taxable income from business

**Unit 1: Introduction**

Brief History of Income Tax Act, Finance Act, Scheme of Income Tax, Basic Concepts- Income, Assessee, person, Assessment year, Previous Year, Gross Total Income, Total Income, Marginal rate of Tax—Agricultural Income-Residential Status of individual, Incidence of Tax (including problems)- Incomes which do not form part of Total Income U/S 10.

**Unit 2: Heads of Income**

Income from Salary -features of salary income-allowances, perquisites, provident fund, computation of Taxable salary income

**Unit 3: Income from Salary: Retirement benefits**

Gratuity, Commutation of Pension, Leave encashment - problems

**Unit 4: Income from House Property**

Basis of charge - deemed ownership - exemptions determination of annual value- Deductions u/s 24-computation of income from house property.

**Unit 5: - a) Depreciation-** Meaning, computation of Deprecation

**b) Profits and gains of Business and profession (Individual Assesseees)-** Expenses expressly allowable and inadmissible, General Deductions/ expenditures u/s 37, losses, deemed profits, Method of accounting-computation of taxable income from business. Computation of Income from profession in Case of Advocates, Doctors, Chartered Accountant.

**References:**

- 1.Direct Taxation-T.N.Manoharan
- 2.Direct Taxation- Girish Ahuja, & Ravi Gupta
- 3.Direct Taxation- Dr. Vinod.k.singania
- 4.Income Tax law and practice-Gaur & Narang
- 5.Income Tax Law- Dinakar Pagare
- 6.Income Tax Law & Accounts-Bhagavati Prasad
- 7.Income Tax Law and Accounts – H.C. Mehrothra

**ENC23001**

**SEMESTER III**  
**DISCIPLINE SPECIFIC COURSE - 9**  
**3.5 CORPORATE GOVERNANCE**

**L:T:P-3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Deliberate in depth to uphold ethics and morality in business

CO2: Learn the details of practicing good corporate governance

CO3: Learn the characteristics of theories of corporate governance

CO4: Understand the details of Corporate Governance in India

CO5: Learn in depth the 4ps of corporate governance

**Unit 1: Introduction to corporate governance**

Meaning, Definition, need and importance. Benefits of corporate governance. Cadbury Committee Report in UK.

**Unit 2: Business Ethics**

Concept, importance & benefits – corporate philosophy & ethics – Managing ethics & legal compliance.

**Unit 3: Theories of Corporate Governance**

Agency theory, Stewardship theory & Stakeholders theory.

**Unit 4: Mechanism & Control**

4 ps of corporate governance (people, purpose, process & performance) – wealth creation, management & distribution – disclosure in office documents – A brief note on clause 49 of listing agreements of company with stock exchanges. Compliance aspect of corporate governance.

**Unit 5: Corporate Governance in India**

Reforming constitution of Board of Directors – A brief study of Kumara Birla Mangalam Committee – Naresh Chandra Committee – Narayanmurthy Committee – Corporate Governance code- Board subcommittee for compliance with Corporate Governance regulation.

**References:**

1. Corporate Governance – Subhash Chandra Das
2. Corporate Governance – Kesho Prasad
3. Corporate Governance – Ashwathappa

**END21001**

**SEMESTER IV**  
**DISCIPLINE SPECIFIC COURSE - 10**  
**4.3 CORPORATE ACCOUNTING- II**

**Course Outcome:**

On successful completion of this course the students can:

C01: Learn in depth the latest regulation of Insurance for the preparation of final accounts

C02: Understand the characteristics of Human Resource Accounting

C03: Identify the characteristics of intermediate in stock exchange and start career as stock Broker

C04: Prepare final accounts of life insurance as per latest regulations

C05: Understand the details of Inflation accounting

C06: Learn in depth about Holding and Subsidiary company and play a vital role in preparation of consolidated Balance Sheet

C07: Learn the details of Electricity Supply Act 2003 and able to prepare final accounts of electricity companies

**Unit 1: Accounting for General Insurance Companies**

Fire and marine insurance, preparation of final accounts as per latest regulations

**Unit 2: Accounting for Life Insurance**

Preparation of valuation balance sheet, preparation of final accounts as per latest regulations.

**Unit 3: Final accounts of Electricity Companies**

Forms of financial statements, differences between depreciation as per companies act and as per tariff policy under Electricity supply act 2003

**Unit 4: Holding Company Accounts**

Accounting for Holding Company: Preparation of Consolidated Balance Sheet, Minority interest, Computation of Goodwill/ Capital Reserve, Revaluation of assets of subsidiary Company.

**Unit 5: Human Resource Accounting**

Accounting Aspects of Human Capital –Meaning, Basic Premises, Need and Significance of HRA, Advantages and Limitation of HRA; Monetary and Non-Monetary Models; Cost Based Models- Acquisition Cost Method, Replacement Cost Model, Opportunity Cost Method, standard cost method, Current Purchasing Power Method (C.P.P.M.).

**Unit 6: Inflation accounting and income measurement**

Inflation Accounting: Concept – Limitations of historical based-cost financial statements – Methods of Inflation Accounting: Current Purchasing Power Method – Current Cost Accounting Method (Including problems). Income Concepts for financial reporting – Measurement and Reporting of Revenues, Expenses, Gains and Losses (Theory only) – Analysis of Changes in Gross Profit (Including problems).

**References:**

1. Accounting Principles; Anthony, R.N. and Reece, J.S.: Richard Irwin Inc.
2. Advanced Accounting ; Gupta, R.L and Radhaswamy, M: Sultan Chand and Sons, New Delhi.
3. Advanced Accounts; Shukla. M.C., Grewal T.S., and Gupta,S.C.: S. Chand & Co. New Delhi.
4. Higher Sciences of Accountancy : Agarwala A.N. Agarwala, K.N.:Kitab Mahal, Allahabad.
5. Financial Accounts, MishraA.K :Sahitya Bhawan Publishers and Distributers
6. Chakraborty, S.K., Human Asset Accounting: The Indian Context in Topics in Accounting and Finance, Oxford University Press.

**END22001**

**SEMESTER IV**  
**DISCIPLINE SPECIFIC COURSE - 11**  
**4.4 INCOME TAX-II**

**Course Outcome:**

On successful completion of this course the students can:

- C01: Understand in detail the provisions for computation of capital gain and income from other sources  
 C02: Learn in depth the provisions of IT Act for the Assessment of firm and company  
 C03: Learn the details of set off and carry forward of losses  
 C04: Identify in detail different sections of IT Act to reduce tax liability  
 C05: Deliberate in details with examples and appear before IT tribunal on behalf of his clients  
 C06: Understand in details with examples IT Authorities and able to work in different position of CBDT  
 C07: Learn to compute the taxable capital gain and income from other sources

**Unit 1: Capital Gain**

Capital Asset, Transfer, cost of acquisition, cost of improvement, indexation, types of Capital gain- exemptions for individual assessee u/s 54-54GB-problmes

**Unit 2: Income from other sources**

Income from other sources. Set off and carry forward of losses (theory only)

**Unit 3: Assessment of Individual**

Application of Deductions u/s 80C-80U, Section 87A computation of Tax liability. (Available software package for computation of tax liability, computation using Excel-Work sheet)

**Unit 4: Assessment of Partnership Firm**

Definition of Firm, Partner U/S 2(23) Residential Status -conditions u/s 184, Provisions u/s 40(b)-Deductions from 80G80JJA- Alternate Minimum Tax(AMT)-Computation of tax liability of Firms (Use of available software package for computation of tax liability, Related Forms and Challans-Computation using excel work- sheet)

**Unit 5: Assessment of Company**

Definition of Company, Closely-held company, Widely-held Company, Indian Company, Foreign Company-Residential Status of company-Applicable Deductions u/s 80G -80JJA-

Computation of Tax Liability (Including Minimum Alternate Tax) (Use of Software package-Quick Books/ Electrocom)

**References:**

- 1.Direct Taxation-T.N.Manoharan

D

B.Com CBCS Syllabus 2019-20

- 2.Direct Taxation- Girish Ahuja, & Ravi Gupta
- 3.Direct Taxation- Dr. Vinod.k.singania
- 4.Income Tax law and practice-Gaur & Narang
- 5.Income Tax Law- Dinakar Pagare
- 6.Income Tax Law & Accounts-Bhagavati Prasad
- 7.Income Tax Law and Accounts – H.C. Mehrothra

**END23001**

**SEMESTER IV**

**DISCIPLINE SPECIFIC COURSE - 12**

**4.5 QUANTITATIVE TECHNIQUES**



**L:T:P-3:1:0****Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth the classification and operation of matrices and determinants

CO2: Learn the details of progression and their application to business

CO3: Understand in detail the concept of Ratio, proportion and variation

CO4: Learn in depth the Laws of indices and logarithms and its application to solve business problem

CO5: Understand the details of simple interest and compound interest

CO6: Find the value of present worth, bankers gain, banker's and true discount

**Unit 1: Indices and logarithms**

Meaning-Basic laws of Indices and their application for simplification, laws of logarithms-common logarithms, application of log table for simplification.

**Unit 2: Progression**

Meaning of sequence, progression; types of progressions; arithmetic progression and geometric progression-general terms and sum of 'n' term of Arithmetic progression and Geometric progression-Application problems on Arithmetic progression and geometric progression.

**Unit 3: Ratio, proportion, variation, and percentages**

Meaning and their application to business

**Unit 4: Simple interest and compound interest-Bills discounting-**

Meaning-concepts; Bankers discount, true discount, bankers' gain and present worth of bill.

**Unit 5: Matrices and determinants**

Meaning and types of matrices, matrix operation - addition, subtraction and multiplication  
Determinants of a matrix and its evaluation; solutions of linear equations by using cramer's rule.

**References:**

1. Dr. B H Suresh and Mahadevaswamy G H, Quantitative Techniques, Nithya Publications, Mysore.
2. P.R. Vittal, Business Mathematics, Revised Edition, Margham Publications, New Delhi, 2001.

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3. V.K.Kapoor, Introductory to Business Mathematics, S.CHAND, New Delhi, 2009.
4. Sancheti and Kapoor, Business Mathematics, Sultan chand and Sons, New Delhi-42.
5. G.K.Ranganath and T.V. Narsimha Rao Basic Mathematics- Volume II.

**ENE21001**

**SEMESTER V**

**DISCIPLINE SPECIFIC COURSE - 13**

**5.1 ENTREPRENEURSHIP DEVELOPMENT**

**L: T: P-3:1:0****Course Outcome:**

On successful completion of this course the students can:

- CO1: Understand in depth the required characteristics and procedure to become an young entrepreneur
- CO2: Specify in details with application, if applicable, easily access different financial scheme to small business
- CO3: Identify in detail with examples to easily different financial schemes offered by Banks and Government Agencies
- CO4: Understand in depth and identify the social responsibility of an entrepreneur towards different sectors
- CO5: Learn in depth the Self employment opportunities
- CO6: Learn in detail the ethics in business
- CO7: Identify the content of project report
- CO8: Understand in depth the procedure of setting up of new business

**Unit 1: Introduction**

Meaning, definition of Entrepreneur, Enterprise, Entrepreneurship, Characteristics of successful entrepreneur, Functions, Role of entrepreneur in economic development, women entrepreneur, Rural entrepreneur, Agricultural entrepreneur-meaning and challenges.

**Unit 2: Entrepreneurship Development Program (EDP)**

Meaning, objective, importance, institutions doing EDP in India, DIC, CEDOCK, SSI, NSIC, EDII, AWAKE, KVIC, RUDSET, Industrial estate-Meaning and importance.

**Unit 3: Financing of Small Business in India**

Institutional and non institutional assistance SFCs, banks, SIDBI, NBFC-meaning and schemes; venture capital, bills discounting, factoring, state and central government subsidies and incentives for SSI (existing) - recent industrial policy(2011), PM MUDRA YOJANA- meaning, objectives, procedures for obtaining loan under MUDRA.

**Unit 4: Setting up of new business, forms for small business**

Small proprietorship, partnership, private company, cooperative society-meaning and nature, project formulation, project report-meaning, importance, general format of project report, project appraisal, financial, technical, marketing, social feasibility study, obtaining license, clearance certificate, registration procedure.

**Unit 5: Business Ethics**

Meaning, ethics in business, importance, various social responsibility of an entrepreneur towards customers, suppliers, government and society, self-employment-recent trends in

the areas of self employment-event management-meaning and areas of business in event management (party organizing , catering, wedding plan and corporate event plan) tourism-meaning, tourism products, E-marketing as self employment opportunity.

**Reference:**

1. Entrepreneurship And Small Business Management- C B Guptha And S S Khanka
2. Entrepreneurship Development – C B Guptha And Srinivasan
3. Entrepreneurship development development –Shankaraiah
4. Entrepreneurship development-S S Khanka

## 5.2 IFRS (IND - AS)

**L:T:P-3:1:0**

### Course Outcome:

On successful completion of this course the students can:

CO1: Deliberate the characteristics of IFRS

CO2: Understand in depth frame work for the preparation and presentation of financial statement

CO3: Learn in details with examples Accounting for assets and liabilities

CO4: Learn in details with examples IND AS on business combination

CO5: Understand the details of IND AS in relation to accounting for Revenue and Expenses

### Unit 1: IFRS

Meaning, Need for IFRS, IASB, IASB Current Structure, IFRS Due Process, Benefits and limitations of IFRS; Introduction to Indian Accounting Standards (IND-ASs - Converged IFRSs), Accounting Regulations in New Companies Act – 2013, IFRSs issued by IASB (1-17), List of IND-ASs.

### Unit 2: Framework for the Preparation and Presentation of Financial Statements

Meaning of Framework, Purpose and status - Scope - Application - Uses and their information and needs – objectives - Underlying assumptions – Qualitative characteristics – Elements of Financial statements – Recognition and Measurement of the elements of financial statement Balance sheet, Statement of changes in Equity, Statement of Profit and Loss consolidated financial statements, other comprehensive income as per schedule III of the Companies Act, 2013 – **Simple problems on each statement.**

### Unit 3: Accounting for Assets and Liabilities

Recognition and Measurement criteria for Investment Property (IND-AS 40) – Borrowing Cost (IND-AS 23) – Provisions, Contingent Assets and Contingent Liabilities (IND-AS 37) - Share-based Payment (IND-AS 102) - . Recognition and Measurement for Property, Plant and Equipment (IND-AS 16) – Intangible Assets (IND-AS 38) - Inventories (IND-AS 2) - Leases (IND-AS 17) – Impairment of Assets (IND-AS 36) - **Theory and Simple Problems only**

### Unit 4: Accounting for Revenue and Expenses

Income Taxes (IND-AS 12) – Employee Benefits (IND-AS 19) -Construction contracts (IND-AS 11) - Revenue (IND-AS 18) - Revenue from Contracts with Customers (IND-AS 115).

### Unit 5: IND-AS on Business Combination

IND-AS on Business Combination, Consolidation and Disclosure-Consolidated Financial Statements (IND-AS 110) – Joint Arrangements (IND-AS 111) – Business Combinations (IND-AS 103) – Related Party Disclosures (IND-AS 24) – Operating

Segments (IND-AS 108) – First-time adoption of International Financial Reporting Standards (IND-AS101)– Financial Instruments: Disclosures (IND-AS 107) – Disclosure of interests in Other Entities (IND-AS 112) –Earning Per Share (IND-AS 33) – Interim Financial Reporting (IND-AS34)– Insurance Contracts (IND-AS 104)– **Theory and Simple Problems only.**

**References:**

1. A Quick Guide to Indian Accounting Standards (Ind-AS) by Chethan N. Patel and BhupendraMantri, Taxmann Publication (P.) Ltd.
2. Students' Guide to Ind ASs – Converged IFRSs by Dr. D.S. Rawat, Taxmann Publication (P.) Ltd.
3. IFRS for India, Dr.A.L. Saini, Snow white publications
4. Roadmap to IFRS and Indian Accounting Standards by CA ShibaramaTripathy
5. IFRS concepts and applications by Kamal Garg, Bharath law house private limited
6. IFRS: A quick reference guide by Robert J Kirk, Elsevier Ltd.

**ENF21001****SEMESTER VI****DISCIPLINE SPECIFIC COURSE - 15**

## 6.1 PRINCIPLES AND PRACTICE OF AUDITING

**L:T:P-3:1:0**

### **Course Outcome:**

On successful completion of this course the students can:

C01: Learn in depth to practice as an Auditor

C02: Learn the characteristics of errors and frauds and minimize them in maintenance of books of accounts

C03: Identify in detail the importance of Internal Control and Internal Check

C04: Identify the details of audit planning

C05: Learn in depth verification and valuation of Assets and Liabilities

C06: Deliberate in details with examples audit of different types of organizations

### **Unit 1: Introduction**

Meaning and definition of auditing- Nature and importance of auditing objectives of auditing-advantages, different types of audit, qualities of an auditor- audit report- auditing in a computerized environment.

### **Unit 2: Audit planning and control**

Factors affecting audit planning - audit programme advantages-audit note book- appointment of a company auditor- qualifications, disqualifications-rights and duties of a company auditor.

### **Unit 3: Internal check and internal control**

Meaning and objective-internal check for various transactions-limitations of internal control. Vouching-meaning and importance – vouching of cash transactions.

### **Unit 4: verification and valuation of assets and liabilities**

Meaning- problems in valuation of assets, verification and valuation of assets and liabilities- goodwill, Stock in trade, Investments, Patents, Copy rights and trademarks, plant and machinery- capital, creditors, debentures, outstanding expenses, contingent liabilities.

### **Unit 5: Audit of different types of organizations**

Audit of sole trader, audit of partnership firms, audit of hotels, audit of educational institutions, audit of trust, audit of co-operative societies.

### **References:**

- |                        |                    |
|------------------------|--------------------|
| 1. Auditing            | T R Sharma         |
| 2. Practical auditing  | B N Tandon         |
| 3. Practical auditing- | Spicer and Spegler |

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**SEMESTER VI  
DISCIPLINE SPECIFIC COURSE -16**



**6.2: BUSINESS LAWS****L:T:P-3:1:0****Course Outcome:**

On successful completion of this course the students can:

- CO1: Understand in details various laws related to business and able to work as legal adviser of business enterprises
- CO2: Understand the characteristics of legal environment and practice business ethics
- CO3: Learn in depth and apply the basic legal knowledge to business enterprises
- CO4: Understand the characteristics of different intellectual properties and protect them
- CO5: Identify and appointed as member of various commerce and legal boards / committee
- CO6: Specify the details of Information technologies Act
- CO7: Learn the provisions of Special Contract

**Unit 1: Introduction**

Concept of law, Sources Of Law- Mercantile Law; Agreement, Contract-Definition, Essentials Of a Contract, Legal Rules As To Valid Offer And Acceptance; Termination Of An Offer.

**Unit 2: Contractual Capacity**

Minor's Agreement, Consideration-Definition, Essentials and Exceptions. Free Consent-Coercion, Undue Influence, Fraud, Misrepresentation, Mistake, Definition and Features only.

**Unit 3: Special Contract**

Contingent contract, quasi contracts, Wagering Agreement, Discharge of a Contract, Remedies for Breach of Contract.

**Unit 4: Intellectual Property Act**

Definition and Registration Procedure for Patent, Copy Right, Trademarks.

**Unit 5: Information Technology Act 2000**

Definition of Information-Digital Signature, Legal Recognition of Electronic Records, License to issue Digital Signature Certificate And Acceptance Of Digital Signature.

**References:**

1. Mercantile Law - N.D.Kapoor P C Tulsian and Bharat

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2. Business Law - Tulsian

3. Mercantile Law - P P S Gogna .

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**GROUP A1**  
**SKILL ENHANCEMENT COURSE-1**  
**COMPUTERIZED ACCOUNTING SYSTEM**

**L: T: P- 2:0:2**

**Course Outcome:**

On successful completion of this course the students can:

C01: Learn in depth the characteristics of computerized accounting system

C02: Identify the reason for differences between cash book and bank statement

C03: Learn in details with examples computerised accounting software

C04: Specify in details with examples periodic reports

C05: Learn the classification and characteristics of data entry system

C06: Prepare the quotation, purchase order etc., using computer software

**Unit 1: a) – Computerised Accounting System**

Meaning of computerised Accounting Traditional / Manual System of Accounting; process of Computerised Accounting; features of Computerised Accounting; difference between manual accounting system and computerised accounting. Process/Steps in Computerised Financial Accounting; Advantages of the Computerised Financial Accounting System; Various Components of a Computerised Financial Accounting System

**b) - Voucher Types of Voucher; Bank Payment Voucher; Bank Receipt Voucher; Cash Payment Voucher ; Cash Receipt Voucher ; General Voucher.**

**Unit 2: - Bank Reconciliation Statement**

Common transactions with bank; Cashbook and bank statement ; Reasons for difference between cash book and bank statement ; Bank reconciliation statement

**Unit 3: Computerized Accounting**

Scope of Computerized Accounting; Computerized Accounting Software; Creating a Corporation in Computerized Accounting Software. Chart of Accounts ; Creating Chart of Accounts ; Update Chart of accounts ; Charts of accounts Beginning Balances ; Organizational codes ; Editing charts of accounts;

**Unit 4: Periodic Reports**

General Journal ; Ledger; Trial Balance ; Income Statement ; Balance Sheet Inventory report; Account Receivable report; Account Payable report

**Unit 5: Data Entry System**

Voucher and Entry of vouchers ; Sales Entries ; Purchase Entries; Cash Receipt Entries ; Cash Payment Entries ; Bank transaction Entries Maintain the Records of Sales &

Customers ; Quotations to customers ; Sales orders ; Sales Invoices ; Sales receipts ; Record of Customers ; Sales report ; Customer Report.

**Unit 6: Maintain the Records of Purchases and Vendors/ Suppliers**

Preparing the Quotations; Purchase orders; Payment to vendors; Record of vendors; Utility Bills Payable; Purchase Report; Vendors Report.

**References:**

- 1.Computer Accounting (Accounting & Finance) Paperback – Michael Fardon
- 2.Computerized Accounting Spiral-bound – 2008- Arens and Ward (Author)
- 3.Computerized Accounting -Prof.C.M.Tembhurnekar, Dr.Alok Dwivedi
- 4.[https://margcompusoft.com/Free\\_accounting\\_software.html](https://margcompusoft.com/Free_accounting_software.html)

**GROUP A1**  
**SKILL ENHANCEMENT COURSE-2**  
**E-FILLING OF RETURNS**

**L:T:P-2:0:2**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth the types of e-filing and e-verification of returns

CO2: Specify in details with examples E-filing of returns

CO3: Understand the details of steps involved in e- filling of different forms of IT Return

CO4: Learn the details of E-filing of returns under GST

CO5: Learn the details of returns to be filled by composition tax payer

**Unit 1: E-filing of Returns**

Meaning- objectives- advantages, features of E-filing; Types of e- filing, e-filing Process flow, Types of e-Verification of Returns, How to e-file, who should file e-return;

**Unit 2: ITR-1 and ITR2- ITR-3- ITR-4 introduction**

Format- Heads of income covered- contents- filling the return- steps involved in filing of ITR-1, ITR-2, ITR-3, ITR-4

**Unit 3: ITR-5- ITR-6; ITR-7- introduction**

Format- Heads of income covered- contents- filling the return- steps involved in filing of ITR-5, ITR-6, ITR 7.

**Unit 4: E-filing of returns under GST**

GSTR-1- GSTR-1A, GSTR-2, GSTR 2A; GSTR-3, GSTR 3A, GSTR-3B, GSTR 9, Assesses required to file, contents to be filled, Documents required, steps in filing the above returns;

**Unit 5: Returns to be filed by composition tax payers**

GSTR-4A, GSTR-4, GSTR-9; Returns to be submitted by an input service distributor- GSTR 6, GSTR-6A; Returns to be filed by Tax Deductor-GSTR-7, GSTR-7A;Contents- steps to be followed in filing the above returns

**References:**

- 1.<https://incometaxindiaefiling.gov.in/eFiling/Portal>
- 2.<https://www.bankbazaar.com/tax/step-by-step-guide-efile-income-tax-return-online.html>
- 3.<https://www.icicibank.com/knowledge-base/tax/steps-for-e-filing>
- 4.<https://taxguru.in/income-tax/download-free-ebook-the-process-efiling-income-tax-returns.html>
- 5.Students Guide To e>Returns- vinod K singhania- taxmann
- 6.<https://www.profitbooks.net/gst-returns/>

**GROUP A1**  
**SKILL ENHANCEMENT COURSE -3**  
**PRINCIPLES AND PRACTICE OF GENERAL INSURANCE**

**L: T: P-3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Identify the classification and characteristics of General insurance

CO2: Learn the details of fire insurance policies, insurance coverage and consequential loss

CO3: Deliberate in details with examples underwriting and settlement of claims

CO4: Understand in depth the details of claim procedure and Settlement limitation

CO5: Learn in detail with examples non life miscellaneous insurance

**Unit 1: Introduction**

Meaning of General Insurance – The Evolution and Growth of General Insurance – Types of General Insurance – Fundamentals of General Insurance –Recent innovations. Organization and Management of General Insurance Companies – Regulatory Framework for General Insurance in India.

**Unit 2: Fire Insurance**

Standard policies – Fire Insurance coverage – Consequential loss (fire) Insurance policies – Declaration policies, Marine Insurance: Marine Cargo policies – Hull policies – Institute cargo clauses – Institute hull clauses – Open policies – Accumulation of risk per location - Motor Insurance: Types of policies – Third party Insurance – Comprehensive coverage – Conditions and Exclusions – premium.

**Unit 3: Non life miscellaneous insurances**

Personal Accident Insurance, Health Insurance and Mediclaim policies, Liability Insurance, Burglary Insurance other Miscellaneous Insurances, Rural Insurance covers, Engineering Insurance and its Consequential loss covers, Aviation hull and Aviation liability.

**Unit 4: Underwriting and Settlement of Claims**

Proposal forms, Cover notes, Certificates of Insurance, Endorsements, Moral and Physical Hazards, Statistics Spreading of Risks, Premium Rating, Premium Loading.

**Unit 5: Settlement of Claims**

Claim procedure, TPAs: Claim forms, Investigation / Assessment, Essential Claim Documents, Settlement Limitation, Arbitration, Loss Minimization and Salvage.

**References:**

1. Insurance Institute of India – IC 34 – General Insurance
2. Insurance Institute of India – IC 45- General Insurance Underwriting
3. Module I, Principles and Practice of General Insurance, The Institute of Chartered Accountants of India: New Delhi.
4. H Narayanan, Indian Insurance: A Profile, Jaico Publishing House: Mumbai.
5. K.C. Mishra and G.E. Thomas, General Insurance - Principles and Practice, Cengage Learning: New Delhi



**GROUP A1**  
**SKILL ENHANCEMENT COURSE - 4**  
**LOGISTICS AND SUPPLY CHAIN MANAGEMENT**

**L: T: P-3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Understand in depth supply chain management

CO2: Write down the details of designing the supply chain network

CO3: Learn in details with examples designing and planning transportation network

CO4: Learn the details of Information technology in supply chain

CO5: Identify the dimensions of logistics

CO6: Understand in depth the details of demand management and customer care

**Unit 1: Introduction to Supply Chain Management**

Supply chain – objectives, importance, decision phases, process view, competitive and supply chain strategies, achieving strategic fit, supply chain drivers, obstacles, framework, facilities, inventory, transportation, information, sourcing, pricing.

**Unit 2: Designing the Supply Chain Network**

Designing the distribution network, role of distribution, factors influencing distribution, design options – e-business and its impact, distribution networks in practice, network design in the supply chain, role of network, factors affecting the network design decisions, modelling for supply chain.

**Unit 3: Designing and Planning Transportation Networks**

Role of transportation, modes and their performance, transportation, infrastructure and policies, design options and their trade-offs, tailored transportation. SOURCING AND PRICING: Sourcing, In-house or Outsource – 3<sup>rd</sup> and 4<sup>th</sup> PLs – supplier scoring and assessment, selection, design collaboration, procurement process, sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

**Unit 4: Information Technology in the Supply Chain - IT Framework**

Customer relationship management, internal supply chain management – supplier relationship management, transaction management, future of IT. Coordination in a supply chain: Lack of supply chain coordination and the Bullwhip effect, obstacle to coordination, managerial levers, building partnerships and trust, continuous replenishment and vendor-managed inventories, collaborative planning, forecasting and replenishment.

**Unit 5: Dimensions of Logistics**

Introduction: A macro and micro dimension, logistics interfaces with other areas, approach to analysing logistics systems, logistics and systems analysis, techniques of logistics system analysis – factors affecting the cost and importance of logistics.

**Unit 6: Demand Management and Customer Service**

Outbound to customer logistics systems, Demand Management, Traditional Forecasting, CPFRP, customer service, expected cost of stock-outs, channels of distribution.

**References:**

1. Sunil Chopra and Peter Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson.
2. Coyle, Bardi, Longley, The management of Business Logistics – A supply Chain Perspective, Thomson Press.
3. Supply Chain Management by Janat Shah Pearson Publication.
4. Donald J Bowersox, Dand J Closs, M Bixby Coluper, Supply Chain Logistics Management, TMH, Second Edition.

**GROUP A2**  
**SKILL ENHANCEMENT COURSE-5**  
**CORPORATE TAX PLANNING**

**L: T: P-3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

- C01: Learn in depth and specify the tax saving strategies for decision making
- C02: Understand in depth the provisions and laws of tax and able to become tax consultant
- C03: Identify the tax provisions and deductions and able to become tax planner with reference to business restructuring
- C04: Write down the details and identify special provisions in respect of Free Trade Zone, Infrastructure Development and Backward areas
- C05: Learn in detail the provision of Income Tax Act relating to amalgamation
- C06: Understand the classification and characteristics of taxation relief
- C07: Deliberate the provisions of IT Act in relation to managerial decisions

**Unit 1: Introduction:**

Corporation tax, Tax Planning, Tax Evasion, Tax Avoidance, Tax Management, Dividend Tax, Domestic Company, Foreign Company.

- Unit 2:** a) **Tax Planning for new Business:** Location and Nature of Business, Forms of Business Organization  
b) **Tax Planning and Financial Management Decisions:** Tax Planning relating to Capital Structure Decision, Dividend Policy, Inter-Corporate Dividends and Bonus Shares

**Unit 3: Tax Planning and Managerial Decisions**

Tax planning in respect of Own or Lease, sale of assets used for scientific research, make or buy decisions, repair, replace, renewal or renovation of an asset, shut-down or continue decisions.

**Unit 4: Special Tax Provisions**

Tax provisions in respect of Free Trade Zone, Tax provisions in respect of Infrastructure Development, Tax provisions in respect of Backward Areas, Tax provisions in respect of Tax Incentives to Exporters.

**Unit 5: Amalgamation**

Meaning of amalgamation under the Income-tax Act, Transactions not treated as amalgamation, Actual cost and written down value when assets are transferred in a scheme of amalgamation, When a capital asset (other than a block of assets) is transferred, When a block of asset is transferred, Assets in amalgamation not treated as transfer, Transfer of capital assets to amalgamated Indian company.

**Unit 6: Tax Payment**

Tax deduction at source, Tax collection at source, and Advance payment of tax, Relief for double taxation [Secs. 90, 90A and 91], ADT agreements [Sec. 90], Modes of granting relief under ADT agreements , Unilateral relief [Sec. 91], Double taxation relief in case of specified associations [Sec. 90A]

**References:**

1. Direct Tax Laws and Practices- Vibnod K. Singhania
2. Direct Taxes – H C Meharothra
3. Corporate tax planning & business tax procedures- Vinod K songhania

**GROUP A2**  
**SKILL ENHANCEMENT COURSE-6**  
**COMPANY LAW AND SECRETARIAL PRACTICE**

**L: T: P-3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

C01: Understand in depth features of Companies Act -2013 and types of companies

C02: Learn in details the promotion of a Joint Stock Company and conversion

C03: Write down the details of conducting the Board of Directors and Subcommittee meetings

C04: Understand the procedure for alteration of Articles of Association and Memorandum of Association

C05: Learn in detail the appointment of company secretary

C06: Learn the preparation of minutes of various meetings

**Unit 1: Companies Act**

Introduction- companies Act 2013- features of companies Act - 2013, Types of companies- Public companies, Pvt company, statutory corporation, One person company, Dormant company, Associate company, Small company, Limited Liability Partnership- Application of Company Law to banking/insurance sector- Registrar of companies- functions, Ministry of Corporate affairs-functions; SEBI-functions of SEBI.

**Unit 2: Secretary**

Definition, Who can be company secretary, Appointment, General Legal position, Duties of a Company Secretary, Rights of Company Secretary, Liabilities of Company Secretary, Qualification for Appointment as secretary, Dismissal of the Secretary, Secretary in the Whole time practice, Secretarial Compliance certificate, Specimen form

**Unit 3: Company Formation and Conversion**

Company Formation and Conversion Choice of the form of the business entity, Conversion/reconversion of one form of business entity into another, Procedure for incorporation of private/public companies, Companies limited by guarantee and unlimited companies and their conversion/re-conversion registration., Obtaining certificate of commencement of business, obtaining certificate of re-registration, Commencement of new business and certification,

**Unit 4: Procedure for alteration of various clauses of memorandum**

Procedures for alteration of articles, Effect of alteration, specimen forms: Procedure for issue of Shares – Public Issue, Rights Issue and Bonus Shares, Issue of Shares at Par/Premium/Discount; Issue of Shares on Preferential /Private Placement Basis – Allotment, Calls on Shares and Issue of Certificates – Issue of Sweat Equity Shares,

Employees Stock Option Scheme (ESOPs), Employees Stock Purchase Scheme (ESPS), Shares with Differential Voting Rights

### **Unit 5: Meetings**

Collective Decision Making Forums, Authority, Accountability, Delegation and Responsibility ; Board Meetings , Convening and Management of Meetings of Board and Committees; Preparation of Notices and Agenda Papers, General Meetings, Convening and Management of Statutory Meeting, Annual and Extra-Ordinary General Meetings, Voting through Electronic Means; Conducting a Poll and Adjournment of a Meeting; Post-Meeting Formalities, Preparation of Minutes and Dissemination of Information and Decisions

### **References:**

1. S. Srikanth , Shanti Rekha Rajagopal ,Revathy Blakrishnan, Corporate Laws and Secretarial Practice, Jain Book
2. M C Kuchhal, Secretarial Practice, Vikas Publishing House, New Delhi.
3. Sangeet Kedia, Advanced Company Law And Practice, Pooja Law Publishing Company,

**ENE25001 / ENF25001****GROUP A2****SKILL ENHANCEMENT COURSE-7****QUANTITATIVE DECISION TOOLS****L: T: P-3:1:0****Course Outcome:**

On successful completion of this course the students can:

C01: Understand in depth the characteristics and features of statistics

C02: Learn the details of methods and sources of collection of data

C03: Understand in details with examples Measures of central tendency

C04: Understand in detail the characteristics and application of correlation and regression

C05: Understand in details the classification and application of correlation

C06: Deliberate the characteristics of Index numbers

C07: Learn the characteristics of Testing of hypothesis with application

C08: Learn the creation of variables and entering data using SPSS

**Unit 1: Introduction**

Meaning and definition of statistics, functions, advantages, limitations- collection of data - methods of collecting primary data, and sources of secondary data - classification and tabulation-SPSS –Introduction, uses, creation of variables and entering data.

**Unit 2: Measure of central tendency**

Meaning and Definition of Averages-Arithmetic mean, Median, Mode [grouping method], standard deviation, Calculation of mean, median and Standard deviation using SPSS.

**Unit 3: Correlation**

Meaning and Definition, types of correlation, Methods of calculating correlation coefficient [Karl pear sons and Spearman's correlation] calculation of correlation using SPSS; Regression-Meaning and Definition, Distinction between correlation and Regression, Regression equations and estimations Calculation of Regression using SPSS.

**Unit 4: Index Numbers**

Definition – Types – Methods of Construction and Problems in the Construction – Cost of living index numbers.

Note-Besides solving problems chapter-wise in class rooms, teach using SPSS in computer lab.

**Unit 5: Testing of Hypothesis**

Meaning of hypothesis, types of hypotheses, test of Significance Procedure of testing hypothesis – Z test, one sample t test, Chi square test.

**References:**

1. Fundamentals of Statistics: D. N. Elhance, Veena Elhance and B. M. Aggarwal
2. Statistical Methods: S. P Gupta.
3. Fundamentals of Statistics: S.C Gupta
4. Practical Statistics: R S N Pillai and Bhagavathi
5. Statistics (Theory, Methods and Application): D.C. Sancheti and V.K. Kapoor
6. Statistics for Management: Richard I. Levin and David S. Rubin
7. Statistics: Dr. B.H. Suresh, Dr. G.H. Mahadevaswamy, Nithya Publications, Mysore.



**ENE26001 / ENF26001**

**GROUP A2**

**SKILL ENHANCEMENT COURSE-8**

**BUSINESS RESEARCH METHODS**

**L: T: P-3:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth different methods of research, methodology, data collection, analysis and interpretation of data to become a good business researcher

CO2: Understand and able to report about various issues of different organisations through research report

CO3: Understand the details of types of Business Research and Research design

CO4: Identify and contribute to the discipline of commerce and management through the research

CO5: Deliberate the details of Data analysis

CO6: Identify the details of Research Report

CO7: Specify in details with examples sampling and hypothesis testing

**Unit 1: Introduction to Business Research**

Meaning, types, criteria of good research, scientific approach to research in physical and management science, limitations of applying scientific methods in business research problems, ethical issues in business research, research process, problem formulation, preparation of business research plan/proposal.

**Unit 2: Business Research Design**

Types of business research, Exploratory, Descriptive, and Causal research, Exploratory research: Meaning, suitability, collection, hypothesis, formulation, Descriptive research: Meaning, types of descriptive studies, data collection methods, Causal research: Meaning, various types of experimental designs, types of errors affecting research design.

**Unit 3: Data Collection**

Primary and Secondary data – Sources – advantages/disadvantages, Data collection Methods – Observations, Survey, Interview and Questionnaire design, Qualitative Techniques of data collection. Measurement and Scaling Techniques: Nominal Scale, Ordinal Scale, Interval Scale, Rating Scale, Criteria for good measurement, attitude measurement.

**Unit 4: Sampling and Hypothesis Testing**

Sampling: Meaning, Steps in Sampling process, Types of Sampling – Probability and non probability Sampling Techniques, Errors in sampling. Hypothesis: Meaning, Types, characteristics, sources, Formulation of Hypothesis, Errors in hypothesis testing.

**Unit 5: Data Analysis**

Editing, Coding, Classification, Tabulation, Univariate, Bivariate and multivariate Analysis, Interpretation.

**Unit 6: Research Report**

Types, advantages, disadvantages, Components of research reports, format, chapterisation, language, referencing.

**References:**

1. Marketing Research – Naresh K Malhotra – Pearson Education.
2. Business Research Methods- S.N.Murthy/U.Bhojanna- Excel Books.
- 3 .Business Research Methods–Donald R. Cooper & Pamela S Schindler, TMH.
4. Marketing research: Text and cases- Rajendra Nargundkar – TMH.
5. Business Research Methods – Alan Bryman & Emma Bell, Oxford.
6. Research Methodology – C R Kothari- Vishwa Prakashan.
7. Business Research Methods – William G Zikmund- Thomson,
8. Methodology of Research in Social Sciences – O R Krishnaswami, M Ranganatham, HPH.

**ENE27001 / ENF27001**

**GROUP A2**

**SKILL ENHANCEMENT COURSE-9**

**PROJECT WORK**

**L:T:P- 1:0:3**

C1 - Proposal of Project Work - 15 Marks

C2 - Progress of Project Work - 15 Marks

Viva - 20 Marks

Valuation of Report - 50 Marks

**Course Outcome:**

On successful completion of the project work the students are able to:

C01: Understand in depth the gap between theory and practical through internship

C02: Understand in detail with examples the procedure and able to write a report on the various issues of an organization

C03: Convince and communicate effectively

C04: Learn in detail and able to absorb as an employee by the employer

C05: Specify and analyze the components of project report and prepare the report effectively

C06: develop leadership qualities

**ENE28001**

**GROUP B**  
**SEMESTER V**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**CONSUMER AFFAIRS**

**L: T: P-4:1:0****Course Outcome:**

On successful completion of the project work the students are able to:

CO1: Learn conceptual frame work of consumer and consumer market

CO2: Understand in depth the characteristics of consumer protection law in India

CO3: Deliberate the details of role played by the advisory bodies at different level

CO4: Indentify the grievance redressal mechanism

CO5: Specify the details of role played by industry regulator in consumer protection

CO6: Understand in depth the consumer movement in India

**Unit 1: Conceptual Framework**

Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labelling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

**Unit 2: The Consumer Protection Law in India**

Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice. Organizational set-up under the Consumer Protection Act

**Unit 3: Advisory Bodies**

Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

**Unit 4: Grievance Redressal Mechanism**

Grievance Redressal Mechanism under the Indian Consumer Protection Law , Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and

hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties. Leading Cases decided under Consumer Protection law by Supreme Court/National

Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

### **Unit -5: Role of Industry Regulators in Consumer Protection.**

Banking: RBI and Banking Ombudsman. ii. Insurance: IRDA and Insurance Ombudsman iii. Telecommunication: TRAI iv. Food Products: FSSAI v. Electricity Supply: Electricity Regulatory Commission vi. Real Estate Regulatory Authority

### **Unit 6: Contemporary Issues in Consumer Affairs**

Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview

**Note:** Unit 2, 3 and 4 refer to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified

### **References:**

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
7. E-books :- [www.consumereducation.in](http://www.consumereducation.in)
8. Empowering Consumers e-book,
9. e-book, [www.consumeraffairs.nic.in](http://www.consumeraffairs.nic.in)

**ENE29001**

**GROUP B**  
**SEMESTER V**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**INTERNATIONAL BUSINESS**

**L: T: P-4:1:0****Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in detail about import and export and able to become an importer and exporter

CO2: Specify in detail the application of foreign trade policies and analyse how international factors affect domestic concern

CO3: Learn in depth and analyse legal issues related to international business

CO4: Identify and analyse various social culture and responsibility awareness on global issues

CO5: Understand in detail and identify sources of trade finance and forms of payment

CO6: Identify the function of WTO and regional integrations

CO7: Understand in depth characteristics of foreign exchange market

CO8: Identify the details of facilities provided by the International monetary institutions

**Unit 1: Introduction**

Globalisation – Meaning and implications - Globalisation of markets and production – The emerging global economy - Drivers of Globalisation. Modes and entry strategies of international business – arguments for and against – trends in international trade. Differences between domestic and international business.

**Unit 2: International Business Environment**

Cultural aspects, values and norms, social structure, religious and ethical systems, language, education, implications of cultural differences on business. International business environment, Political and legal factors, political systems, legal systems, International business environment, Economic factors, the determinants of economic development. Tariffs, subsidies, local content requirements, administrative policies, anti dumping policies, political and economic arguments for intervention ,Development of the world trading system.

**Unit 3: WTO and Regional Integrations**

GATT, the Uruguay round of negotiations. WTO, genesis and functions, the future of WTO. Regional Integrations, Trading Blocks, nature and levels of integration, arguments for and against regional integration, Trading blocks, European Union, ASEAN, APEC, NAFTA, SAARC.

**Unit 4: Multinational Corporations**

Organisation, design and structures, head quarters and subsidiary relations in multinational corporations.

**Unit5: Foreign Exchange Market**

Functions, nature of foreign exchange market, the trading mechanism, exchange rate determination, balance of trade, stability of exchange rate, currency convertibility

**Unit 6: International Monetary System**

Funding facilities and strategies of IMF and World Bank, Expatriation and Repatriation, Ethical dimensions in International Business.

**References:**

1. Charles W L Hill. And Arun Kumar Jain. International Business: competing in the global market place, Mc Graw-Hill.
2. John D. Daniels Lee H Radebaugh, International Business: Environments and Operations Addison Wesley.
3. Justin Paul – International Business – Prentice Hall of India.
4. Oded Shenkar Yadong Luo: International Business – John Wiley and Co.
5. Wild J. John, Wild L. Keneth and Han C. Y. Jerry, International Business: An integrated approach, Prentice Hall
6. Alan M. Rugman and Richard M. Hodgetts – International Business by Pearson Education.

**ENE30001**

**GROUP B**  
**SEMESTER V**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**GOODS AND SERVICES TAX-I**

**L: T: P-4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

- CO1: Understand the technology and flow of return filing under GST
- CO2: Learn in details and gain knowledge to practice as GST Consultant
- CO3: Learn in details provisions of GST to handle TDS and POS online and off line more efficiently
- CO4: Understand in depth tax provisions to make managerial decisions effectively in various tax related matters
- CO5: Understand the provisions of integrated goods and service Tax Act, 2017
- CO6: Learn in depth the provisions relating to place of supply of goods imported into, or exported from India
- CO7: Identify the details of provisions in relation to Time of supply of goods

**Unit 1: Introduction to GST**

Indirect tax Structure in India, Issues in Indirect Tax, Rationale for Transition to GST; GST-Meaning, Definition of GST, Types of GST, Features of GST, Benefits of GST, Problems on Computation of GST.

**Unit 2: Definitions**

Actionable claim, Address of Delivery, Aggregate Turnover, Agriculturist, Associated enterprises, Business, GST Council, Credit note and Debit note, Deemed exports, Draw-back, Electronic Credit ledger, Exempt Supplies, Input, Input service, Input Service Distributor, Input Tax, Input tax Credit, Intra-state supply of Goods, Job work, Reverse Charge, Invoice, Composition Levy, Mixed Supply, outward supply, Person, Turnover in State



**Unit 3: Levy and Collection of Tax**

Scope of supply; Levy of GST; Liability of tax payable person, Rate and value of tax, meaning and conditions of supply, list of transactions without consideration list of neither a supply of goods, nor supply of services; meaning and treatment of mixed supply: meaning and treatment of composite supply: reverse charge mechanism: Composition levy.

**Unit 4 : The Integrated Goods and Service Tax Act,2017**

Short title, extent and commencement; Definitions; Central tax, Customs frontier of India, Export of Goods and Services, Import of goods and services; Location of Recipient of service, Location of supplier of service; Appointment of officers; Levy and Collection; Power to grant exemption from tax; Inter-State supply;. Intra-State supply; Supplies in territorial waters

**Unit 5: Place of supply of goods other than supply of goods imported into, or exported from India**

Place of supply of goods imported into, or exported from India; Place of supply of services where location of supplier and recipient<sup>1</sup> is in India; Place of supply of services where location of supplier or location of recipient is outside India; Special provision for payment of tax by a supplier of online information and database access or retrieval services

**Unit 6: Time of supply**

Introduction, time of supply-forward charge, reverse charge, residuary, special charges-Time of supply of service- forward charge, reverse charge, Vouchers, Residuary, Special charges. Problems on determination of time of supply.

**References:**

1. Taxmann publications
2. Compendium on Goods and service tax-Dr. Manju S 3.[www.cbec.gov.in/](http://www.cbec.gov.in/)
4. [www.ICSI.edu.in](http://www.ICSI.edu.in)
5. [www.icaai.org](http://www.icaai.org).
6. Students Guide To GST & Customs Law Vinod K Singhania

**ENE31001**

**GROUP B**  
**SEMESTER V**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**FINANCIAL MANAGEMENT-I**

**L: T: P-4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

CO1: Identify the details of various sources of finance

CO2: Learn the characteristics of different methods of time value of money and its application to investment decision

CO3: Learn the classification and characteristics of cost of capital

CO4: Identify the characteristics of capital structure and factors affecting the capital structure

CO5: Learn the details of Capital Budgeting

CO6: Understand the classification and characteristics of Dividend theories

**Unit 1: Introduction to financial management**

Meaning – scope – goals of financial management – sources of finance.

**Unit 2: Time value of Money**

Present value and future value concepts-present value of annuity, application of present and future value to investment decisions, preparation of amortization table.

**Unit 3: Cost of capital**

Meaning- importance of cost of capital in financial decisions, determination of specific costs-cost of debt- cost of preference share capital-cost of equity, cost of retained earnings-weighted average cost of capital-Leverages- meaning- types problems on Leverages.

**Unit 4: Capital Structure**

Meaning-optimum capital structure-features of appropriate capital structure-factors influencing capital structure-theories of capital structure-NI approach-

NOI approach, MM approach, traditional approach, determination of optimal debt-equity mix.

**Unit 5: Capital budgeting**

Meaning-features, role of capital budgeting, techniques of capital budgeting-payback period, average rate of return, net present value, profitability index, internal rate of return, discounted pay back method. Application of excel in capital budgeting techniques.

**Unit 6: Dividend decisions**

Meaning, Dividend decisions, Dividend policies - objectives of dividend policy-determinants of dividend policy-dividend relevance- Walter's model, Gordon model-Dividend irrelevance-MM hypothesis.

**References:**

1. Financial Management I.M.Pandey.
2. Financial Management Ravi Kishore
3. Financial Management Dr.V.R.Palanivelu
4. Financial Management Kulkarni
5. Financial Management Tulsian P C
6. Financial Management Khan and Jain

**ENE32001**

**GROUP B**  
**SEMESTER V**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**ADVANCED COST AND MANAGEMENT ACCOUNTING-I**

**L: T: P-4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

- CO1: Learn in depth various Costing methods
- CO2: Understand the details of contract costing and process costing
- CO3: Identify reasons for reconciliation of cost and financial accounts
- CO4: Learn in depth the details of Activity based costing
- CO5: prepare the operating cost sheet

**Unit 1: Introduction to Costing Methods**

Meaning, Importance and Categories, Cost accounting Standards- Generally Accepted Cost Accounting Principles (GACAP)- Purpose, Objective and Applicability.

**Unit 2: Contract costing**

Introduction- Contract account, Profit on incomplete contracts, work in progress, Contractee's Accounts, Escalation clause.

**Unit 3: Process costing:** Introduction, Distinction between Job costing, and process costing, process losses, inter-process profits, Joint products and by-products- Meaning, features, differences, problems on process accounts including joint and by products.

**Unit 4: Operating Costing**

Introduction, transport costing, standing charges, operating/running charges, and preparations of operating cost sheet.

**Unit 5: Reconciliation of cost and financial accounts**

Meaning, need for reconciliation, reasons for disagreement, reconciliation procedure, problems on reconciliation.

**Unit 6: Activity based costing (ABC)**

Definition, Features, Advantages, Differences between ABC and traditional costing, Allocation of overheads; Objectives of ABC, Development of ABC, Implementation of ABC, Problems on Computation of Activity Based Costing and Traditional Costing;

**References:**

1. Cost Accounting: N.K. Prasad
2. Cost Accounting: Nigam & Sharma :
3. Practical Costing: Khanna, Pandey & Ahuja
- 4: Cost Accounting: M.L. Agarwal
5. Cost Accounting: Jain & Narang
6. Cost Accounting: S.P. Iyengar

**ENE33001**

**GROUP B**  
**SEMESTER V**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**RETAIL MANAGEMENT**

**L: T: P-4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

- C01: Learn in depth the characteristics of retailing
- C02: Understand in depth the details of retail consumer
- C03: Identify and basis of retail market segmentation and strategies
- C04: Specify the factors determining the retail location selection
- C05: Understand in depth merchandise and managing them
- C06: Learn in depth the details of retail operation and retail pricing

**Unit 1: Introduction to Retailing**

Concept of retailing, Functions of retailing, Terms and Definition, retail formats and types, Retailing Channels, Retail industry in India, Importance of retailing, Changing trends in retailing.

**Unit 2: Understanding the Retail Consumer**

Retail consumer behaviour, Factors influencing the Retail consumer, Customer decision making process, Types of decision making, Market research for understanding retail consume.

**Unit 3: Retail Market Segmentation and Strategies**

Market Segmentation and its benefits, kinds of markets, definition of Retail strategy, Strategy for effective market segmentation, Strategies for penetration of new markets, Growth strategies, Retail value chain.

**Unit 4: Retail Location Selection**

Importance of Retail locations, Types of retail locations, Factors determining the location decision, Steps involved in choosing a retail locations, Measurement of success of location.

**Unit 5: Merchandise Management**

Meaning of Merchandising, Factors influencing Merchandising, Functions of Merchandising Manager, Merchandise planning, Merchandise buying, Analyzing Merchandise performance.

**Unit 6: Retail Operations and Retail Pricing**

Store administration, Premises management, Inventory Management, Store Management, receipt Management, Customer service, Retail Pricing, Factors influencing retail prices pricing strategies, controlling costs.

**References:**

1. Retail Management 01 Edition S. C. Bhatia
2. Retail Management: Text and Cases (English, Paperback, Swapna Pradhan
3. Retail Management; Principles and Practices – R. Sudarshan
4. Retail Management PB (English, Paperback, Mathur U C)

**ENF28001**

**GROUP C**  
**SEMESTER VI**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT**

**L: T: P-4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

C01: Learn in depth the characteristics of investment

C02: Understand in depth characteristics of financial system and stock market

C03: Identify and use different models for portfolio analysis

C04: Learn in depth capital asset pricing model

C05: Identify the risk and return of investment

C06: Understand in depth portfolio selection

C07: Understand in depth the efficient market hypothesis and portfolio analysis

**Unit 1: Introduction to Investment**

Meaning, Financial and Economic Meaning, Characteristics, Objectives, Investment v/s Speculation, Investment v/s Gambling, Types of Investors and Investment avenues.

**Unit 2: Indian Financial System and Stock Market-Investment Planning,**

Introduction to Stock Market, Overview of Indian Financial System, Market Indices, Methods of Computation of Market Indices.

**Unit 3: Portfolio Management**



Meaning, Phases, Evolution, Role of Portfolio Management, Calculation of Risk and Return, Fundamental Analysis: Economic Analysis, Industry analysis and Company analysis and Technical Analysis: Meaning, Dow Theory, basic Principles, Trends and charts.

#### **Unit 4: Share and Bond Valuation-Share**

Concepts and present value, share valuation model, constant Growth Model, Multiple Growth Model, Discount rate, Multiplier Approach to share values and Regression Analysis. Bonds: Bond Returns, Prices, Pricing Theories, Bond Risks and Bond Duration.

#### **Unit 5: Efficient Market Hypothesis and Portfolio Analysis**

EMH: Random Walk Theory, the Efficient Market Hypothesis, Forms of Market Efficiency. Portfolio Analysis: Expected Return and Risk of Portfolio, Reduction of Portfolio Risk through Diversification, Portfolio with more than two Securities – solved examples.

#### **Unit 6: Portfolio Selection**

Feasible set of Portfolios, Selection of Optimal Portfolio, Limitations of Markowitz Model and Single Index Model and Multi Index Model. Capital Asset Pricing Model and Arbitrage Pricing Theory.

#### **References:**

1. Investment analysis and Portfolio Management Prasanna Chandra
2. Security Analysis and Portfolio Management Punithavathi pandian
3. Security Analysis and portfolio Management Ambika Prasad Dash
4. Security Analysis and Portfolio Management, M. Ranganatham, R. Madhumathi

**ENF29001**

**GROUP C**  
**SEMESTER VI**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**FINANCIAL DERIVATIVES**

**L: T: P-4:1:0****Course Outcome:**

On successful completion of this course the students can:

CO1: Learn in depth the characteristics of financial derivatives and derivatives market

CO2: Deliberate the characteristics of futures and forwards

CO3: Understand in details with examples options

CO4: Deliberate the classification and characteristics of financial swaps

CO5: Write down the details of commodity market

CO6: Identify in depth credit derivatives

**Unit 1: Financial Derivatives**

Introduction, -meaning- Types of financial derivatives - Features of derivatives market - Factors contributing to the growth of derivatives - functions of derivative markets - traders in derivatives markets - Derivatives market in India

**Unit 2: Futures and forwards**

Meaning, differences-valuation of futures, Mechanics of buying & selling futures, Margins, Hedging using futures -specification of futures - Commodity futures, Index futures, interest rate futures – arbitrage opportunities.

**Unit 3: Options:**

Types of options, option pricing, factors affecting option pricing – call and put options on dividend and non-dividend paying stocks put-call parity - mechanics of options - stock options - options on stock index - options on futures – interest rate options. Concept of exotic option. Hedging & Trading strategies involving options, valuation of option: basic model, one step binomial model, Black and Scholes Model,

**Unit 4: Financial Swaps**

features and uses of swaps - Mechanics of interest rate swaps – valuation of interest rate swaps – currency swaps – valuation of currency swaps

**Unit 5: Commodity derivatives**

Commodity futures market-exchanges for commodity futures in India, Forward Market Commissions and regulation-commodities traded – trading and settlements – physical delivery of commodities

**Unit6: Credit Derivatives**

Meaning, common credit derivatives, types of credit dervates, Credit Default swaps(CDS), Total Return swaps, Collateralized debt obligations(CDO), Indian scenario.

**References:**

1. Financial Derivatives- Vohra and Bagri
2. Capital Market Instruments Kotreshwar G
3. Fundamental Financial Derivatives N R Parasuraman
4. Financial Derivatives S L Guptha

**ENF30001**

**GROUP C**  
**SEMESTER VI**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**GOODS AND SERVICES TAX AND CUSTOM DUTY-II**

**L: T: P-4:1:0**

**Course Outcome:**

On successful completion of this course the students can:

C01: Understand the technology and flow of return filing under GST

C02: Learn in details and gain knowledge to practice as GST Consultant

C03: Learn in details provisions of GST in relation to value of taxable supply and input tax credit

C04: Understand in depth tax provisions to make managerial decisions effectively in various tax related matters

C05: Learn in detail the procedure to be followed to assess the value and determine customs duty

C06: Understand the procedure of registration under GST

C07: Prepare tax invoice, credit and debit notes

**Unit 1: Value of taxable supply**

Conditions, inclusions, Consideration not wholly in money, Supply between two related persons, Supply through agent, cost based value, Residual valuation, specific supplies, Service of pure agent. Problems on determination of value of supply.

**Unit 2: Input tax credit**

Meaning, conditions for taking credit, ineligible input tax credit, availability of credit in special circumstances, Input tax credit and change in constitution of registered person, Taking input tax credit in respect of inputs and capital goods sent for job work, Manner of Distribution of Credit by Input Service Distributor (ISD)

**Unit 3: Tax Invoice, Credit and Debit Notes**

Tax invoice; Prohibition of un authorised collection of tax; Amount of tax to be indicated in tax invoice and other documents ; Credit and debit notes.

**Unit 4: Registration under GST**

Persons liable for registration, compulsory registration, Procedure for Registration, Rejection of application for registration, cancellation of Registration

**Unit 5: Returns**

Brief introduction to various GSTRS-procedure for filing various returns.

**Unit 6: Customs Act 1962**

Meaning- Notified goods –specified goods- Prohibition of importation and exportation under sec 11- types of customs duty- Basic customs duty, Education Cess, Anti dumping duty, Safeguard Duty, IGST, GST Compensation Cess- Computation of Assessable value and applicable duties. Exports – Meaning- zero rated supply.

**References:**

1. Taxmann publications
2. Compendium on Goods and service tax-Dr. Manju S
3. [www.cbec.gov.in/](http://www.cbec.gov.in/)
4. Systematic Approach GST- Dr. Ravi. Gupta, Dr. Girish. Ahuja

**ENF31001**

**GROUP C**  
**SEMESTER VI**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**FINANCIAL MANAGEMENT -II**

**L: T: P-4:1:0****Course Outcome:**

On successful completion of this course the students can:

C01: Deliberate the details of working capital management

C02: Learn in depth the details of cash management

C03: Understand the details of working capital financing

C04: Deliberate in details with examples Venture capital financing

C05: Learn in depth the details of shareholders value creation

C06: Deliberate in depth International financial management

**Unit 1: Working Capital Management**

Meaning, Features, types of working capital, factors influencing working capital, level of current assets, operating cycle and cash cycle, current assets financing policy

**Unit 2: Cash Management**

Cash budget cash collection and disbursement, options for investment of surplus funds, credit management- credit policy variables-credit evaluation. Inventory management- need for inventories; order quantity-EOQ model- monitoring and control of inventories-ABC- JIT techniques.

**Unit 3: Working Capital Financing**

Leasing-types of leases, Rationale for leasing, operating leases, leasing as a financing decision; hire purchase financing- Hire purchase financing v/s lease financing, instalment sale, evaluation of Hire purchase financing

**Unit 4: Venture Capital Financing**

Meaning, features, development of venture capital in India, stages in venture financing- the business plan- essentials of a business plan, the process of venture capital financing- Methods of venture financing; Disinvestment mechanisms

**Unit 5: Share Holder Value Creation**

Financial goals and strategy, shareholder value creation- market value added, Market to book value, Economic value added(EVA)- Balanced scorecard- the learning and growth perspective, significance of balanced score card , implementation of score card.

**Unit 6: International Financial Management**

Foreign exchange market, foreign exchange rates- spot exchange rates, bid-ask rate, forward exchange rates- foreign exchange risk- transaction exposure, economic exposure, translation exposure, hedging of foreign exchange risk- foreign currency option, money market operations- financing international operations.

**References:**

1. Financial Management I.M.Pandey.
2. Financial Management Ravi Kishore
3. Financial Management Dr.V.R.Palanivelu
4. Financial Management Kulkarni
5. Financial Management Tulsian P C
6. Financial Management Khan and Jain

**ENF32001**

**GROUP C**  
**SEMESTER VI**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**ADVANCED COST AND MANAGEMENT ACCOUNTING-II**

**L: T: P-4:1:0****Course Outcome:**

On successful completion of this course the students can:

CO1: Understand the details of management accounting

CO2: Learn in depth the details of financial statement analysis techniques

CO3: Analyze the inflow and outflow of cash and able to prepare cashflow statement

CO4: Understand the characteristics of different types of ratios

CO5: Learn in depth budget and budgetary control and prepare various budget for different activities of the business

CO6: Learn in depth marginal costing and able to effective decision regarding make or buy, accepting foreign order, continuance or discontinuance of manufacturing a products

**Unit 1: Introduction**

Meaning and Definition of Management Accounting, Scope and Objectives of Management Accounting-Differences between Management Accounting and Financial Accounting –Management accounting and Cost accounting-Limitations of Management Accounting.

**Unit 2: Analysis of Financial Statements**

Common Size Statements, Comparative Statement, Trend analysis.

**Unit 3: Ratio Analysis**

Meaning and Objectives-Types of rations - (A) Profitability Ratios-GP ratio - NP Ratio- Operating ratio- Operating profit ration-Return on capital employed ratio- EPS, (B) Turnover Ratios-working capital turnover ratio- Stock Turnover ratio-Fixed assets turnover ratio-Debtors turnover Ratio-Creditors turnover Ratio, (C) Financial ratios – Current Ratio-liquidity ratio-Debt-equity ratio-Proprietary Ratio-Capital gearing Ration- Advantages and Limitations of Ratios- Construction of Balance sheet using ratios.

**Unit 4: Cost Flow Statement**



Meaning, Definition, Uses and Limitations-Differences between funds flow statement and cash flow statement-Preparation of Cash flow statement (AS-7): Direct method and Indirect Method.

### **Unit 5: Marginal Costing**

Definition - Basic concepts - Assumptions - Marginal Cost statement - Contribution-Break Even Analysis-P/V Ratio-Margin of Safety - Decision areas - Make or Buy and Pricing.

### **Unit 6: Budget and Budgeting Control**

Definition - Basic Concepts - Budget Manual - Key factor - Classification of Budgets - Problems on cash budget, sales budget, Flexible Budget, Cash Planning and Motives for holding cash.

### **References:**

1. Cost Accounting: N.K. Prasad
2. Cost Accounting: Nigam & Sharma :
3. Practical Costing: Khanna, Pandey & Ahuja
4. Cost Accounting: M.L. Agarwal
5. Cost Accounting: Jain & Narang
6. Cost Accounting: S.P. Iyengar

**ENF33001**

**GROUP C**  
**VI SEMESTER**  
**DISCIPLINE SPECIFIC ELECTIVE**  
**ORGANISATIONAL BEHAVIOUR**

**L: T: P-4:1:0****Course Outcome:**

On successful completion of this course the students can:

C01: Understand in detail behaviour of employees and able to manage them efficiently

C02: Identify in details employees performance and able to motivate for effective performance

C03: Learn in depth and analyse the behaviour of employees

C04: Understand in details key positions in an organisation and able to occupy them

C05: Learn in details with examples frame policies and strategies in organisation

**Unit 1: Introduction**

Meaning, definition, historical development, fundamental principles of OB, contributing disciplines, approaches, challenges and opportunities.

**Unit 2: Foundations of Individual Behaviour**

Individual behaviour: Foundations of individual behaviour. Ability: Intellectual abilities, Physical ability, the role of disabilities. Personality: Meaning, formation, determinants, traits of personality, personality attributes influencing OB. Attitude: Formation, components of attitudes, relation between attitude and behaviour.

**Unit 3: Perception and Emotions-** Perception: Process of perception, factors influencing perception, link between perception and individual decision making. Emotions: Affect, mood and emotion and their significance, basic emotions, emotional intelligence, self-awareness, self-management, social awareness, relationship management.

**Unit 4: Motivation and Leadership**

Motivation- meaning, theories of motivation-needs theory, two factor theory, Theory X and Y, application of motivational theories. Leadership: Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories-Fiedler's model, SLT, transactional and transformation leadership.

**Unit 5: Group Behaviour**

Definition, types, formation of groups, building effective teams. Conflict: Meaning, nature, types, process of conflict, conflict resolution. Power and politics: Basis of power, effectiveness of power tactics.

**Unit 6: Emerging Challenges**

Emerging challenges, managing diversity, globalisation, technology transformation, e - business, promoting ethical behaviour.

**References:**

1. Organizational behaviour, Stephen P Robbins, Timothy A. Judge, Neharika Vohra, 14th Edition, Pearson
2. Organization Behaviour – Ashwathappa, Himalaya Publication House
3. Organizational Behaviour: A modern approach - Arun Kumar and Meenakshi, Vikas Publishing House
4. Organizational Behaviour - Fred Luthans, 12/e, McGraw Hill International
5. Management and Organizational Behaviour - Laurie J Mullins, Pearson education
6. Fundamentals of Organizational Behaviour - Slocum/Hillriegel, Cengage Learning

**B.COM**

**Question Paper Pattern**

**(For all courses except Quantitative Techniques, Computerised Accounting and E-filling of returns)**

**PART-A**

**Answer the following. Each question carries 15 marks.**

**2X15=30**

- 1. ....  
OR
- 2. ....
- 3. ....  
OR
- 4. ....

**PART-B**

**Answer the following. Each question carries 10 marks.**

**2X10=20**

- 5. ....  
OR
- 1. ....
- 7. ....  
OR
- 8. ....

**PART-C**

**Answer any four of the following. Each question carries 5 marks.**

**4X5=20**

- 9. ....
- 10. ....
- 11. ....
- 12. ....
- 13. ....
- 14. ....

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**B.COM**

**Question Paper Pattern  
4.5 Quantitative Techniques**

**Time: 3 hrs**

**Max. Marks: 70**

**Part-A**

**Answer the following. Each question carries two marks**

**10X2=20**

- 1. a. .... f.....
- b. .... g.....
- c..... h. ....
- d. .... i. ....
- e..... j. ....

**Part-B**

**Answer any four of the following. Each question carries five marks 4X5=20**

- 2. ....
- 3. ....
- 4. ....
- 5. ....
- 6. ....

**Part-C**

**Answer any three of the following. Each question carries ten marks**

**3X10=30**

- 7. ....
- 8. ....
- 9. ....

10. ....

**B.COM**

**Question Paper Pattern**

**3.6 Computerized Accounting System (SEC-1) / 4.6 E-filing of returns (SEC-2)**

**Time: 3 hrs**

**Max. Marks:70**

**Part-A**

**Answer the following. Each question carries two marks.**

**10X2=20**

- 1. a. ....
- b. ....
- c. ....
- d. ....
- e. ....
- f. ....
- g. ....
- h. ....
- i. ....
- j. ....

**Part-B**

**Answer any four of the following. Each question carries five marks.**

**4X5=20**

- 2. ....
- 3. ....
- 4. ....
- 5. ....
- 6. ....

**Part-C**

**Answer any three of the following. Each question carries ten marks**

**3X10=30**

- 5. ....

D

- 6. ....
- 7. ....
- 8. ....





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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
**(An autonomous College of University of Mysuru)**  
**Re-accredited by NAAC with 'A' grade**  
**Ooty road, Mysuru-570 025, Karnataka**

**DEPARTMENT OF BIOCHEMISTRY**

**SYLLABUS**  
**FOR**

**I to IV Semester B. Sc. (Basic/Honors)**  
**Program in Biochemistry**

**Biotechnology & Biochemistry -BScBtBc40**  
**Microbiology & Biochemistry -BScMbBc42**

**Under**

**NATIONAL EDUCATION**  
**POLICY -2020(NEP-2020)**

**SYLLABUS**  
**CHOICE BASED CREDIT SYSTEM**  
**FOR**

**V and VI Semester B.Sc. PROGRAMME**

**Biochemistry, Microbiology & Biotechnology**  
**Botany, Biochemistry & Microbiology**

**2022-2023**

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## B.Sc syllabus - Programme: Biochemistry-Biotechnology and Biochemistry-Microbiology

### Scheme for examination and assessment for B.Sc. Biochemistry under NEP scheme 2021-22

Year	Sem	Course Type	Title of the Course	Combination	Course Code	Credits	Maximum Marks in the Exam/ Assessment				Exam Duration	
							L:T:P	SEE		IA		
I BSc	I	DSC-1 Theory	Chemical Foundations of Biochemistry-1	BC-BT	FSA49040	4:0:0	60	-	40 (20+20)	-	2.5h	-
		BC-MB		FSA49042								
		DSC-1 Practicals	Chemical Foundations of Biochemistry-1	BC-BT	FSA49040	0:0:2	-	25	-	25 (10+15)	-	3h
		BC-MB		FSA49042								
		OE-1 Theory	Biochemistry in Health and Diseases	BC-BT	FSA96040	3:0:0	60	-	40 (20+20)	-	2.5h	-
	BC-MB	FSA96042										
	SEC-1.1 Theory	Biochemical Techniques-1	-	-	2:0:0	60	-	40 (20+20)	-	2.5h	-	
	SEC-1.2 Theory	Microbiological quality of food and water	-	-	2:0:0	60	-	40 (20+20)	-	2.5h	-	
	II	DSC-2 Theory	Chemical Foundations of Biochemistry -2	BC-BT	FSB49040	4:0:0	60	-	40 (20+20)	-	2.5h	-
		BC-MB		FSB49042								
DSC-2 Practicals		Qualitative and Quantitative analysis	BC-BT	FSB49040	0:0:2	-	25	-	25 (10+15)	-	3h	
BC-MB			FSB49042									
OE-2 Theory		Nutrition and Dietetics	BC-BT	FSB96040	3:0:0	60	-	40 (20+20)	-	2.5h	-	
BC-MB	FSB96042											
SEC-2.1 Theory	Biochemical Techniques-2	-	-	2:0:0	60	-	40 (20+20)	-	2.5h	-		
SEC-2.2 Theory	Bioinformatics	-	-	2:0:0	60	-	40 (20+20)	-	2.5h	-		
II BSC	III	DSC-3 Theory	Bio-organic chemistry	BC-BT	FSC49040	4:0:0	60	-	40 (20+20)	-	2.5h	-
		BC-MB		FSC49042								
		DSC-3 Practicals	Bio-organic chemistry	BC-BT	FSC49040	0:0:2	-	25	-	25 (10+15)	-	3h
		BC-MB		FSC49042								
		OE-3.1 Theory	Biochemical Techniques	BC-BT	FSC96040	3:0:0	60	-	40 (20+20)	-	2.5h	-
	BC-MB	FSC96042										
	OE-3.2 Theory	Hormones-Biochemistry & Functions	BC-BT	FSC97040	3:0:0	60	-	40 (20+20)	-	2.5h	-	
	BC-MB		FSC97042									
	IV	DSC-4 Theory	Analytical Biochemistry	BC-BT	FSD49040	4:0:0	60	-	40 (20+20)	-	2.5h	-
		BC-MB		FSD49042								
DSC-4 Practicals		Analytical Biochemistry	BC-BT	FSD49040	0:0:2	-	25	-	25 (10+15)	-	3h	
BC-MB			FSD49042									
OE-4.1 Theory		Biochemical Toxicology	BC-BT	FSD96040	3:0:0	60	-	40 (20+20)	-	2.5h	-	
BC-MB	FSD96042											
OE-4.2 Theory	Plant Biochemistry	BC-BT	FSD97040	3:0:0	60	-	40 (20+20)	-	2.5h	-		
BC-MB		FSD97042										



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## Preamble

Biochemistry, today is considered as an application oriented integrated basic science. It's an interdisciplinary science that has emerged by the confluence of principles of Chemistry, Physics and Mathematics to Biology. Advances in Biochemistry have immense positive implications on the understanding of biochemical interactions, cellular communications, hormonal mechanisms and the cross talks between them. The research in Biochemistry has been translational and there is a shift from hypothesis driven research to data dependent research that promises translational, product oriented research. Much of the advancement in Biochemistry is in the advancement of Biotechnology, as a basic science discipline Biochemistry lead to Biotechnological advancement. Considering its pivotal role in Biological sciences, it is imperative to strengthen the fundamental concepts of Biochemistry. The current pattern is designed to provide a focused learning outcome-based syllabus at the Honors level providing structured teaching-learning experiences catering to the needs of the students. The honors course will prepare the students academically and prepare them for employability. The program also inculcate various attributes at the Honors level. These attributes encompass values related to emotional stability, social justice, creative and critical thinking, well-being and various skills required for employability, thus preparing students for continuous learning and sustainability. The new curriculum based on learning outcomes of B. Sc. (Honors) in Biochemistry offers basic knowledge of chemistry in general, including the concepts in organic, inorganic, physical, analytical, spectroscopy and pharmaceutical chemistry. The course defines clearly the objectives and the learning outcomes, enabling students to choose the elective subjects broadening their skills. The course also offers skills to pursue research in the field of Biological Chemistry and thus would produce best minds to meet the demands of society.

## Curriculum

Name of the Degree Program	: B.Sc. (Basic/Honors)
Discipline Core	: Biochemistry
Total Credits for the Program	: 184 Starting year of implementation: 2021-22

The learning outcomes are designed to help learners understand the objectives of studying B.Sc. Biochemistry (Honors) that is, to analyze, appreciate, and understand the basic concepts of biomolecular processes and chemical reactions occurring in the living system. This course is fundamental to tackle many of the health – related challenges facing society. Considering the rapid and far-reaching advances in biological sciences in 21st century, it is imperative to have curriculum incorporating these updated emerging concepts of biochemistry. The current pattern is designed to impart concept-based learning with emphasis on hands-on training, skill development and research. Aimed at multi-faceted development of a student, the curriculum includes courses encompassing core courses, intra and inters discipline specific courses, skill and ability enhancement courses to impart in-depth knowledge in biochemistry complemented with varied subjects and skills. The course seeks to discover and nurture typical attributes of a competent science graduate such as; spirit of inquiry, critical thinking, problem solving, analytical reasoning, aptitude to research/industry and entrepreneurial instincts.

**Program Learning Outcome:** The learning outcome-based curriculum is specific in terms of changes in cognitive and psychomotor behavior of students. Biochemistry Honors course is intended to provide a broad framework enabling students to acquire a skill set that helps them understand and appreciate the field of biochemistry. The structure or design of this framework shall ensure a high standard of the Honors degree in Biochemistry at national level. The program specification are intended as a reference point for prospective students, current students, academic in delivering the program and realizing its objectives. Keeping in pace with the developmental trends in Biochemistry and allied areas, it is expected that the students undertaking Biochemistry (Honors) course become conversant with the essence of Biochemistry and exhibit certain levels of learning outcomes as proposed below;

### **PROGRAMME OUTCOME (PO)**

<b>P01</b>	To create interest in Biochemistry and appreciation for chemical basis of biological processes.
<b>P02</b>	To inculcate the spirit of inquiry and value of systematic study of a discipline. Provide a general understanding of the related disciplines with a holistic knowledge generation in biological sciences.
<b>P03</b>	To provide an in-depth understanding of chemical reaction mechanisms in biological processes.
<b>P04</b>	To provide a flavor of historical developments of enzymes and their applications in research, diagnostics and various industries.
<b>P05</b>	Gain proficiency in basic laboratory techniques and be able to apply the scientific method to the processes of experimentation, hypothesis testing, data interpretation and logical conclusions.
<b>P06</b>	Develop problem solving and analytical skills through case studies, research papers and hands-on-experience
<b>P07</b>	To appreciate biochemical mechanistic basis of physiological processes, metabolism under normal and pathological conditions importance and levels of metabolic regulations.
<b>P08</b>	To apply and effectively communicate scientific reasoning and data analysis in both written and oral forms. They will be able to communicate effectively with well-designed posters and slides in talks aimed at scientific audiences as well as the general public.
<b>P09</b>	To bridge the knowledge and skill gap between academic out and industry requirements.
<b>P010</b>	To give students experience in conducting independent, hypothesis-driven, biological research, project planning and management
<b>P011</b>	To provide skills to publish research findings, and awareness of IP rights, and scientific publication ethics and problems of plagiarism.
<b>P012</b>	To prepare competent human resource with better knowledge, hands-on-experience and scientific attitude, at national and global levels for careers in research and development, academia and Pharma-, biotech- and agro-, and food processing industries.

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## **GRADUATE ATTRIBUTES B. Sc. BIOCHEMISTRY (Honors):**

Graduates with strong academic knowledge, discipline-specific and generic skills complemented with social responsibility are greatest asset of the country. The curriculum frame work under NEP for Biochemistry graduates aims to build the following attributes;

### **Disciplinary Knowledge:**

- a) Ability to comprehend fundamental concepts of biology, chemistry and apply basic principles of chemistry to biological systems.
- b) Ability to relate various interrelated physiological and metabolic events.
- c) Ability to critically evaluate a problem and resolve to challenge blindly accepted concepts
- d) Ability to think laterally and in an integrating manner and develop interdisciplinary
- e) Good experimental and quantitative skills and awareness of laboratory safety
- f) A general awareness of current developments at the forefront in biochemistry and allied subjects.
- g) Awareness of resources, and their conservation.

### **Communication Skills:**

- a) Ability to speak and write clearly in English and local language
- b) Ability to listen to and follow scientific viewpoints and engage with them.
- c) Ability to understand and articulate with clarity and critical thinking one's position.

### **Critical Thinking:**

- a) Ability to conceptualize critical readings of scientific texts in order to comprehend.
- b) Ability to place scientific statements and themes in contexts and also evaluate them in terms of generic conventions.

### **Problem Solving:**

- a) Ability make careful observation of the situation, and apply lateral thinking and analytical skills.

### **Analytical Reasoning:**

- a) Ability to evaluate the strengths and weaknesses in scholarly texts spotting flaws in their arguments.
- b. Ability to use scientific evidences and experimental approach to substantiate one's argument in one's reading of scientific texts.

### **Research Skills:**

- a) Ability to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers.
- b) Ability to plan and write a research paper.

### **Teamwork and Time Management:**

- a) Willingness to participate constructively in class room discussions and contribute to group work.
- b) Ability to meet a deadline.

### **Scientific Reasoning:**

- a) Ability to analyze theories and beliefs, evaluate ideas and scientific strategies.
- b) Ability to formulate logical and convincing arguments.

### **Reflective Thinking:**

- a) Ability to locate oneself and see the influence of location—regional, national, global— on critical thinking.

### **Self-Directing Learning:**

- a) Ability to work independently in terms of organizing laboratory, and critically analyzing scientific literature.
- b) Ability to postulate hypothesis, questions and search for answers.

### **Digital Literacy:**

- a) Ability to use digital resources, and apply various platforms to convey and explain concepts of biochemistry.

### **Multicultural Competence:**

- a) Ability to engage with and understand cultures of various nations and respect and transcend differences.

**Moral and Ethical Values:**

- a) Ability to interrogate one's own ethical values, and to be aware of ethical and environmental issues.  
 b) Ability to read values inherited in society and criticism vis-a-vis, the environment, religion, spirituality, and structures of power.

**Leadership qualities:**

- a) Ability to lead group discussions, to formulate questions related to scientific and social issues.

**Life-long Learning:**

- a) Ability to retain and build on critical thinking skills, and use them to update scientific knowledge and apply them in day to day business.

**Exit Options and credit requirement**

Progressive Certificate in Science, Diploma in Science, Bachelor of Science Degree or Bachelor of Science Degree with Honors in Biochemistry is awarded at the completion of every progressive year.

A student will be allowed to enter/re-enter only at the ODD semester and can only exit after EVEN semester. Re-entry at various as lateral entrants in academic programs based on the above mentioned earned credits and proficiency test records.

<b>Exit with</b>	<b>Credit requirements</b>
<b>CERTIFICATE IN SCIENCE</b> at the successful completion of First year (Two Semesters) of the Four Years Multidisciplinary Undergraduate Degree Program.	50
<b>DIPLOMA IN SCIENCE</b> at the successful completion of Second year (Four Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	100
<b>BACHELOR OF SCIENCE DEGREE</b> at the successful completion of Three year (Six Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	142
<b>BACHELOR OF SCIENCE DEGREE WITH HONOURS IN BIOCHEMISTRY</b> at the successful completion of Four year (Eight Semesters) of the Four Years Multidisciplinary Undergraduate Degree Program.	184



# Syllabus Theory and Practical B.Sc. (Basic/Honors) Semester-I

**Course code:** DSC-1T: BC-101;

**Course Title:** Chemical Foundations of Biochemistry-1 (Theory)

<b>Course title</b>	<b>Chemical Foundation of Biochemistry-1</b>
Course code	DSC-1T: BC-101
Course credits	04
Total contact hours	56
Duration of ESA (Hour)	03
Formative assessment marks	40
Summative assessment marks	60

**Course Outcome:**

This will inculcate confidence and clarity of mind in students to understand the chemistry of Biomolecules, and Biological reactions.

Course Outcomes /Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
Aptitude	x	x	x									
Critical thinking		x										
Subject clarity	x	x										x
Analytical Skill	x				x	x						

<b>Content of Theory course- Chemical Foundation of Biochemistry-1 Total credits = 4</b>	<b>56hr</b>
<b>Unit 1: Scope of Biochemistry and Units of measurement</b>	<b>14 hr</b>
Origin of life, types of organisms, prokaryotes, eukaryotes, unicellular, multicellular, compartmentation of functions in lower and higher organisms, and common physiological events of organisms, chemical composition of living organisms, subcellular organelles, SI units, mass, volume, temperature, amount, length and time. An overview on the metric system, atomic weight, molecular weight, equivalent weight, basicity of acids, acidity of bases, Avogadro's number, molarity, normality, molality, Dalton concept, mole concept, concentration, mole to molar conversion, oxidation number and its significance, density and specific gravity, their significances.	
<b>Unit 2 : Atomic structure and Chemical bonds</b>	<b>14 hr</b>
Structure of an atom, electrons and Quantum numbers, orbitals, shapes of orbitals, s, p, d, and f subshells, K, L, M, N, O, P, and Q shells. Illustration of Pauli's exclusion principle, Aufbau principle, and Hund's rule, electron configuration, octet rule. Formation and properties of noncovalent and covalent bonds, hydrogen bonds, ionic bonds, van der Waals interactions, London forces, dipole-dipole interactions, electrostatic interactions, and hydrophobic interactions. Sigma, pi and co-ordinate bonds, back bonding.	

Corresponding energy associated, outline of theories of bonding.	
<b>Unit 3: Buffers and Colligative properties</b>	<b>14 hr</b>
Acids, bases, Arrhenius concept, proton transfer theory, Lewis concept, Lowry and Bronsted concepts. Buffers, composition, pH, pH scale, Henderson-Hasselbalch equation, titration curve of H <sub>3</sub> PO <sub>4</sub> , pK value, isoelectric pH, ionization of HCl, HNO <sub>3</sub> , H <sub>2</sub> SO <sub>4</sub> . Colligative properties and anomalous colligative properties of solutions, structure of water, phase diagram of pure water, ionic product of water, special properties of water, buffers in animal system. Solutions and types, ionizable solutes, non-ionizable solutes, vapor pressure and its application in distillation, Vant Hoff law, Roul't's law, boiling point, freezing point, de-icing, osmosis and osmotic pressure determination, reverse osmosis, surface tension.	
<b>Unit 4: Electrochemistry and Redox reactions</b>	<b>14 hr</b>
Scope of electrochemistry, electrochemical cells, Daniel cell, galvanic cell, electrode potential and its measurement, electrolysis, types of electrolytes, primary and secondary batteries, electrodes, half-cell reaction, standard electrodes. Laws of thermodynamics, entropy and enthalpy, their relation, Gibb's energy, free energy change, Lewis concept, ions, redox reactions, redox potential, application of redox potential, energy linked to redox reactions, reduction of oxygen, oxidation and reduction of iron in hemoglobin, biological active forms of zinc, calcium, nickel, molybdenum, selenium, and cobalt, NAD <sup>+</sup> /NADH, NADP <sup>+</sup> /NADPH, FAD/FADH <sub>2</sub> , FMN/FMNH <sub>2</sub> . Molecularity and order of a reaction.	
<b>References:</b> <ol style="list-style-type: none"> <li>Advanced Inorganic Chemistry: A comprehensive Text,1999, Cotton A and Geoffrey Wilkinson, 6th edition, Wiley publication</li> <li>Inorganic Chemistry, 2014, Miessler GL, Paul Fischer PJ, and Tarr DA, 5th edition,Pearson Publication</li> <li>Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication</li> <li>Inorganic Chemistry, 2015, Overton, Rourke, Weller , Armstrong and Hagerman,Oxford Press</li> <li>Physical Chemistry: A molecular approach ,2019, Donald A, McQuarrie and Simon JD,Viva Books Publication</li> <li>Physical chemistry 2019, Atkins P, Paula JD, Keeler J , 11th edition , Oxford press</li> </ol>	

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

**Course code: DSC-1P: BC-102:**

**Course Title: Volumetric Analysis – Practicals-1**

<b>Course title</b>	<b>Volumetric analysis – practicals-1</b>
Course code	DSC-1P: BC-102
Course credits	02
Total contact hours	56 (4 h/ week)
Duration of ESA (Hour)	3
Formative assessment marks	25
Summative assessment marks	25

<b>Content of Practical course- Volumetric analysis- Practical-1</b>	
<b>Total Teaching Hours = 56;</b> <b>Total Credits = 2</b>	<b>56 hr</b>
<b>List of experiments to be conducted</b>	
<ol style="list-style-type: none"><li>1. Concept of molarity, molality and normality. Calculation and preparation of molar solutions. (Problems to be given in exams). Calculation and preparation of normal solutions and percent solutions and dilute solutions.</li><li>2. Calibration of volumetric glassware's (Burette, pipette).</li><li>3. Preparation of standard Sodium carbonate solution, standardization of HCl (Methylorange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).</li><li>4. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H<sub>2</sub>SO<sub>4</sub> in the given solution (phenolphthalein).</li><li>5. Preparation of standard Oxalic acid. Standardization of KMnO<sub>4</sub> and estimation of H<sub>2</sub>O<sub>2</sub> in the given solution.</li><li>6. Preparation of standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. Standardization of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> and estimation of CuSO<sub>4</sub> in the given solution.</li><li>7. Preparation of ZnSO<sub>4</sub>. Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.</li><li>8. Preparation of standard potassium biphthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).</li><li>9. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard KMnO<sub>4</sub> solution.</li><li>10. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).</li><li>11. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.</li><li>12. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids</li><li>13. Preparation of standard Oxalic acid solution. Standardization of KMnO<sub>4</sub> solution and estimation of calcium in milk.</li></ol>	
<b>References</b>	
<ol style="list-style-type: none"><li>1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.</li><li>2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.</li><li>3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,</li></ol>	

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4. Principles of Practical Chemistry- M. Viswanathan
  5. Instrumental Methods of chemical Analysis B.K Sharma.
  6. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill
  7. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
  8. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.
  9. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
  10. General Chemistry experiment – Anil J Elias (University press).
  11. Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.
  12. Quantitative chemical analysis S. Sahay (S. Chand & Co.).
  13. Practical Chemistry Dr O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication
  14. College Practical Chemistry. V K Ahluwalia, SunithaDingra, Adarsh Gulati
  15. Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV Learning Publication

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Practical record and Viva voce	05
Total	25

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**Open Elective Course Code: OE-1T:BC-103;**  
**Course Title: Biochemistry in Health and Diseases (theory)**

<b>COURSE TITLE</b>	<b>Biochemistry in Health and Diseases</b>
Couse code	OE-1T: BC-103
Course credits	03
Total contact hours	42
Duration of ESA (Hour)	03
Formative assessment marks	30
Summative assessment marks	70

**Course Outcome:** This open elective course offering to students of various streams gives knowledge about health and various terminologies used in health and disease conditions; Difference between communicable and non-communicable diseases; Health promotion and treatments for various diseases and disorders.

<b>Content of Theory course- Biochemistry in Health and Diseases</b>	<b>42 hr</b>
<b>Total credits =3</b>	
<b>Unit 1: Introduction</b>	<b>14 hr</b>
WHO definition of health, Health and hygiene, General health care, Factors affecting health, Indices and evaluation of health, Disease patterns in developed and developing world; Classification of diseases - Endemic, Epidemic, Pandemic; Professional health hazards.  Disease conditions: Acute disease, Chronic disease, Incurable disease, Terminal disease, Illness, disorders, Syndrome, Pre-disease.	
Treatment: Psychotherapy, Medications, Surgery, Medical devices, and Self-care. Dimensions of Health: Physical, Mental, Spiritual, Emotional, Environmental, and Philosophical.	
<b>Unit 2: Types of Diseases</b>	<b>14 hr</b>
Tuberculosis, Cholera, Typhoid, Conjunctivitis.  Sexually transmitted diseases (STD): Information, statistics, and treatment guidelines for STD, Prevention: Syphilis, Gonorrhoea, AIDS, etc.  Non-communicable diseases: Malnutrition- Under nutrition, Over nutrition, Nutritional deficiencies; Anemia, Stroke, Rheumatic heart disease, Coronary heart disease, Cancer, blindness, accidents, mental illness, Iodine deficiency, Fluorosis, Epilepsy, Asthma.  Genetic disorders: Down's syndrome, Klinefelter's syndrome, Turner's syndrome, Thalassaemia, Sickle cell anemia.  Lifestyle disorders: Obesity, Liver cirrhosis, Diabetes mellitus, Hypertension (Causative agents, symptoms, diagnosis, treatment, prognosis, prevention)	

<b>Unit 3: Health Promotions</b>	<b>14 hr</b>
<p>Preventing drug abuse, Oral health promotion by tobacco control.</p> <p>Mental hygiene and mental health: Concepts of mental hygiene and mental health, Characteristics of mentally healthy person, Warning signs of poor mental health, Promotive mental health, strategies and services, Ego defense mechanisms and implications, Personal and social adjustments, Guidance and Counseling.</p> <p>Infection control: Nature of infection, Chain of infection transmission, Defenses against infection transmission</p>	
<p><b>References</b></p> <ol style="list-style-type: none"> <li>1. Modern Nutrition in Health and Disease 2006 10<sup>th</sup> Edition by Maurice E. Shils, Moshe Shike, A Catharine Ross.</li> <li>2. Clinical Biochemistry and Metabolic Medicine, 2012 Eighth Edition by Martin Andrew Crook, CRC Press,</li> <li>3. Nutrition &amp; Health in Developing Countries, 2000, Editors: R. Semba and M.W. Bloem, Humana Press</li> </ol>	

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

**Skill enhancement course: Course Code: SEC-1T:BC-104.1;  
Course Title: Biochemical Techniques-1 (theory)**

<b>Course title</b>	<b>Biochemical Techniques-1</b>
Course code	SEC-1T: BC-104.1
Course credits	02
Total contact hours	28
Duration of ESA (Hour)	03
Formative assessment marks	40
Summative assessment marks	60

**Course Level Learning Outcomes:** Students will be exposed to various spectrophotometry and chromatographic techniques and their applications in separation of chemicals like biomolecules, organic chemicals, drugs etc.

<b>Content of Theory course- Biochemical Techniques-1</b> <b>Total credits =2</b>	<b>28 hr</b>
<b>Unit 1: Photometry</b>	14 hr
Principle of light absorption by molecules. Beer-Lambert law, Types of spectrophotometers. Principles and working of colorimeter, Visible spectrophotometer, UV-Visible spectrophotometer, Fluorescent spectrophotometry, nano-drop-spectrophotometry, Atomic absorption spectrophotometry. Types of Detectors-Phototube, Photomultiplier tube, Photo diode, Diode array detector, Charge coupled device detectors. Applications of spectrophotometry in estimation of organic compounds, enzyme assays, enzyme kinetics, recording spectrum, time-lapse studies,	
<b>Unit 2: Chromatography</b>	14 hr
Separation of small molecules by TLC, column chromatography, HPLC, and GLC.RP-HPLC, normal phase HPLC, HILIC. Column materials, ODS v/s BDS columns, Different columns used in HPLC, and GLC. Different types of detectors used in HPLC and GLC. Preparation of sample for separation by HPLC and GLC. Importance of column material and pore size. Isocratic v/s gradient HPLC	
<b>References</b> 1. Biophysical Chemistry, Principles & Techniques - Upadhyay, Upadhyay and Nath –Himalaya Publ. House. 2. Principles & Techniques of Practical Biochemistry – Wilson, Walker-Cambridge Univ.Press. 3. Chromatography – G. Abbott. 4. Physical Biochemistry- Application to biochemistry and molecular biology by David Freifelder. W. H. Freeman & Co. San Fransisco. 2 <sup>nd</sup> Edition	

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

**Skill enhancement course: Course Code: SEC-1T: BC-104.2;  
Course Title: Microbiological quality of food and water (Theory)**

<b>Course title</b>	<b>Microbiological quality of food and water</b>
Course code	SEC-1T: BC-104.2
Course credits	02
Total contact hours	28
Duration of ESA (Hour)	03
Formative assessment marks	40
Summative assessment marks	60

**Course Level Learning Outcomes:** Students will learn various means of microbial contaminations in water and food and their implications on health. Student will learn about the standard methods of detection of contaminating microorganisms in food and water samples.

<b>Content of Theory course- <u>Microbiological quality of food and water</u></b> <b>Total credits =2</b>	<b>28 hr</b>
<b>Unit 1: Water Quality &amp; Assessment</b>	<b>14 hr</b>
Sampling of water to detect the microbiological quality of water. Isolation of microorganisms from water sample. Medium: Growth medium, differential medium and specific medium.  Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for fecal coliforms (b) Membrane filter technique and (c) Presence/absence tests	
<b>Unit 2: Microbiology of Food</b>	<b>14 Hr</b>
Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general. Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods.  Cultural and rapid detection methods of food borne pathogens in foods. Food borne diseases: Food intoxication, food infection, shigellosis. Food sanitation and control: HACCP, Indices of food sanitary quality and sanitizers.	
<b>References:</b>	
<ol style="list-style-type: none"> <li>1. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.</li> <li>2. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.</li> <li>3. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, NY.</li> <li>4. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.</li> </ol>	



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5. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
  6. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
  7. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th Ed., CBS Publishers and Distributors, Delhi, India.
  8. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
  9. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

# Syllabus Theory and Practical B.Sc. (Basic/Honors) Semester-II

**Course code:** DSC-2T: BC-201;

**Course Title:** Chemical Foundations of Biochemistry -2(theory)

<b>Course title</b>	<b>Chemical Foundations of Biochemistry -2</b>
Course code	DSC-2T: BC-201
Course credits	04
Total contact hours	56
Duration of ESA (Hour)	03
Formative assessment marks	40
Summative assessment marks	60

**Course Outcome:** These topics will enable students to understand the fundamentals of chemical processes in biological systems

Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
Aptitude	x	x	x									
Critical thinking	x	x										
Subject clarity	x	x										x
Analytical Skill	x	x			x	x						

<b>Content of Theory course- Chemical Foundations of Biochemistry-2</b>	<b>56 hr</b>
<b>Total credits = 4</b>	
<b>Unit 1: Chemical Catalysis</b>	<b>14 hr</b>
Definition, characteristics, types, intermolecular, multifunctional, theories of catalysis, properties, characteristics of enzyme catalysis, autocatalysis, industrial catalysis and their role in biological systems (brief). Colloids: true solutions, classification, peptisation, purification, ultrafiltration, Brownian movements, electric properties, coagulation, mutual, lyophilic sols, boiling, dialysis, electro and persistent dialysis, addition of electrolytes, colloids in daily life and applications. Emulsion, types, micelles with biomolecules and its biological applications.	
<b>Unit 2: Nomenclature of Organic Compounds</b>	<b>14 hr</b>
Classification, naming- IUPAC nomenclature, compounds containing one, two functional groups with chains, homologous series. Stereochemistry, geometrical and structural Isomerism, conformation and free rotation. Optical isomerism, symmetry of elements, plane polarized light and optical purity. Nomenclature of enantiomers, epimers, racemic mixture, resolution. Fischer and Newman projection formulae, molecule with one and two chiral and achiral centers. Priority rules; E and Z (CIP rules), R and S, D and L notations, absolute (r and s) and relative (d and l) configuration. Role of stereochemistry in biological systems.	

<b>Unit 3: Organometallic Compounds</b>	<b>14 hr</b>
<p>Metal atom linked organic compounds. Preparation of Grignard reagents and structure, limitations, protonolysis and reactions. Organolithium compounds, preparation and reactions. Organozinc compounds. Organoboranes its mechanisms. Ferrocenes.</p> <p>Introduction to mineral and ores, classification, concentration, extraction, refining, uses of minerals and metals and its importance.</p> <p>Porphyrins and Metal ions: Role of metal ions in biological systems, Fe, Cu, Zn, structure and functions of porphyrins, metalloporphyrins and iron-sulphur clusters with suitable examples and their role in biological systems.</p>	
<b>Unit 4: Inorganic Chemistry</b>	<b>14 hr</b>
<p>Nomenclature of inorganic molecules and coordination compounds, formula. IUPAC nomenclature. Central metal ion, ligand, coordination number, sphere, complex ion, oxidation number of central atom, homoleptic and heteroleptic complexes. Isomerism in complexes, structural, ionisation, solvate, linkage and coordination, Stereoisomerism, geometrical, optical isomerism with simple inorganic complexes. Applications of qualitative, quantitative analysis, photographic, metallurgy, medicine, catalysis and biosystems.</p> <p>Heavy Metal Poisons: Introduction, poisons, lead, mercury, aluminium, arsenic, corrosives, cyanide, irritants, phosphorus, CO<sub>2</sub>, SO<sub>2</sub>, SO<sub>3</sub>, NO<sub>2</sub>, halides and acid fumes, poisoning, sources, signs and symptoms. Free radicals: introduction, definition, generation and scavenger systems. Redox reactions, types, stock notations, change in oxidation number and combination. Endergonic and exergonic reactions with examples. The Importance in biological systems.</p>	
<b>References</b>	
<ol style="list-style-type: none"> <li>1. Physical Chemistry 2006, Peter Atkins. 8th edition, W.H. Freeman and Company</li> <li>2. Inorganic Chemistry: Principles of structure and Reactivity, 2006, Huheey JE, Keiter EA, Keiter RL, Pearson Education India</li> <li>3. Stereochemistry: Conformation and Mechanism, 2009, Kalsi PS, New Age International Publications</li> <li>4. Introduction to Stereochemistry 2012, Kurt Mislow, Dover Publications</li> <li>5. A text book of Organic Chemistry 2016, Raj K Bansal, 6th edition, New Age International Publications</li> <li>6. Advanced Inorganic Chemistry 1999, Cotton et al, 6th edition, A Wiley - International</li> <li>7. Principles of physical Chemistry by Puri, Sharma and Pathania.</li> <li>8. Physical Chemistry by R. L. Madan, G. D. Tuli. S. Chand and Co.</li> <li>9. A Text Book of Physical Chemistry by K.L. Kapoor. Vol.2. Mc. Millan Publisher, India Ltd.</li> <li>10. Advanced Organic Chemistry by Bahl and Arun Bahl.</li> </ol>	

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

**Course code: DSC-2P: BC-202:**

**Course Title: Qualitative and Quantitative analysis – practicals-2**

<b>Course title</b>	<b>Qualitative and Quantitative analysis-practical's-2</b>
Course code	DSC-2P: BC-202
Course credits	02
Total contact hours	56 (4 h/ week)
Duration of ESA (Hour)	3
Formative assessment marks	25
Summative assessment marks	25

Course Outcome: The Course Objective is to provide experimental practice of quantitative and qualitative analysis. Also it provides training in physical chemistry laboratory techniques. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

<b>Content of Practical course- Qualitative and quantitative analysis-2</b>	
<b>Total Teaching Hours = 56; Total Credits = 2</b>	<b>56 hr</b>
<b>List of experiments to be conducted</b>	
<p>1. Systematic Semi micro–Qualitative Analysis of Inorganic Salt Mixtures Systematic semi micro qualitative analysis of two acid and two basic radicals in the given inorganic salt mixture. The constituent ions in the mixture to be restricted to the following. (Any four binary mixtures shall be given) Anions: <math>\text{HCO}^-</math>, <math>\text{CO}_2^-</math>, <math>\text{Cl}^-</math>, <math>\text{Br}^-</math>, <math>\text{NO}^-</math>, <math>\text{BO}^{3-}</math>, <math>\text{SO}^{2-}</math> and <math>\text{PO}_3^-</math>. Cations: <math>\text{Pb}^{2+}</math>, <math>\text{Al}^{3+}</math>, <math>\text{Fe}^{2+}</math>, <math>\text{Fe}^{3+}</math>, <math>\text{Mn}^{2+}</math>, <math>\text{Zn}^{2+}</math>, <math>\text{Ca}^{2+}</math>, <math>\text{Sr}^{2+}</math>, <math>\text{Ba}^{2+}</math>, <math>\text{Mg}^{2+}</math>, <math>\text{K}^+</math>, <math>\text{Na}^+</math> and <math>\text{NH}^+</math>. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald's viscometer.</p> <p>2. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmeter.</p> <p>3. Determination of molecular weight of non-volatile solute by Walker-Lumsden method.</p> <p>4. Determination of rate constant of decomposition of <math>\text{H}_2\text{O}_2</math> using <math>\text{KMnO}_4</math> by volumetric analysis method using ferric chloride as catalyst.</p> <p>5. Determination of distribution coefficient of benzoic acid between water and benzene or iodine between water and carbon tetrachloride.</p> <p>6. Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively. (Types of binary mixtures- Solid – Solid, Solid – Liquid, Liquid – Liquid)</p> <p>7. Verification of Beer's Law. Estimation of unknown concentration of a</p>	

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biomolecule by using colorimeter

8. Calibration of pH meter and determination of pH of aerated soft drinks.

### References

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
4. Principles of Practical Chemistry- M. Viswanathan
5. Instrumental Methods of chemical Analysis B.K Sharma.
6. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill
7. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
8. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.
9. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
10. General Chemistry experiment – Anil J Elias (University press).
11. Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.
12. Quantitative chemical analysis S. Sahay (S. Chand & Co.).
13. Practical Chemistry Dr O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication
14. College Practical Chemistry. V K Ahluwalia, SunithaDingra, Adarsh Gulati
15. Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV Learning Publication

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Practical record and Viva voce	05
Total	25

**Open Elective Course Code: OE-2T:BC-203;**  
**Course Title: Nutrition and Dietetics (theory)**

<b>Course title</b>	<b>Nutrition and Dietetics</b>
Couse code	OE-2T: BC-203
Course credits	03
Total contact hours	56
Duration of ESA (Hour)	03
Formative assessment marks	40
Summative assessment marks	60

**Course outcomes:**

- The student will gain knowledge about energy requirements and the Recommended Dietary Allowances.
- The student will understand the functions and role of macronutrients, their requirements and the effect of deficiency and excess
- The student learns the impact of various functional foods on our health
- The student will be able to apply basic nutrition knowledge in making foods choices and obtaining an adequate diet.
- The student gains competence in connecting the role of various nutrients in maintaining health and learn to enhance traditional recipes.

<b>Content of Theory course- Nutrition and Dietetics</b>	<b>Total credits =3</b>
<b>Unit 1: Basic Concepts of Nutrition</b>	<b>14 hr</b>
Introduction, Basic principles of a balanced diet to provide energy and nutrients. Composition of foods and proximate analysis of foods. Calorific value of foods and Basal metabolism. Basal Metabolic Rate (BMR), Factors affecting BMR, Energy requirements for different physical activities, Specific dynamic action of food, Nutritive value of proteins. Energy requirements and recommended dietary allowance (RDA) for infants, children and pregnant women. Protein calorie malnutrition.	
<b>Unit 2: Macronutrients and Micronutrients</b>	<b>14 hr</b>
Carbohydrates- Digestible and non-digestible, Dietary fibers, Essential fatty acids, lipoproteins and cholesterol. Essential amino acids, Fortification of foods, Protein requirement for different categories.  Vitamins-Sources, requirements, functions and deficiency symptoms of Vitamin-C, Thiamine, Riboflavin, Pyridoxine, Folic acid, Vitamin B12. Absorption of fat-soluble vitamins- A, D, E and K.  Micronutrients: Source, Daily requirement, functions and deficiency disease symptoms of Macro-minerals (Ca, P, and Cl) and micro minerals/trace elements (I, Fe, Zn and Se).	

<b>Unit 3: Dietetics and Diet Therapy</b>	<b>14 hr</b>
<p>Introduction. Food pyramid. Diet planning and introduction to diet therapy. Nutritional requirements for different age groups, anemic child, expectant women, and lactating women. Diet planning for prevention and cure of nutritional deficiency disorders.</p> <p>Diet therapy: Functional foods, Anthropometric measurements, dietary considerations during fever, malaria, and tuberculosis. Prevention and correction of obesity, underweight, and metabolic diseases by diet therapy. Dietary interventions to correct and or manage the gastrointestinal diseases (indigestion, peptic ulcer, constipation, diarrhea, steatorrhea, irritable bowel syndrome.</p> <p>Functional foods-based diet therapy for diabetes, cardiovascular disease and cancer.</p>	
<p><b>References</b></p> <ol style="list-style-type: none"> <li>1. Clinical Dietetics and Nutrition, 2002, Antia FP and Abraham P. Oxford University Press; 4th Edition. ISBN-10: 9780195664157.</li> <li>2. Oxford Handbook of Nutrition and Dietetics, 2011, Webster-Gandy J, Madden A and Holds worth M. Oxford University Press, Print ISBN-13: 9780199585823.</li> <li>3. Krause’s Food, Nutrition and Diet therapy, 2003, Mahan KL and Escott-Stump S. Elsevier, ISBN: 9780721697840.</li> </ol>	
<ol style="list-style-type: none"> <li>4. Human Nutrition and Dietetics. 1986, Passmore R. and Davidson S. Churchill Livingstone Publications, ISBN-10: 0443024863.</li> <li>5. Rosemary Stanton’s Complete Book of Food &amp; Nutrition, 2007, Simon &amp; Schuster Publishers, Australia, ISBN 10: 0731812999</li> <li>6. Food Science and Nutrition, 2018, Roday S. Oxford University Press Publishers, ISBN: 9780199489084/0199489084.</li> <li>7. Food Science, 2007, Srilakshmi S. New Age International (P) Limited Publishers, ISBN: 9788122420227/ 8122420222.</li> </ol>	

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

**Skill enhancement course: Course Code: SEC-2T:BC-204.1;  
Course Title: Biochemical Techniques-2 (theory)**

<b>Course title</b>	<b>Biochemical Techniques-2</b>
Course code	SEC-2T: BC-204.1
Course credits	02
Total contact hours	28
Duration of ESA (Hour)	03
Formative assessment marks	40
Summative assessment marks	60

**Course Level Learning Outcomes:** Students will be exposed to various electrophoretic and mass spectrometry techniques and their applications in biomolecular separations and drug discovery. A thorough understanding of the above techniques would provide job opportunities in CROs for drug discovery and metabolism and also in diagnostic development companies.

<b>Content of Theory course- Biochemical Techniques-2</b>	<b>28 hr</b>
<b>Total credits =2</b>	
<b>Unit 1: Electrophoresis</b>	14 hr
Protein and nucleic acid Separations: PAGE, Non-denaturing PAGE, Non-reducing SDS-PAGE. 2-D electrophoresis, Preparation of pH gradient gel. Procedure of preparation of polyacrylamide gels, importance of buffers in electrophoretic separations, importance of stacking and resolving gels, use of denaturing agents and reducing agents in electrophoresis. Applications of electrophoretic techniques in disease diagnosis. Staining techniques- Coomassie staining, PAS staining, Silver staining, Fluorescent dye staining, Submerged-gel electrophoresis for the separation of nucleic acids. Nucleic acid staining Techniques. Zymography.	
<b>Unit 2: Mass spectrometry</b>	14 hr
Ionization techniques: Electro ionization, Fast-atom bombardment, Electro-spray ionization, Chemical ionization, Photo-ionization, MALDI. Construction and applications of Mass spectrometer, LC-MS/MS, GC-MS/MS. Preparation of samples for LC-MS and GC-MS. Detectors: Electron multiplier, Faraday's cup, Photomultiplier conversion dynode, Array detectors. Application of LC-MS and GC-MS in drug discovery and metabolic studies.	
<b>References</b>	
<ol style="list-style-type: none"> <li>1. Biophysical Chemistry, Principles &amp; Techniques – Upadhyay, Upadhyay and Nath –Himalaya Publ. House.</li> <li>2. Principles &amp; Techniques of Practical Biochemistry – Wilson, Walker-Cambridge Univ.Press.</li> <li>3. Chromatography – G. Abbott.</li> <li>4. Physical Biochemistry- Application to biochemistry and molecular biology by David Freifelder. W. H. Freeman &amp; Co. San Fransisco. 2<sup>nd</sup> Edition</li> <li>5. LC-MS in drug analysis Methods and protocols. Edr.Lorali J. Langman, Christine L H Snozek, Springer publications</li> </ol>	



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**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

**Skill enhancement course: Course Code: SEC-2T:BC-204.2;  
Course Title: Bioinformatics (theory)**

<b>Course title</b>	<b>Bioinformatics</b>
Course code	SEC-2T: BC-204.2
Course credits	02
Total contact hours	28
Duration of ESA (Hour)	03
Formative assessment marks	40
Summative assessment marks	60

**Course level learning outcomes:**

By studying this course the students completing B.Sc. (Hons) Biochemistry will have an understanding of the tools of bioinformatics and computational biology and will be in a position to access biological data bases and softwares which will be helpful in understanding sequence alignments and predicting the structures of biomolecules such as proteins. Students will be exposed to available bioinformatics tools and databases. They will be in a position to comprehend the fundamental aspects of in-silico protein structure prediction. They will understand application of theoretical approaches to biological systems. Students will get trained in the application of programs used for database searching, protein and DNA sequence analysis, and prediction of protein structures.

<b>Content of Theory course- <u>Bioinformatics</u></b>	<b>28 hr</b>
<b>Total credits =2</b>	
<b>Unit 1: Introduction to Bioinformatics</b>	<b>14 hr</b>
Bioinformatics: Introduction, Basics of Computer and operating systems, Hardware, Software, Introduction to programming Languages and Paradigms, PERL/R programming, role of supercomputers in biology.  Scope of bioinformatics - Genomics, Proteomics, comparative and functional genomics, Genome annotation, gene prediction approaches and tools. Transcriptome and Proteome, Tools of proteome analysis. DNA microarray: understanding of microarray data and correlation of gene expression data to biological processes and computational analysis tools. Computer aided drug design (CADD) and Systems Biology.	
<b>Unit 2: Database &amp; Sequence Alignment</b>	<b>14 hr</b>
Biological databases: Introduction to biological databases - primary, secondary and composite databases, useful programs, ClustalW, BLASTp. NCBI, EBI, ExPaSy, nucleic acid databases (GenBank, EMBL, DDBJ, NDB), protein databases (PIR, Swiss-Prot, TrEMBL, PDB), metabolic pathway database (KEGG, EcoCyc).  Sequence alignment: Similarity, identity and homology. Concept of Alignment: Pair-wise sequence alignment, gaps, gap-penalties, scoring matrices, PAM250, BLOSUM62, local and global sequence alignment, multiple sequence alignment, Progressive Alignment Algorithm, Application of multiple sequence alignment. BLAST and CLUSTALW.	

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**References:**

1. Bioinformatics – 2008. Principles and Applications, 1st ed. Ghosh, Z. and Mallick, B., Oxford University Press (India),
2. M. Michael Gromiha, 2010. Protein Bioinformatics: From Sequence to Function, Academic Press.
3. Bioinformatics: Sequence and Genome Analysis (2001), 1st ed., Mount, D.W. Cold Spring Harbor Laborator Press (New York)
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (2005), 3rd ed., Baxevanis, A.D. and Ouellette, B.F., John Wiley & Sons, Inc. (New Jersey).
5. NCBI data base, open source learning

**Pedagogy: MOOC/desk work/book chapter/problem solving /assignment**

<b>Formative Assessment</b>	
Assessment occasion	Weightage in marks
Class test (Two class tests)/ Continuous evaluation	20
Seminar/ class work	10
Assignment/ open discussion/ quiz	10
Total	40

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## **B. Sc. Degree Examinations according to NEP 2021**

**60 : 40 pattern**

**Theory papers: Total marks = 100 marks**

C1= 20 marks(IA)

C2= 20marks(IA)

C3= 60marks (Main exam.)

**Practical papers: Total marks = 50 marks**

C1= 10 marks (IA)

C2= 10 marks(IA) +05(Record)

C3= 25 marks (Main Exam.)

IA = Internal assessment (Assignment/seminar/test/viva-voce).

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B.Sc. DEGREE (BASIC/HONS) I AND II SEMESTERS EXAMINATION  
MODEL QUESTION PAPER  
BIOCHEMISTRY

TIME : 2 h

MAX. MARKS: 60

**NOTE: ALL SECTIONS ARE COMPULSORY**

**SECTION - A**

1. Answer any FIVE of the following 5 x 2 = 10
- a.
  - b.
  - c.
  - d.
  - e.
  - f.
  - g.

**SECTION - B**

Answer any FOUR of the following 4x 5 = 20

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

**SECTION - C**

Answer any THREE of the following 3 x 10 = 30

- 8.
- 9.
- 10.
- 11.
- 12.

**Note: section C may include sub questions a, b**

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B. SC. DEGREE (BASIC/ HONS.) I AND II SEMESTERS EXAMINATION MODEL

QUESTION PAPER (PRACTICALS)

BIOCHEMISTRY

Time: 3 h

Max. Marks: 25

1. Write the principle and procedure of \_\_\_\_\_ experiment 05
  2. Major experiment (Conduct and report the results) 15
  3. Viva-voce 05
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**B.Sc. DEGREE (BASIC/HONS) I AND II SEMESTERS EXAMINATION**  
**SCHEME OF THEORY EXAMINATION**  
**I B.Sc., I SEMESTER**  
**DSC-I**

**TITLE: Chemical Foundations of Biochemistry-1**

**Times: 3hrs**

**Max Marks: 60**

**Question Paper to be set for total of 94 marks including choices**

<b>UNITS</b>	<b>2 mark questions</b>	<b>5 mark questions</b>	<b>10 mark questions</b>	<b>Total Marks</b>
UNITS: 1 <b>Scope of Biochemistry and Units of measurement</b>	2	1	1.5	24
UNITS: 2 <b>Atomic structure and Chemical bonds</b>	2	2	1	24
UNITS: 3 <b>Buffers and Colligative properties</b>	2	1	1.5	24
UNITS: 4 <b>Electrochemistry and Redox reactions</b>	1	2	1	22

I Main:  $2 \times 7 = 14$  Marks

II Main:  $5 \times 6 = 30$  Marks

III Main:  $10 \times 5 = 50$  Marks

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**DSC 1- PRACTICALS**  
**SCHEME OF PRACTICAL EXAMINATION**  
**I B.Sc., I SEMESTER**

**TITLE: Volumetric Analysis-Practicals-1**

**Times:3hrs**

**Max Marks: 25**

Practical proper :20

Vivo voce : 05

**NOTE :-** Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Dept.

**PART- A**

**05 Marks**

**I. Any one of the following experiment may be given for procedure writing.**

1. Concept of molarity, molality and normality. Calculation and preparation of molar solutions. (Problems to be given in exams). Calculation and preparation of normal solutions and percent solutions and dilute solutions.
  2. Calibration of volumetric glassware's (Burette, pipette).
  3. Preparation of standard Sodium carbonate solution, standardization of HCl (Methylorange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).
  4. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H<sub>2</sub>SO<sub>4</sub> in the given solution (phenolphthalein).
  5. Preparation of standard Oxalic acid. Standardization of KMnO<sub>4</sub> and estimation of H<sub>2</sub>O<sub>2</sub> in the given solution.
  6. Preparation of standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. Standardization of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> and estimation of CuSO<sub>4</sub> in the given solution.
  7. Preparation of ZnSO<sub>4</sub>. Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.
  8. Preparation of standard potassium biphthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
  9. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard KMnO<sub>4</sub> solution.
  10. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).
  11. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
  12. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids
  13. Preparation of standard Oxalic acid solution. Standardization of KMnO<sub>4</sub> solution and estimation of calcium in milk.
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## PART – B

15 Marks

### II. Any one of the following experiment may be Set

1. Preparation of standard Sodium carbonate solution, standardization of HCl (Methylorange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).
2. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H<sub>2</sub>SO<sub>4</sub> in the given solution (phenolphthalein).
3. Preparation of standard Oxalic acid. Standardization of KMnO<sub>4</sub> and estimation of H<sub>2</sub>O<sub>2</sub> in the given solution.
4. Preparation of standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. Standardization of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> and estimation of CuSO<sub>4</sub> in the given solution.
5. Preparation of ZnSO<sub>4</sub>. Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.
6. Preparation of standard potassium biphthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
7. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard KMnO<sub>4</sub> solution.
8. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).
9. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
10. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids
11. Preparation of standard Oxalic acid solution. Standardization of KMnO<sub>4</sub> solution and estimation of calcium in milk.

### III. Viva-voce

05 Marks

**Total marks: 25: [15 (Practical Exam) + 05 (viva)]**

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**SCHEME OF VALUATION  
(ASSESSMENT OF EXPERIMENTAL RESULTS)**

**PART - B**

Preparation of standard solution and calculation of normality - 3 Marks

Standardization and estimation

Discrepancy in titre values	Standardization	Estimation
▯ 0.1 ml	4 Marks	4 Marks
▯ 0.2 ml	3 Marks	3 Marks
▯ 0.3 ml	2 Marks	2 Marks
▯ 0.5 ml (or) any other value	1 Marks	1 Marks
 CALCULATIONS	 2 Marks	 2 Marks

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**DSC II- PRACTICALS**  
**SCHEME OF PRACTICAL EXAMINATION**  
**I B.Sc., II SEMESTER**

**TITLE: Volumetric Analysis-Practicals-1**

**Times:3hrs**

**Max Marks: 25**

Practical proper :20

Vivo voce : 05

**NOTE :-** Candidates are required to submit the records duly signed by the teacher-in-charge and certified by the Head of the Dept.

**PART- A**

**05 Marks**

**I. Any one of the following experiment may be given for procedure writing.**

1. Systematic Semi micro–Qualitative Analysis of Inorganic Salt Mixtures Systematic semi micro qualitative analysis of two acid and two basic radicals in the given inorganic salt mixture. The constituent ions in the mixture to be restricted to the following. (Any four binary mixtures shall be given)  
Anions:  $\text{HCO}^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$  and  $\text{PO}_4^{3-}$ .  
Cations:  $\text{Pb}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$  and  $\text{NH}_4^+$ .
  2. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald's viscometer.
  3. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmometer.
  4. Determination of molecular weight of non-volatile solute by Walker-Lumsden method.
  5. Determination of rate constant of decomposition of  $\text{H}_2\text{O}_2$  using  $\text{KMnO}_4$  by volumetric analysis method using ferric chloride as catalyst.
  6. Determination of distribution coefficient of benzoic acid between water and benzene or iodine between water and carbon tetrachloride.
  7. Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively. (Types of binary mixtures- Solid – Solid, Solid – Liquid, Liquid – Liquid)
  8. Verification of Beer's Law. Estimation of unknown concentration of a biomolecule by using colorimeter
  9. Calibration of pH meter and determination of pH of aerated soft drinks.
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## PART – B

15 Marks

### II. Any one of the following experiment may be Set

1. Systematic Semi micro–Qualitative Analysis of Inorganic Salt Mixtures Systematic semi micro qualitative analysis of two acid and two basic radicals in the given inorganic salt mixture. The constituent ions in the mixture to be restricted to the following. (Any four binary mixtures shall be given)  
Anions:  $\text{HCO}^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$  and  $\text{PO}_4^{3-}$ .  
Cations:  $\text{Pb}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$  and  $\text{NH}_4^+$ .
2. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald's viscometer.
3. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmometer.
4. Determination of molecular weight of non-volatile solute by Walker-Lumsden method.
5. Determination of rate constant of decomposition of  $\text{H}_2\text{O}_2$  using  $\text{KMnO}_4$  by volumetric analysis method using ferric chloride as catalyst.
6. Determination of distribution coefficient of benzoic acid between water and benzene or iodine between water and carbon tetrachloride.
7. Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively. (Types of binary mixtures- Solid – Solid, Solid – Liquid, Liquid – Liquid)
8. Verification of Beer's Law. Estimation of unknown concentration of a biomolecule by using colorimeter
9. Calibration of pH meter and determination of pH of aerated soft drinks.

### III. Viva-voce

05 Marks

**Total marks: 25: [20 (Practical Exam) + 05 (viva)]**

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**SCHEME OF VALUATION  
(ASSESSMENT OF EXPERIMENTAL RESULTS)**

Sl No.	Experiment	Discrepancy between the expected value and the candidate value	Marks to be awarded
1	<p>Systematic Semi micro–Qualitative Analysis of Inorganic Salt Mixtures</p> <ol style="list-style-type: none"> <li>1. Preliminary test</li> <li>2. Detection of two Acid radical/anions(2+2)</li> <li>3. Group Separation table for detection of basic radicals/cations</li> <li>4. Detection of two Basic radical/Cations(2+2)</li> <li>5. report</li> </ol>		<p>02</p> <p>04</p> <p>04</p> <p>04</p> <p>01</p>
2	<p>Determination of</p> <p>a) Density using specific gravity bottle</p> <p>b) Viscosity of the given liquid by ostwald’s method.</p>	<p>±2%</p> <p>±3%</p> <p>Any other value</p> <p>Calculation</p> <p>±4%</p> <p>±6%</p> <p>±8%</p> <p>Any other value</p> <p>Calculation</p>	<p>04marks</p> <p>03marks</p> <p>02mark</p> <p>01 mark</p> <p>05marks</p> <p>04marks</p> <p>03mark</p> <p>02mark</p> <p>01 mark</p>

4	Determination of molecular weight of non volatile substance by Walker – Lumsden method	$\pm 10\%$ $\pm 6\%$ $\pm 8\%$ Any other value Calculation	10Marks 08Marks 06Marks 04Marks 02Marks
5	Determination of rate constant of decomposition of $\text{H}_2\text{O}_2$ using $\text{KMnO}_4$ .	$\pm 10\%$ $\pm 15\%$ $\pm 20\%$ Any other value Calculation	09 Marks 07Marks 05 Marks 03Marks 03 marks
6	Determination of partition co-efficient benzoic acid between water and benzene or iodine between water and carbon tetrachloride	$\pm 10\%$ $\pm 11-18\%$ $\pm 18 -25\%$ Any other value Calculation	12Marks 8Marks 08Marks 06Marks 03 marks

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## SEMESTER III

<b>COURSE TITLE</b>	<b>BIO-ORGANIC CHEMISTRY</b>
<b>COURSE CREDITS</b>	<b>04</b>
<b>TOTAL CONTACT HOURS</b>	<b>56</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>40</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>60</b>

### Course outcome:

These topics will enable students to understand the fundamentals of organic chemistry pertinent to their importance in understanding biochemical reactions.

Course outcomes /Programoutcomes	1	2	3	4	5	6	7	8	9	10	11	12
Aptitude	X	X	X	X								
Critical thinking		X										
Subject clarity	X	X				X	X	X		X		X
Analytical skill	X				X	X	X	X	X			X

### UNIT 1: Reaction mechanisms and aliphatic hydrocarbons

**14 hours**

Introduction, meaning of the term, kinetic and non-kinetic. Fundamental aspects: Homo and heterolytic cleavage. Concept of inductive effect, mesomeric effect, resonance, and hyper conjugation. Classification of organic reactions (substitution, addition, elimination, and re-arrangement), with two examples for each. Concepts Reactive intermediates of the following – free radicals, carbo cations and carbanions, free radicals, carbines, nucleophiles and electrophiles(Formation and Stability).

Hydrocarbons -Mechanism of addition of HCl to propene, Markownikoff's rule. Peroxide effect, Alkenes – Ozonolysis, oxidation. Alkynes – formation of acetylides and their importance. Dienes– types with examples. Conjugate dienes, 1,3-butadiene – stability, mechanism of addition of HBr. Conformational analysis of ethane and n-butane.

### UNIT 2: Mechanism of substitution, elimination, and addition reactions

**14 hours**

$S_N1$  and  $S_N2$  reactions on tetrahedral carbon, energy profile diagrams, Stereochemistry, factors affecting  $S_N2$  and  $S_N1$  reactions

The Elimination reactions-  $E_2$  reaction, Zaitsev rule,  $E_1$  reaction. Stereochemistry of  $E_1$  &  $E_2$  reactions,  $E_2$  &  $E_1$  elimination from cyclic compounds. Substitution and Elimination reactions in Synthesis.

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Addition reactions - Aldehydes and Ketones - nucleophilic addition of acetals & ketals. Addition of Ammonia, primary amines, and other ammonia derivatives. Conjugate addition. Conjugate addition in alpha and beta unsaturated aldehydes and ketones 1, 2 and 1,4 addition.

### **UNIT 3: Mechanism of electrophilic aromatic substitution reactions**

**14 hours**

Aromatic compounds - aromaticity, criteria for aromaticity, anti-aromatic, and non-aromatic compounds with examples. Mechanism of electrophilic aromatic substitution reactions- Halogenation, nitration, sulfonation, Friedel crafts alkylation. Friedel crafts acylation- mechanism involved. Relative reactivity of substituted benzenes, polycyclic benzenoid hydrocarbons.

The reaction of the coenzymes.

Overall view of metabolism, thiamine pyrophosphate- structure and its role in decarboxylation of alpha- keto acids.

Biotin- structure and its role in carboxylation of some important biochemical reactions of carbohydrate and lipid metabolism.

Vit B<sub>2</sub> its role in rearrangement reactions.

Vit B<sub>2</sub> coenzymes its role in redox reactions with suitable examples.

### **UNIT 4: Bio-organic compounds**

**14 hours**

Alcohols: Classification, monohydric alcohols: examples, general and distinguishing reactions. Dihydric alcohols: glycols, Tri hydric alcohols: glycerol – synthesis from propene, properties and uses. Phenols: Classification, electronic interpretation of acidity of phenols, mechanism of Kolbe, Reimer– Tiemann and bromination reactions.

Hydroxy acids: Structure and properties: Lactic acid, Citric acid and Isocitric acid. Dicarboxylic acids: Maleic and Fumaric acid. Ketoacids: Pyruvic,  $\alpha$ -Ketoglutaric, Oxaloacetic acid.

Carbonyl compounds: General properties, Keto-enol tautomerism. Mechanisms: addition of HCN to acetaldehyde, Claisen and aldol condensations. Quinones: o and p-benzoquinones-structure and properties.

Amines: Classification, properties, functional group – Basicity of amines, acylation. Reaction with HNO<sub>2</sub> & Schiff's base formation. Distinguishing reactions of primary, secondary and tertiary amines.

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Heterocyclic compounds: Definition, classification with examples, structure and biological importance of furan, pyrrole, thiophene, pyridine, pyran, thiazole, pyrimidine, purine, indole, imidazole, quinoline and isoquinoline. Basicity of pyrrole and pyridine.

Terpenes: Definition, Isoprene rule, classification, isolation, structure and biological importance of menthol, camphor, farnesol, phytol, lanosterol, lycopene and dolichols.

Steroids: Basic ring structure in steroids. Structure and biological importance of cholesterol, phytosterols, ergosterol, cortisol,  $\beta$ -estradiol, testosterone, and aldosterone. Bile acids (Mono, Di & Tri cholic acids).

Alkaloids: Definition, classification based on their structure and biological functions, Isolation of alkaloids, structure and physiological action of morphine, nicotine and atropine.

## REFERENCES

1. Textbook of Organic Chemistry 22<sup>nd</sup> Edition S. Chand Publishers 2019.
2. Organic Chemistry. Vol. I Fundamental Principles. I. L. Finar. 6<sup>th</sup> Edn. ELBS, 2002
3. Organic Mechanisms, Peter Sykes, Longman, 1977
4. Organic Chemistry. R.T. Morrison and R.N. Boyd. 6<sup>th</sup> Edn. Prentice Hall, India, 2018
5. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6<sup>th</sup> Edn. Macmillan Publications 2012
6. Chemistry- An Introduction to General, Organic and Biological Chemistry, 7<sup>th</sup> Edn. Karen C. Timberlake, Benjamin Cummings, 1999
7. Reaction Mechanisms at a Glance, ed. M. Moloney, Blackwell Science 2000.

PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING /ASSIGNMENT

<b>Formative Assessment</b>	
<b>ASSESSMENT OCCASION</b>	<b>WEIGHTAGE IN MARKS</b>
CLASS TEST ( 2 CLASS TESTS )	20
SEMINARS / CLASS WORK	10
ASSIGNMENT/ OPEN DISCUSSION	10
TOTAL	40

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## SEMESTER III

### PRACTICALS III

<b>COURSE TITLE</b>	<b>BIO-ORGANIC CHEMISTRY</b>
<b>COURSE CREDITS</b>	<b>02</b>
<b>TOTAL CONTACT HOURS</b>	<b>4 Hours/Week</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>25</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>25</b>

#### Course outcome:

This course aims to familiarize students with the principles of organic chemistry and basic qualitative analysis of organic compounds. Course objective is to provide experimental practice of preparation of organic compounds and extraction of biologically important compounds.

#### Experiments:

I. Systematic qualitative analysis of organic compounds (6 practicals)

1. Urea	2. Aniline	3. Benzoic Acid
4. Salicylic acid	5. Benzaldehyde	6. Acetophenone
7. Chlorobenzene	8. Nitrobenzene	

II. Preparation of following organic compounds (2 practicals)

1. Acetylation: Preparation of acetyl salicylic acid from salicylic acid.
2. Oxidation: Preparation of benzoic acid from benzaldehyde.
3. Nitration: Preparation of m-dinitrobenzene from nitrobenzene.
4. Hydrolysis: Preparation of benzoic acid from ethyl benzoate.

III. Extractions

1. Extraction of caffeine from tea leaves
  2. Extraction of starch from potatoes
  3. Extraction of casein from milk
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### REFERENCES:

1. Practical Organic Chemistry: Qualitative Analysis by S.P. Bhutani, A. Chhikara 2009
2. Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis by Arthur Israel Vogel 2003
3. Comprehensive practical organic chemistry- preparation and quantitative analysis. V. K.Ahluwalia and Renu Aggarwal 2004
4. Practical Hand Book of Systematic Organic Qualitative Analysis. Md. Rageeb Md. Usman, S. S. Patil 2017
5. Laboratory Manual of Inorganic & Organic Chemistry (Qualitative Analysis) KalpaMandal, Sonia Ratnani 2020

PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING/ ASSIGNMENT

<b>Formative Assessment</b>	
<b>ASSESSMENT OCCASION</b>	<b>WEIGHTAGE IN MARKS</b>
CONTINUOUS EVALUATION AND CLASS TEST	15
RECORD / VIVA VOCE	10
TOTAL	25



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# SEMESTER III

## OPEN ELECTIVE 1

<b>COURSE TITLE</b>	<b>BIOCHEMICAL TECHNIQUES</b>
<b>COURSE CREDITS</b>	<b>03</b>
<b>TOTAL CONTACT HOURS</b>	<b>42</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>40</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>60</b>

### Course outcome:

These topics will enable students to develop competence in handling various chromatographic, electrophoretic and isotopic techniques and apply them in isolating and characterizing different biological molecules.

### UNIT 1 : Microscopy & Centrifugation Techniques

**14 hours**

**Microscopy:** Different types of microscopes – electron microscopes – TEM, SEM. Fluorescence and confocal microscopes used in fine structure studies.

**Centrifugation Techniques:** Introduction, basic principles, and applications of sedimentation. Centrifuges and their use - small bench centrifuges, large capacity refrigerated centrifuges, high speed refrigerated centrifuges, continuous flow centrifuges, Preparative ultra- centrifuges, analytical ultracentrifuges, and density gradient centrifugation.

### UNIT 2 : Chromatography & Electrophoresis techniques

**14 hours**

**Chromatography:** Introduction, classification of chromatographic techniques. Principle, materials, theory and applications of paper chromatography, thin layer chromatography, column chromatography- adsorption chromatography, gel permeation, ion exchange chromatography, affinity chromatography, gas chromatography, FPLC, high performance (pressure) liquid chromatography.

**Electrophoresis techniques:** Introduction. Principles and application of electrophoretic techniques-paper electrophoresis, starch gel electrophoresis, polyacrylamide gel electrophoresis, agarose gel electrophoresis, isoelectric focusing, isotachopheresis, pulse field electrophoresis, two-dimensional electrophoresis, capillary electrophoresis,

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preparative and high voltage electrophoresis.

### UNIT 3 : Radio isotopic techniques & Spectroscopy

14 hours

**Radio isotopic techniques:** Introduction to isotopes; mass and radioisotopes. Nature of radioactive decay, rate of radioactive decay, units of radioactivity, measurement of radioactivity- proportional counters, scintillation counters, autoradiography, isotopic dilution technique. Applications of radioisotopes in the biological sciences.

**Spectroscopy:** Introduction, Nature of electromagnetic Radiations. Principles and applications of the following spectroscopic techniques in biochemical investigations- Visible and Ultraviolet spectroscopy, Fluorescence spectroscopy, Infrared spectroscopy, Optical rotation dispersion (ORD), Circular dichroism (CD) spectroscopy, electron spin resonance (ESR), Atomic Absorption spectroscopy, Nuclear Magnetic resonance (NMR) spectroscopy and Mass spectroscopy

#### REFERENCES:

1. Modern Experimental Biochemistry: Rodney Boyer, 3<sup>rd</sup> Edn. Benjamin Cummings, 2000
2. Practical Skills in Biomolecular Sciences: R Reed, D. Holmes, J. Weyers, and A. Jones 1998
3. Physical Biochemistry: David Frifielder 2<sup>nd</sup> Edition, 1983
4. Biophysical Chemistry Upadya and Upadya, 2016
5. Introductory Practical Biochemistry: SK Sawhney and Randhir Singh, 2001

PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING /ASSIGNMENT

<b>Formative Assessment</b>	
<b>ASSESSMENT OCCASION</b>	<b>WEIGHTAGE IN MARKS</b>
CLASS TEST ( 2 CLASS TESTS )	20
SEMINARS / CLASS WORK	10
ASSIGNMENT/ OPEN DISCUSSION	10
TOTAL	40

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# SEMESTER III

## OPEN ELECTIVE 2

<b>COURSE TITLE</b>	<b>HORMONES - BIOCHEMISTRY AND FUNCTION</b>
<b>COURSE CREDITS</b>	<b>03</b>
<b>TOTAL CONTACT HOURS</b>	<b>42</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>40</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>60</b>

**Course outcome:** These topics will enable the students to:

- Understand the function of hormones and their regulation.
- Know how hormonal systems act in an integrated manner to regulate overall bodyfunctions.
- Understand how failure of these normal physiologic functions and integrations are associated with some endocrine disorders.

### **UNIT 1 :Overview of endocrine system**

**14 hours**

Introduction to the system and concepts of signaling. Classification, intercellular communication, regulation of synthesis and secretion of hormones. Chemical signaling- endocrine, paracrine, autocrine, and neuroendocrine mechanisms. Mechanisms of hormone action: synergism, antagonism, permissive effects. Division of hormones by the origin, chemical structure, location, and mechanism of action. Physiological role and disorders of Pituitary, Pineal, Thyroid and Parathyroid hormones. Introduction to the hypothalamus as the true master gland with Releasing hormones and inhibitory substances. Neurohypophysis and its secretions – ADH and Oxytocin

### **UNIT 2 :Endocrine glands and their secretions**

**14 hours**

Physiological role and disorders of hormones of pancreas, adrenal, and placenta. Introduction to gastrointestinal hormones and neurotransmitters (Acetyl choline, GABA, Serotonin). Mechanism of action, target tissues, and the physiological effects of gastrointestinal hormones. Structure and functions of sex hormones. Hormones during

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ovarian and uterine phases of menstrual cycle; Placental hormones; role of hormones during parturition and lactation. Hormone receptors: receptors in the cell membrane and in the cell. Secondary and tertiary messengers (cAMP and Ca<sup>2+</sup>). Overview on signal transduction pathways for steroidal and non-steroidal hormones (One example each).

### UNIT 3 : Clinical endocrinology

**14 hours**

Clinical endocrinology- Blood volume, composition and functions of plasma and serum. Separation and storage of body fluids. Methods of hormone estimation, principles of assay systems, normal range of hormones in tissues and clinical conditions leading to abnormal levels with interpretations. Thyroid function test- Determination of T3, T4, and TSH. Infertility profile: Determination of LH, FSH, TSH, Estrogen, Progesterone, Total Testosterone, Free testosterone. Major manifestations of disease of the endocrine pancreas, thyroid, hypothalamus, and pituitary disease.

#### REFERENCES:

1. Norman AW, Litwack G (1997), Hormones, 2<sup>nd</sup> Edition, Elsevier Publications.
2. Bolander F (2004), Molecular Endocrinology, 3<sup>rd</sup> Edition, Elsevier Publications.
3. Rifai N (2007), Tetz Fundamentals of Clinical Chemistry, 6<sup>th</sup> Edition, Elsevier Publications.
4. Henry's Clinical Diagnosis and Management by Laboratory Methods (2011), 22<sup>nd</sup> Edition, Elsevier.
5. Vasudevan DM (2011), Text book of Medical Biochemistry, 6<sup>th</sup> Edition, Jaypee Publishers.
6. Chatterjea MN & Shinde R (2012), Text book of Medical Biochemistry, 8<sup>th</sup> Edition, Jaypee Publications.
7. Bishop ML, Fody EP, Schoeff LE (2013), Clinical Chemistry: Principles, Techniques, and Correlations, 7<sup>th</sup> Edition, Wiley Publications.
8. J N Singh (2017), Biochemistry General, Hormonal and Clinical - 1<sup>st</sup> Edition, Atithibooks Publishers.
9. Rifai N (2017), Tetz Textbook of Clinical Chemistry and Molecular Diagnostics, 6<sup>th</sup> Edition Saunders Publications.

PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING /ASSIGNMENT

<b>Formative Assessment</b>	
<b>ASSESSMENT OCCASION</b>	<b>WEIGHTAGE IN MARKS</b>
CLASS TEST ( 2 CLASS TESTS )	20
SEMINARS / CLASS WORK	10
ASSIGNMENT/ OPEN DISCUSSION	10
TOTAL	40

## SEMESTER IV

<b>COURSE TITLE</b>	<b>ANALYTICAL BIOCHEMISTRY</b>
<b>COURSE CREDITS</b>	<b>04</b>
<b>TOTAL CONTACT HOURS</b>	<b>56</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>40</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>60</b>

**Course outcome:** These topics will enable the students to

- Understand the concept of biological sample preparation
- Appreciate chemistry and application of analytical instruments.
- Get acquainted with care and maintenance of equipment and chemicals.
- Understand clinically relevant biochemical analysis of all biochemical components i.e., proteins, electrolytes, hormones etc.,
- Have basic knowledge of clinical and forensic analytical methods and their principles.

Course outcomes /Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12
Aptitude	X	X	X	X								
Critical thinking		X				X						
Subject clarity	X	X						X				X
Analytical skill				X	X	X	X	X	X	X	X	X

### UNIT 1: Biological sample preparation and fractionation

**14 hours**

Introduction and objectives of bioanalysis and extraction of molecules from tissues and cells. Sample preparation types of sample living, postmortem extraction of macromolecules from tissues; liquid-liquid, liquid-solid and precipitation methods.

**Centrifugation-** Introduction, principles of centrifugation, Sedimentation, angular velocity, centrifugal field, relative centrifugal field. Types of centrifugations- Preparative and analytical. Differential, density gradient and ultra-centrifugation. Basic instrumentation; types of rotors and their design. Laboratory centrifuge; operational instruction and applications. Analytical Centrifuges- Optics; Application in sub-cellular fractionation. Sedimentation coefficient, care, and maintenance of instrument.

### UNIT 2: Chromatography

**14 hours**

General principles of chromatography, history of chromatography. Classification based on 1. physical way stationary and mobile phase are brought together- Planar and column



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chromatography, 2. based on types of mobile and/or liquid phase adsorption and partition- Gas chromatography and liquid chromatography. Based on stationary phase- thin layer chromatography, Paper chromatography - ascending, descending and circular, 2-D chromatography, Rf values.

Classification of chromatography based on separation: Principles, methodologies and applications of adsorption, partition, ion-exchange, gel-filtration and affinity- chromatography. Advanced chromatography- HPLC and FPLC, UPLC and GLC.

### **UNIT 3: Electrophoretic and radio isotopic methods**

**14 hours**

**Electrophoresis:** General principle of electrophoresis, velocity of a charged molecule in the applied electric field, relevance of Ohm's law in electrophoretic separations. Supporting media for electrophoresis; work of Tiselius, paper, agarose, polyacrylamide. Chemistry of polymerization of acrylamide gels, methodology and applications of native PAGE and SDS-PAGE, 2-D electrophoresis, Identification of proteins post electrophoresis- dyes and biological activities. Agarose gel and Pulse field electrophoresis, Applications of capillary electrophoresis and isoelectric focusing. Cellulose acetate electrophoresis. Principle and applications of immune-electrophoresis.

**Radioisotopic methods:** Radioactivity-Types of radioactive decay, Properties of  $\alpha$ ,  $\beta$ ,  $\gamma$  radiations. Group displacement law. Decay law - decay constant, Half-life period and average life of a radioactive element. Detection of radioactivity - GM counter and scintillation counters (only principal and working) Applications of radioisotopes -  $^3\text{H}$ ,  $^{14}\text{C}$ ,  $^{131}\text{I}$ ,  $^{60}\text{Co}$  and  $^{32}\text{P}$ . Biological effects of radiations. Radiolabeling, safety measure in handling radio isotopes.

### **UNIT 4: Spectroscopic methods of bio-analysis**

**14 hours**

**Spectroscopic methods:** Wave particle duality of light, electromagnetic spectrum, transition in spectroscopy. Principle, design and application of UV-Vis spectrophotometer. Beer's law and its limitations, determination of molar absorption coefficient of molecules. Working principle and application of a colorimeter, flame photometer and fluorimeter. Principle and application of IR, and Raman, ESR and NMR spectroscopy.

#### **REFERENCES:**

1. Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer 2011
  2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8<sup>th</sup> Edn. Andreas Hoffman and Samuel Clockie, Ed., Cambridge University Press, 2018.
  3. Biochemistry and Molecular Biology; 5th Edn. D. Papachristodoulou, A. Snape, W.H. Elliott, and D. C. Elliott, Oxford University Press 2014
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PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING /ASSIGNMENT

<b>Formative Assessment</b>	
<b>ASSESSMENT OCCASION</b>	<b>WEIGHTAGE IN MARKS</b>
CLASS TEST ( 2 CLASS TESTS )	20
SEMINARS / CLASS WORK	10
ASSIGNMENT/ OPEN DISCUSSION	10
TOTAL	40



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# SEMESTER IV

## PRACTICALS IV

<b>COURSE TITLE</b>	<b>ANALYTICAL BIOCHEMISTRY</b>
<b>COURSE CREDITS</b>	<b>02</b>
<b>TOTAL CONTACT HOURS</b>	<b>4 Hours/ Week</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>25</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>25</b>

**Course outcome:** This course aims to provide experimental practice of analytical techniques in Biochemistry. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

- Sourcing and handling biological samples.  
Develop skill and proficiency in basic techniques
- Centrifugation
- Chromatography
- Electrophoresis and
- Spectroscopy

### Experiments:

1. Preparation of human lymphocytes using clinical centrifuge
  2. Determination of packed cell volume/ hematocrit
  3. Resolution of basic, acidic and aromatic amino acids by descending and circular paperchromatography.
  4. Separation of plant pigments by gel-permeation chromatography
  5. Identification and resolution of pigments by thin layer chromatography.
  6. Determination of void volume of a gel-filtration column
  7. Recording the absorption spectrum of riboflavin
  8. Colorimetric estimation of glucose by DNS method
  9. Estimation of DNA by diphenylamine method
  10. Estimation of RNA bu orcinol method
  11. Electrophoretic separation of plasma proteins
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**REFERENCES:**

1. Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer, 2011
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8<sup>th</sup>Edn. Andreas Hoffman and Samuel Clockie, Ed., Cambridge University Press, 2018.
3. Biochemistry and Molecular Biology; 5<sup>th</sup> Edn. D. Papachristodoulou, A. Snape, W.H. Elliott, and D. C. Elliott, Oxford University Press, 2014

PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING /ASSIGNMENT

<b>Formative Assessment</b>	
<b>ASSESSMENT OCCASION</b>	<b>WEIGHTAGE IN MARKS</b>
CONTINUOUS EVALUATION AND CLASS TEST	15
RECORD / VIVA VOCE	10
TOTAL	25



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# SEMESTER IV OPEN

## ELECTIVE 1

### BIOCHEMICAL TOXICOLOGY

<b>COURSE TITLE</b>	<b>BIOCHEMICAL TOXICOLOGY</b>
<b>COURSE CREDITS</b>	<b>03</b>
<b>TOTAL CONTACT HOURS</b>	<b>42</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>40</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>60</b>

**Course outcome:** This open elective course offered to various streams gives basic idea about biochemical basis of various effects of toxins/ pharmaceuticals and an outline of process involved in toxicity testing and drug dosing.

- Categorize the classes of toxicants/drugs and know specific examples
- State the routes of exposure to toxins/drugs;
- Explain the processes of absorption, metabolism and elimination of toxins/drugs; and
- Explain environmental and physiological factors that affect toxicant metabolism

#### **UNIT 1 : Fundamentals of toxicology and dose response**

**14 hours**

Scope of toxicology; why should we know about toxins/xenobiotics (drugs) and What makes a substance toxic? Grading toxicity, Use of animal studies for toxicity, *in vitro* toxicity, organ toxicity (liver and kidney toxicity). Indicators of toxicity/drug effects; biomarkers. Concentration and site of action, dose response, effect of route of administration, ED<sub>50</sub>, LD<sub>50</sub>/TD<sub>50</sub>. Hazard and risk assessment, risk, acceptable daily intake (ADI) and tolerable daily intake (TDI).

#### **UNIT 2 : Factors affecting toxic responses**

**14 hours**

Disposition- Outline of toxin/drug uptake, entry to cells and systemic circulation. Effect of size, shape, solubility, and charge on their uptake. Major sites of absorption, liver, intestine, skin, role of transporters, role of plasma proteins in distribution, plasma levels of toxins/drugs, plasma half-life, excretion- disposition by kidney, biliary excretion. Metabolism- types of metabolic changes of foreign compounds, biotransformation/detoxification reactions, phase-1 and, phase -2 reactions, nature of phase-1 and phase 2 enzymes.

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### UNIT 3 : Targets of toxic damages and biochemical mechanism of toxicity 14 hours

Toxins/drugs causing liver, kidney, gall bladder, and lung damage, methods of identifying the damages. Examples of biochemical toxicity mechanisms; chemical carcinogens - Benzo[a]pyrene, Tamoxifen. Liver necrosis- carbon tetrachloride, Valproic Acid, and Iproniazid, Kidney damage- Chloroform, Antibiotics- gentamycin, Lung damage- 4-Ipomeanol, Neurotoxicity- Isoniazid, paracetamol, primaquine, cyclophosphamide.

#### REFERENCES:

1. Biopharmaceuticals Biochemistry and Biotechnology 2nd Edn. Gary Walsh, John Wiley & Sons, Ltd, England, 2003.
2. Fundamentals of Experimental Pharmacology, Ghosh, M.N. 2nd Edition, Scientific Book Agency, Kolkata, 1984.
3. Introduction to Biochemical Toxicology, 3<sup>rd</sup> Edn., Ernest Hodgson, Robert C. Smart; Wiley-Interscience; , 2001
4. Principles of Biochemical Toxicology, John A. Timbrell, 4<sup>th</sup> Edn. 2009, Taylor & Francis
5. Remington Pharmaceutical Sciences, Lippincott, Williams and Wilkins, 2000

PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING /ASSIGNMENT

Formative Assessment	
ASSESSMENT OCCASION	WEIGHTAGE IN MARKS
CLASS TEST ( 2 CLASS TESTS )	20
SEMINARS / CLASS WORK	10
ASSIGNMENT/ OPEN DISCUSSION	10
TOTAL	40

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# SEMESTER IV

## OPEN ELECTIVE 2

<b>COURSE TITLE</b>	<b>PLANT BIOCHEMISTRY</b>
<b>COURSE CREDITS</b>	<b>03</b>
<b>TOTAL CONTACT HOURS</b>	<b>42</b>
<b>DURATION OF ESA</b>	<b>03</b>
<b>FORMATIVE ASSESSMENT MARKS</b>	<b>40</b>
<b>SUMMATIVE ASSESSMENT MARKS</b>	<b>60</b>

**Course outcomes:** These topics will enable the students to

- Understand the plant cell, photosynthesis, transporters, and important primary metabolites.
- Illustrate plant growth regulators, plant's responses to various biotic and abiotic stresses.
- Explain about plant secondary metabolites and their functional importance.

### **UNIT 1 :Plant cell biology**

**14 hours**

**Plant cell- structure and molecular components:** Cytoskeleton- an overview. Plant cell division, cell cycle. Outlines of energy production in plant cells, Carbon assimilation and nitrogen assimilation.

**An overview of photosynthesis:** C3, C4 plants and crassulacean acid metabolism (CAM); photorespiration; Phytochromes, cryptochromes and phototropins. Non-protein thiols and sulfur cycle.

**Plant cell membranes and membrane transport:** Introduction to plant cell membranes and membrane constituents. Organization of transport systems across plant membranes; Different types of pumps operate at plant cell and organelle membranes; classification and importance of H<sup>+</sup>-ATPases. Ion channels-properties and significance; Aquaporins and water transport.

**Important Primary metabolites of plants:** Cellulose, starch, sucrose, oligosaccharides; fructans, gums, mucilages, poly unsaturated fatty acids, lignin, suberin, surface waxes, sulfides and sweet proteins.

### **UNIT2 :PCR and Stress responses**

**14 hours**

**Plant growth regulators:** Auxins, cytokinins, gibberellins, abscisic acid, ethylene, brassinosteroids, polyamines, jasmonic acid, salicylic acid.

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**Plant responses to biotic and abiotic stresses:** Introduction; Plant pathogens and diseases; plant defense systems - hypersensitive response; systemic acquired resistance; induced systemic resistance; Plant biotic stress response to pathogens and insects.

**Plant abiotic stress responses:** Salt stress, drought, and heavy metal stress responses; osmotic adjustment and significance of osmotic agents such as proline, sugar alcohols and quaternary ammonium compounds; An overview of oxidative stress and oxidative damage. Antioxidant enzymes and stress tolerance.

### **UNIT 3 :Secondary metabolites**

**14 hours**

#### **Plant secondary metabolites (Natural products):**

Introduction; secondary metabolites (natural products) definition; classification of plant secondary metabolites (natural products). An overview of primary metabolism contribution to secondary metabolites biosynthesis.

**Alkaloids:** Classification of alkaloids; Contribution of amino acids for alkaloid biosynthesis; Isolation, purification and characterization of alkaloids. (S)-Seticuline-the chemical chameleon.

**Phenolics:** Classification of phenolic compounds; Classification of flavonoids; Classification of anthocyanins; Isolation, purification and characterization of phenolics.

**Terpenoids:** Classification of terpenoids, biogenic isoprene rule; volatile compounds; plant growth regulator terpenoids – gibberellin, abscisic acid; brassinosteroids and saponins Isolation, purification, and characterization of terpenoids

**Biological properties of secondary metabolites:** Role of secondary metabolites - in plants' defense; in insects' signalling, morphogenesis, and defense. Physiologically active secondary metabolites in modern medicine and therapeutic compounds for human ailments

#### **REFERENCES:**

1. Lehninger's Principles of Biochemistry - Nelson & Cox. CBS Publishers & Distributors,2013
  2. Principles of Biochemistry - Moran, Horton, Scrimgeour, Perry. Pearson, 5<sup>th</sup>Edition , 2011
  3. Plant Biochemistry - P.M. Dey & J.B. Harborne. Hart Court Asia Pvt Ltd. 1997
  4. Plant Biochemistry and Molecular Biology - P. Lea & Richard C Leegood., John Wiley & Sons. 1999
  5. Introduction to Plant Biochemistry - Goodwin and Mercer. CBS Publisher and Distributors.2005
  6. Biochemistry and Molecular Biology of Plants - Buchanan, Greussem and Jones. American Society of Plant Physiologists. 2000
  7. Natural Products from plants. Peter B. Kaufman, Leland J. Cseke, Sara Warber, James A. Duke, Harry L. Briemann, CRC Press, Boca Raton 1999.
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8. Natural Products Targeting Clinically Relevant Enzymes. Paula B. Andrade, Patricia Valentao David M. Pereira. Wiley-VCH Verlag GmbH & Co 2017
9. Plant Cell Tissue and Organ Culture: Fundamental Methods - O.L. Gamborg & G.C. Phillips Narosa Publishers, New Delhi, 1995.
10. Kant R. Sweet proteins – Potential replacement for artificial low calorie sweeteners. Nutrition J. 2005; 4:5 doi:10.1186/1475-2891-4-5.
11. Misaka T. Molecular mechanisms of the action of miraculin, a taste-modifying protein. Seminars Cell Develop Biol. 24:222-225, 2013.
12. Temussi PA. Natural sweet macromolecules: how sweet proteins work. Cell Molec Life SciCMLS. 63:1876-1888, 2006

PEDAGOGY: MOOC/DESK WORK/BOOK CHAPTER/PROBLEM SOLVING /ASSIGNMENT

<b>Formative Assessment</b>	
<b>ASSESSMENT OCCASION</b>	<b>WEIGHTAGE IN MARKS</b>
CLASS TEST (2 CLASS TESTS)	20
SEMINARS / CLASS WORK	10
ASSIGNMENT/ OPEN DISCUSSION	10
TOTAL	40

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B Sc III & IV SEMESTERS  
MODEL QUESTION PAPER  
BIOCHEMISTRY

TIME: 3 h

MAX. MARKS: 60

NOTE: ALL SECTIONS ARE COMPULSORY

**SECTION A**

1. Answer any FIVE of the following
- a.
  - b.
  - c.
  - d.
  - e.
  - f.
  - g.

5 x 2 = 10

**SECTION B**

Answer any FOUR of the following

4 x 5 = 20

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

**SECTION C**

Answer any THREE Questions

3 x 10 = 30

- 8.
- 9.
- 10.
- 11.
- 12.

**Note: Section C may include sub questions a, b**

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BSc III & IV SEMESTERS  
MODEL QUESTION PAPER  
BIOCHEMISTRY

TIME: 3 h

**OPEN ELECTIVE**

MAX. MARKS: 60

NOTE: ALL SECTIONS ARE COMPULSORY

**SECTION A**

1. Answer any FIVE of the following

5 x 2 = 10

- a.
- b.
- c.
- d.
- e.
- f.
- g.

**SECTION B**

Answer any FOUR of the following

4 x 5 = 20

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

**SECTION C**

Answer any THREE Questions

3 x 10 = 30

- 8.
- 9.
- 10.
- 11.
- 12.

**Note: section C may include sub questions a, b**

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**INTERNAL ASSESSMENT (as on 4<sup>th</sup> October meeting proceedings)**

<b>DISCIPLINE CORE</b>	<b>DISCIPLINE /OPEN ELECTIVE</b>	<b>PRACTICLAS</b>
<b>60 + 40 ( IA )</b>	<b>60 + 40 ( IA )</b>	<b>25 + 25 ( IA )</b>
<b>Class Test -10+10</b>	<b>Class Test -10+10</b>	<b>Continuous evaluation &amp; class test – 10+10</b>
<b>Seminars /Class work - 10</b>	<b>Seminars /Class work – 10</b>	<b>Record - 5</b>
<b>Assignment /Open discussion - 10</b>	<b>Assignment /Open discussion - 10</b>	

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**DSC III- PRACTICALS**  
**SCHEME OF PRACTICAL EXAMINATION**  
**II B.Sc., III SEMESTER**

**TITLE: Volumetric Analysis-Practicals-1**

**Times:3hrs**

**Max Marks: 25**

Practical proper :20

Vivo voce : 05

**NOTE :-** Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Dept.

**PART- A**

**05 Marks**

**I. Any one of the following experiment may be given for procedure writing.**

Preparation of following organic compounds

1. Acetylation: Preparation of acetyl salicylic acid from salicylic acid.
2. Oxidation: Preparation of benzoic acid from benzaldehyde.
3. Nitration: Preparation of m-dinitrobenzene from nitrobenzene.
4. Hydrolysis: Preparation of benzoic acid from ethyl benzoate.

Extractions

1. Extraction of caffeine from tea leaves
2. Extraction of starch from potatoes
3. Extraction of casein from milk

**PART – B**

**15 Marks**

**II. Any one of the following experiment may be Set**

Systematic qualitative analysis of organic compounds (6 practicals)

1. Urea
  2. Aniline
  3. Benzoic Acid
  4. Salicylic acid
  5. Benzaldehyde
  6. Acetophenone
  7. Chlorobenzene
  8. Nitrobenzene
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**SCHEME OF VALUATION**  
**(ASSESSMENT OF EXPERIMENTAL RESULTS)**  
**II B.Sc., III SEMESTER**

Qualitative analysis of organic compound

Preliminary test	2 M
Detection of elements ( N, S, Halogens)	2 M
Solubility tests	2 M
Functional group test (minimum two test)	4 M
Determination of physical constant (2% error allowed)	2 M
Naming the compound and structure	2 M
Preparation of solid derivative	1 M



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**DSC IV- PRACTICALS**  
**SCHEME OF PRACTICAL EXAMINATION**  
**II B.Sc., IV SEMESTER**

**TITLE: Volumetric Analysis-Practicals-1**

**Times:3hrs**

**Max Marks: 25**

Practical proper :20

Vivo voce : 05

**NOTE :-** Candidates are required to submit the records duly signed by the teacher-in charge and certified by the Head of the Dept.

**PART- A**

**05 Marks**

**I. Any one of the following experiment may be given for procedure writing.**

1. Preparation of human lymphocytes using clinical centrifuge
2. Determination of packed cell volume/ hematocrit
3. Resolution of basic, acidic and aromatic amino acids by descending and circular paper chromatography.
4. Separation of plant pigments by gel-permeation chromatography
5. Identification and resolution of pigments by thin layer chromatography.
6. Determination of void volume of a gel-filtration column
7. Recording the absorption spectrum of riboflavin
8. Electrophoretic separation of plasma proteins

**PART – B**

**15 Marks**

**II. Any one of the following experiment may be Set**

1. Colorimetric estimation of glucose by DNS method
  2. Estimation of DNA by diphenylamine method
  3. Estimation of RNA by orcinol method
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**SCHEME OF VALUATION  
(ASSESSMENT OF EXPERIMENTAL RESULTS)**

**II B.Sc., IV SEMESTER**

Assesment of experimental results	
Preparation of standard solution/ working	2 Marks
Tabular column	2 Marks
Standard curve	2 Marks
Results:	
10% error	8 Marks
15% error	6 Marks
20% error	4 Marks
Any other value	2 Marks
Report	1 Mark





**Scheme for examination and assessment for B.Sc. Biochemistry under CBCS scheme 2019-20**

<b>III BSc</b>	<b>V</b>	DSE-1 Theory	No. Of Course 1 Nutritional Biochemistry	DME 21007	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-1 Practicals	Nutritional Biochemistry	DME 21107	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
		DSE-2 Theory	Molecular Basis Of Infectious Diseases	DME 21207	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-2 Practicals	Molecular Basis Of Infectious Diseases	DME 21307	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
		SEC 1- Theory	No. Of Course 1 Tools And Techniques In Biochemistry	DME 21407	2:0:0	35	-	15 (15+15)	-	2h	-
		SEC 2- Theory	Clinical Biochemistry	DME 21607	2:0:0	35	-	15 (15+15)	-	2h	-
	<b>VI</b>	DSE-3 Theory	No. Of Course 1 Advanced Cell Biology And Endocrinology	DMF 21007	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-3 Practicals	Advanced Cell Biology And Endocrinology	DMF 21107	0:0:2	-	35	-	15 (7.5+7.5)	-	3h
		DSE-4 Theory	Plant Biochemistry	DMF 21207	4:0:0	70	-	30 (15+15)	-	3h	-
		DSE-4 Practicals	Plant Biochemistry	DMF 21307	0:0:2	-	35	-	15 (7.5+7.5)	-	3h

**Practical weightage**

<b>Component</b>	<b>Marks</b>
Knowledge of relevant processes	30%
Skills and operations involved	50%
Result/ products including calculations and reporting	20%

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## SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the first time should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours for **FIFTEEN** marks
- Practical record has to be valued for **FIVE** marks by examiners at the time of examination
- Viva-voce for **FIVE** marks in practical is awarded by continuous assessment in the lab

<b>Sl no</b>	<b>Component</b>	<b>Marks</b>
1	Write up of the experiment	05
2	Conducting experiment	15
3	Result	05
4	Viva-voce	05
5	Practical record	05
<b>TOTAL</b>		<b>35</b>

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## **Programme Outcome for Bachelor of Science in Biochemistry, Microbiology & Biotechnology**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1.** Demonstrate the ability to justify and explain their thinking and/or approach
- PO2.** Develop state-of-the-art laboratory and professional communication skills
- PO3.** Apply the scientific method to design, execute, and analyze an experiment
- PO4.** Explain scientific procedures and their experimental observations
- PO5.** Demonstrate an understanding of fundamental biochemical principles, structure and function
- PO6.** Work as a laboratory technician, biochemists or medical scientist
- PO7.** Explain the processes used by microorganisms for the growth
- PO8.** Explain the theoretical basis of tools, technologies and methods of microbiology
- PO9.** Design and develop solution to Biotechnology problems
- PO10.** Applying appropriate tools keeping in mind safety factor for environment & society
- PO11.** Create, select, and apply appropriate techniques, resources, and modern tools
- PO12.** Support biotechnology research activity with strong technical background

## **Programme Specific Outcome**

### **Bachelor of Science in Biochemistry, Microbiology & Biotechnology**

After completing the graduation in the Bachelor of Science the students are able to;

- PSO 1:** Gain and understand biochemical and molecular processes
  - PSO2:** Communicate scientific information effectively, relating to microbes and their role in ecosystem and health
  - PSO3:** Acquire, articulate, retain and demonstrate laboratory safety skills
  - PSO4:** Demonstrate applications of biochemical and biological sciences
  - PSO5:** Apply appropriate tools and techniques in biotechnological manipulation
  - PSO6:** Understand the responsibilities of biotechnological practices
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## **Programme Outcome for Bachelor of Science in Botany, Biochemistry & Microbiology**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1.** Identify the taxonomic position of plants using principles and methods of nomenclature and classification in Botany
- PO2.** Understand the impact of the plant diversity in societal and environmental context
- PO3.** Demonstrate the knowledge of, and need for sustainable development
- PO4.** Use interdisciplinary approaches with quantitative skills to work on biological problems
- PO5.** Demonstrate the ability to justify and explain their thinking and/or approach
- PO6.** Develop state-of-the-art laboratory and professional communication skills
- PO7.** Apply the scientific method to design, execute, and analyze an experiment
- PO8.** Explain scientific procedures and their experimental observations
- PO9.** Demonstrate an understanding of fundamental biochemical principles, structure and function
- PO10.** Work as a laboratory technician, biochemists or medical scientist
- PO11.** Explain the processes used by microorganisms for the growth
- PO12.** Explain the theoretical basis of the tools, technologies and methods of microbiology

## **Programme Specific Outcome**

### **Bachelor of Science in Botany, Biochemistry & Microbiology**

After completing the graduation in the Bachelor of Science the students are able to;

- PSO 1:** Demonstrate applications of biochemical and biological sciences
  - PSO2:** Inculcating proficiency in all experimental techniques and methods of analysis
  - PSO3:** Acquire, articulate, retain and demonstrate laboratory safety skills
  - PSO4:** Communicate scientific information effectively, relating to microbes and their role in ecosystem and health
  - PSO5:** Gain proper procedures and regulations in handling and disposal of chemicals
  - PSO6:** Understand biochemical and molecular processes that occur in and between the cells
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**(Credits: Theory – 04, Practical – 01)****Theory: 60 Hrs****Course Outcome:****After completion of the course the student is able to;****CO1:** Understand the characteristics of energy metabolism**CO2:** Specify the characteristics of dietary carbohydrates**CO3:** Identify in detail with examples dietary lipid & health**CO4:** Understand the characteristics of minerals

- Unit : 1 INTRODUCTION TO NUTRITION & ENERGY METABOLISM 09 Hrs**  
Defining Nutrition, role of nutrients. Unit of energy, Biological oxidation of foodstuff. Measurement of energy content of food, Physiological energy value of foods, SDA.  
Measurement of energy expenditure. Direct and Indirect Calorimetry, factors affecting thermogenesis, energy utilization by cells, energy output – Basal and Resting metabolism, physical activity, factors affecting energy input - hunger, appetite, energy balance Energy expenditure in man. Estimating energy requirements, BMR factors Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances for different age groups (Adult man, women and children).
- Unit: 2 DIETARY CARBOHYDRATES & HEALTH: 07 Hrs**  
Review functions of carbohydrates. Digestion, absorption, utilization and storage, hormonal regulation of blood glucose. Dietary requirements and source of carbohydrates, blood glucose level.
- Unit :3 DIETARY LIPID & HEALTH: 08 Hrs**  
Review of classification, sources, functions, digestion, absorption, utilization and storage.  
Essential Fatty Acids; Functions of EFA, RDA, – excess and deficiency of EFA. Lipotropic factors, role of saturated fat, cholesterol, lipoprotein and triglycerides. Importance of the following: a) Omega – fatty acids. Omega 3/ omega 6 ratio b) Phospholipids c) Cholesterol in the body d) Mono, Polyunsaturated and Saturated Fatty Acids.
- Unit: 4 DIETARY PROTEINS & HEALTH: 08 Hrs**  
Review of functions of proteins in the body, Digestion and absorption. Essential and Nonessential amino acids. Amino acid Supplementation. Effects of deficiency. Food source and Recommended Dietary Allowances for different age group. Amino acid pool. NPU, Biological Value, Nitrogen balance. PEM and Kwashiorkor.
- Unit :5 FAT & WATER SOLUBLE VITAMINS: 10 Hrs**  
Vitamin A, C, E, K and D  
Dietary sources, RDA, Absorption, Distribution, Metabolism and excretion (ADME), Deficiency. Role of Vitamin A as an antioxidant, in Visual cycle, dermatology and immunity. Role of Vitamin K in Gamma carboxylation. Role of Vitamin E as an antioxidant. Role of Vitamin D and its effect on bone physiology.  
Hypervitaminosis. Vitamin C role as cofactor in amino acid modifications. Niacin- Metabolic interrelation between tryptophan, Niacin and NAD/
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NADP. Vitamin B6-Dietary source, RDA, conversion to Pyridoxal Phosphate. Role in metabolism, Biochemical basis for deficiency symptoms. Vitamin B12 and folate; Dietary source, RDA, absorption, metabolic role Biochemical basis for deficiency symptoms.

**Unit: 6 MINERALS:** Calcium, Phosphorus and Iron - Distribution in the body digestion, Absorption, Utilization, Transport, Excretion, Deficiency, Sources, RDA. **09 Hrs**

Iodine, Fluoride, Mg, Cu, Zn, Se, Manganese - Absorption, Utilization, Transport, Excretion, Deficiency, Sources, RDA.

**Unit: 7 ASSESSMENT OF NUTRITIONAL STATUS:** Anthropometric measurements; Z scores, BMI, skinfold, circumference ratios. Biochemical assessment; Basal metabolic panel, Comprehensive metabolic panel, CBC, Urine Analysis, Assessment of Anemia, ROS assessment. **05 Hrs**

**Unit: 8 FOOD & DRUG INTERACTIONS & NUTRICEUTICALS:** Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions. **04 Hrs**

## **DME21106/ DME21107 PRACTICALS**

- 1 Bioassay for vitamin B12/B1.
- 2 Extraction of oil from oil seeds by soxlet.
- 3 Separation of sugars by circular paper chromatography
- 4 Anthropometric identifications for Kwashiorkor, Marasmus and Obesity.
- 5 Extraction of caffeine from tea leaves
- 6 Vitamin A/E estimation in serum.
- 7 Determination of moisture content of food sample
- 8 Detection of adulterants in food.
- 9 Estimation of Calcium in ragi.
- 10 Estimation of Vitamin – C in lemon or gooseberries by DPPH method
- 11 Estimation of Lactose in milk by Benedict's method
- 12 Estimation of iron in drumsticks
- 13 Determination of iodine value of an oil or fat
- 14 Determination of saponification value of an oil or fat

**Note: Minimum of eight experiments to be done.**

### **Reference:**

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.
  2. Nutrition for health, fitness and sport (2013) Williams.M.H,Anderson,D.E, Rawson,E.S. McGraw Hill international edition. ISBN-978-0-07-131816-7.
  1. Krause's Food and Nutrition Care process (2012); Mahan, L.K Strings,S.E, Raymond,J. Elsevier's Publications. ISBN- 978-1-4377-2233-8.
  1. The vitamins, Fundamental aspects in Nutrition and Health (2008); G.F. Coombs Jr. Elsevier's Publications. ISBN-13- 978-0-12- 183493-7.
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2. Principles of Nutritional Assessment (2005) Rosalind Gibson. Oxford University Press.

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**DSE -2: MOLECULAR BASIS OF INFECTIOUS DISEASES**

(Credits: Theory – 04, Practical – 01)

Theory: 60 Hrs

**Course Outcome:**

After completion of the course the student is able to;

**CO1:** Deliberate in depth infectious agents**CO2:** Learn the detail of bacterial diseases**CO3:** Understand the detail of viral diseases**CO4:** Learn the characteristics of fungal diseases

- Unit : 1 CLASSIFICATION OF INFECTIOUS AGENTS:** Bacteria, Viruses, protozoa and fungi. Past and present emerging and re-emerging infectious diseases and pathogens. Source, reservoir and transmission of pathogens, Antigenic shift and antigenic drift. Host parasite relationship, types of infections associated with parasitic organisms. Overview of viral and bacterial pathogenesis. Infection and evasion **12 Hrs**
- Unit: 2 OVERVIEW OF DISEASES CAUSED BY BACTERIA:** Detailed study of tuberculosis: History, causative agent, molecular basis of host specificity, infection and pathogenicity, Diagnostics, Therapeutics, inhibitors and vaccines. Drug resistance and implications on public health. Other bacterial diseases including Typhoid, Diphtheria, Pertussis, Tetanus, Typhoid and Pneumonia. **18 Hrs**
- Unit: 3 OVERVIEW OF DISEASES CAUSED BY VIRUSES:** Detailed study of AIDS, history, causative agent, pathogenesis, Diagnostics, Drugs and inhibitors. Other viral diseases including hepatitis, influenza, rabies, chikungunya and polio. **12 Hrs**
- Unit: 4 OVERVIEW OF DISEASES CAUSED BY PARASITES:** Detailed study of Malaria, history, causative agents, Vectors, life cycle, Host parasite interactions, Diagnostics, Drugs and Inhibitors, Resistance, Vaccine development. Other diseases including leishmaniasis, amoebiasis. **08 Hrs**
- Unit :5 OVERVIEW OF DISEASES CAUSED BY OTHER ORGANISMS:** **10 Hrs**  
Fungal diseases, General characteristics. Medical importance of major groups, pathogenesis, treatment.

**DME21306/ DME21307****PRACTICALS**

- 1 WIDAL test
- 2 Gram staining
- 3 Acid fast staining
- 4 PCR based diagnosis
- 5 Preparation of media.
- 6 Isolation of bacteria from soil
- 7 Isolation of bacteria from water



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- 8 Structural staining- (cellwall and endospore of bacteria).
  - 9 Simple staining and Negative staining
  - 10 Effect of temperature on growth of microorganisms
  - 11 Effect of pH on growth of microorganisms
  - 12 Demonstration of Bacterial Conjugation
  - 13 Demonstration of bacterial transformation and transduction
  - 14 Photographic demonstration of infectious diseases

**Note: Minimum of eight experiments to be done.**

**Reference:**

1. Prescott, Harley, Klein's Microbiology (2008) 7th Ed., Willey, J.M., Sherwood, L.M., Woolverton, C.J. Mc Graw Hill International Edition (New York) ISBN: 978-007-126727.
  2. Mandell, Douglas and Bennett.S, Principles and practices of Infectious diseases, 7<sup>th</sup> edition, Volume, 2. Churchill Livingstone Elsevier.
  3. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J.Ryan, C. George Ray, Publisher: McGraw-Hill.
  4. Medical Microbiology by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller, Elsevier Health Sciences
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**SEMESTER V**  
**SEC-1: TOOLS AND TECHNIQUES IN BIOCHEMISTRY**

(Credits: Theory – 02)

Theory: 30 Hrs

**Course Outcome:**

**After completion of the course the student is able to;**

**CO1:** Understand in depth chromatography

**CO2:** Learn in depth electrophoresis technique

**CO3:** Deliberate the characteristics of centrifugation

**CO4:** Understand in detail with examples spectrophotometry

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|-----------------|---|---------------|
| <b>Unit : 1</b> | <b>BIOCHEMICAL REAGENTS &amp; SOLUTIONS:</b> Safety practices in the laboratory. Preparation and storage of solutions. Concepts of solution concentration and storing solutions. Quantitative transfer of liquids. Concept of a buffer, Henderson-Hasselbach equation, working of a pH meter.<br><b>Exercise</b><br>Preparation of a buffer of given pH and molarity.   | <b>06 Hrs</b> |
| <b>Unit : 2</b> | Chromatography- Definition, types, Principles of Adsorption and Partition chromatography. Techniques of circular, 2D chromatography, Thin Layer Chromatography- and its advantages<br>Column chromatography – Principle and applications of Gel Filtration chromatography, HPLC   | <b>07 Hrs</b> |
| <b>Unit : 3</b> | Electrophoresis: Principle and applications of electrophoresis technique- PAGE, SDS - PAGE  | <b>03 Hrs</b> |
| <b>Unit : 4</b> | Centrifugation: Principle of differential and density gradient centrifugation. Ultra centrifuge – construction and applications   | <b>03 Hrs</b> |
| <b>Unit: 5</b>  | <b>SPECTROPHOTOMETRIC TECHNIQUES:</b> Principle and instrumentation of UV-visible and fluorescence spectroscopy.<br><b>Exercises</b><br>Determination of the absorption maxima and molar extinction coefficient (of a relevant organic molecule).<br>Measurement of fluorescence spectrum.<br>Determination of concentration of a protein solution by Lowry/BCA method. | <b>05 Hrs</b> |
| <b>Unit :6</b>  | <b>Introduction and importance of virtual labs in biochemistry</b>  | <b>06 Hrs</b> |

**Reference:**

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN:978-0-470-85602-4 / ISBN:978-0-470-85603-1.
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2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2<sup>nd</sup> ed., Freifelder, D., W.H. Freeman and Company, ISBN:0-7167-1315-2/ISBN:0-7167-1444-2.
  3. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.

DME21606/ DME21607

**SEMESTER V**  
**SEC-2: CLINICAL BIOCHEMISTRY**

(Credits: Theory – 02)

Theory: 30 Hrs

**Course Outcome:**

**After completion of the course the student is able to;**

**CO1:** Specify the characteristics of clinical laboratory

**CO2:** Identify in depth blood glucose

**CO3:** Deliberate the detail of lipid profile

**CO4:** Learn in detail with examples cardiovascular diseases

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|-----------------|--|---------------|
| <b>Unit : 1</b> | <b>INTRODUCTION:</b> Organization of clinical laboratory, Introduction to instrumentation and automation in clinical biochemistry laboratories safety regulations and first aid. General comments on specimen collection, types of specimen for biochemical analysis. Precision, accuracy, quality control, precautions and limitations.<br><b>Exercises</b><br>Collection of blood and storage.<br>Separation and storage of serum. | <b>04 Hrs</b> |
| <b>Unit :2</b>  | <b>EVALUATION OF BIOCHEMICAL CHANGES IN DISEASES:</b><br>Basic hepatic, renal and cardiovascular physiology. Biochemical symptoms associated with disease and their evaluation. Diagnostic biochemical profile.  | <b>04 Hrs</b> |
| <b>Unit: 3</b>  | <b>ASSESSMENT OF GLUCOSE METABOLISM IN BLOOD:</b><br>Clinical significance of variations in blood glucose. Diabetes mellitus.<br><br><b>Exercises</b><br>Estimation of blood glucose by glucose oxidase peroxidase method.   | <b>04 Hrs</b> |
| <b>Unit :4</b>  | <b>LIPID PROFILE:</b> Composition and functions of lipoproteins. Clinical significance of elevated lipoprotein.<br><b>Exercises</b><br>Estimation of triglycerides.  | <b>04 Hrs</b> |
| <b>Unit :5</b>  | <b>LIVER FUNCTION TESTS</b><br><b>Exercises</b><br>Estimation of bilirubin (direct and indirect).  | <b>04 Hrs</b> |
| <b>Unit: 6</b>  | <b>RENAL FUNCTION TESTS &amp; URINE ANALYSIS:</b> Use of urine strip / dipstick method for urine analysis.<br><b>Exercises</b>   | <b>06 Hrs</b> |
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Quantitative determination of serum creatinine and urea.

**Unit: 7 TESTS FOR CARDIOVASCULAR DISEASES:** Involvement of enzymes in diagnostics of heart disease including aspartate transaminase, isoenzymes of creatine kinase and lactate dehydrogenase and troponin. **04 Hrs**

**Exercises**

Estimation of creatine kinase MB.

**Reference:**

1. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol.I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN: 9780070076594 / ISBN: 9780070076631.
  2. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. II (2010), Mukherjee, K.L., Tata Mc Graw – Hill Publishing Company Ltd. (New Delhi), ISBN: 9780070076648.
  3. Medical Biochemistry (2005) 2nd ed., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia), ISBN:0-7234-3341-0.
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DMF21006/ DMF21007

**SEMESTER VI**  
**DSE-1: ADVANCED CELL BIOLOGY AND ENDOCRINOLOGY**

(Credits: Theory – 04, Practical – 01)

Theory: 60 Hrs

**Course Outcome:**

**After completion of the course the student is able to;**

**CO1:** Learn the detail of cell membrane

**CO2:** Understand in detail with examples cell-cell interactions

**CO3:** Identify in depth endocrine organs

**CO4:** Deliberate the detail of immunohistochemistry

<b>Unit : 1</b>	<b>PLASMA MEMBRANE &amp; NUCLEAR TRANSPORT:</b> Properties and Composition of Cell Membrane; Structure of Nuclear Envelope; Nuclear Pore Complex; Transport Across Nuclear Envelope; Regulation of Nuclear Protein Import and Export.	<b>08 Hrs</b>
<b>Unit: 2</b>	<b>CELL-CELL INTERACTION:</b> Cell-Cell Interactions and Cell-Matrix Interactions; Components of Extracellular Matrix: Collagen and Non-Collagen Components; Tight Junctions; Gap Junctions; Desmosomes; Hemidesmosomes; Focal Adhesions And Plasmodesmata; Cell Wall; Role Of Cell Interaction In Development.	<b>10 Hrs</b>
<b>Unit :3</b>	<b>CELL CYCLE &amp; PROGRAMMED CELL DEATH:</b> Overview of The Cell Cycle; Eukaryotic Cell Cycle; Events Of Mitotic Phase; Cytokinesis; Events Of Meiosis And Fertilization; Regulation Of Cell Division And Cell Growth; Apoptosis And Necrosis, Stem Cells And Maintenance of Adult Tissues, Hematopoiesis, Embryonic Stem Cells and Therapeutic Cloning.	<b>12 Hrs</b>
<b>Unit :4</b>	<b>CANCER BIOLOGY:</b> Development and causes Of Cancer; Genetic Basis of Cancer; Oncogenes, Tumor Viruses; Molecular Approach to Cancer Treatment.	<b>10 Hrs</b>
<b>Unit: 5</b>	<b>ADVANCED METHODS IN CELL BIOLOGY:</b>	<b>10 Hrs</b>

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Ultracentrifugation, Fluorescence Microscopy- FACS, Confocal Microscopy, Electron Microscopy, Plant and Animal Cell Culture, Immunohistochemistry.

**Unit: 6 ENDOCRINE SYSTEM:** Endocrine organs, hormones- classification, Hierarchy, interplay, dynamic balance and regulation of their secretions. Functions of the hormones of Hypothalamus, Pituitary, Adrenal, Thyroid, pancreas and Gonads. Concept of receptors- Membrane and cytosolic. Mechanism of hormone action - Steroid hormone and Peptide hormone (second messengers hypothesis. Eg: cAMP, DAG, IP3). **10 Hrs**

### **PRACTICALS**

- 1 Isolation of WBC using ficol reagent method
- 2 Study of cell viability /death assay by use of trypan blue and MTT assay.
- 3 Study of apoptosis through analysis of DNA fragmentation patterns in mitochondria.
- 4 Identification and study of cancerous cells using permanent slides and photomicrographs.
- 5 Antigen-Antibody reaction
- 6 Cell counting methods: counting using Haemocytometer.
- 7 Calibration of ocular micrometer and Measurement of average cell size using Stage micrometer
- 8 Separation of cell organelles by differential centrifugation and assay of marker enzymes. (2 Practicals)
- 9 Photographic demonstration of different types of cells.
- 10 Isolation of chloroplast by differential centrifugation & its identification.
- 11 Buccal smear- barr bodies
- 12 Identification of normal & abnormal karyotype using permanent slides
- 13 Estimation of iodine by titrimetric method from commercial salt
- 14 Industrial /Institution visit

**Note: Minimum of eight experiments to be done.**

### **Reference:**

1. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
  2. Karp, G. 2010 Cell and Molecular Biology: Concepts and Experiments. 6 edition. JohnWiley & Sons. Inc.
  3. Alberts, B., Johnson,A., Lewis, J., and Enlarge, M. 2008 Molecular Biology of the Cell.5th ed., Garland Science (Princeton).
  4. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell. J. 2012. Molecular Cell Biology. 7th ed., W.H. Freeman & Company (New York).
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DMF21206/ DMF21207

**SEMESTER VI**  
**DSE-2: PLANT BIOCHEMISTRY**

(Credits: Theory – 04, Practical – 01)

Theory: 60 Hrs

**Course Outcome:**

**After completion of the course the student is able to;**

**CO1:** Specify the characteristics of plant cell structure

**CO2:** Deliberate in detail with examples photosynthesis

**CO3:** Understand the detail of nitrogen metabolism

**CO4:** Learn in detail with examples secondary metabolites

<b>Unit : 1</b>	<b>INTRODUCTION TO PLANT CELL STRUCTURE:</b> Plasma membrane, Vacuole and tonoplast membrane, cell wall, plastids and peroxisomes.	<b>5Hr</b>
<b>Unit :2</b>	<b>PHOTOSYNTHESIS &amp; CARBON ASSIMILATION:</b> Structure of PSI and PSII complexes, Light reaction, Cyclic and non cyclic photophosphorylation, Calvin cycle and regulation; C4 cycle and Crassulacean acid metabolism (CAM), Photorespiration.	<b>14Hr</b>
<b>Unit :3</b>	<b>NITROGEN METABOLISM:</b> Biological Nitrogen fixation by free living and in symbiotic association, structure and function of enzyme Nitrogenase. Nitrate assimilation: Nitrate and Nitrite reductase. Primary and secondary ammonia assimilation in plants; ammonia assimilation by	<b>14Hr</b>

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Induction of hydrolytic enzymes  $\beta$ -galactosidase during germination  
Glutamine synthetase-glutamine oxoglutarate amino transferase (GS-GOGAT) pathway. Seed storage proteins in legumes and cereals.

- Unit :4 REGULATION OF PLANT GROWTH:** Introduction to plant hormones and their effect on plant growth and development, Regulation of plant morphogenetic processes by light. **7Hr**
- Unit :5 SECONDARY METABOLITES:** Representatives alkaloid group and their amino acid precursors, function of alkaloids, Examples of major phenolic groups; simple phenylpropanoids, Coumarins, Benzoic acid derivatives, flavonoids, tannins and lignin, biological role of plant phenolics, Classification of terpenoids and representative examples from each class, biological functions of terpenoids. **12Hr**
- Unit :6 PLANT TISSUE CULTURE:** Cell and tissue culture techniques, types of cultures: organ and explants culture, callus culture, cell suspension culture and protoplast culture. Plant regeneration pathways: organogenesis and somatic embryogenesis. Applications of cell and tissue culture and somoclonal variation. **8Hr**

## PRACTICALS

- 1
- 2 Extraction and assay of Urease from Jack bean
- 3 Estimation of carotene in fruits and vegetables
- 4 Estimation of ascorbic acid in fruits and vegetables
- 5 Estimation of phenols in fruits and vegetables
- 6 Estimation of tannins in fruits and vegetables
- 7 Culture of plant plants (explants)
- 8 Extraction of genomic DNA from coconut endosperm, quantification & determination of its purity by Spectrophotometric method.(2 Practicals)
- 9 Extraction of RNA from spinach leaves
- 10 Estimation of DNA by DPA method
- 10 Estimation of RNA by orcinol method
- 11 Extraction of Starch from potato
- 12 Extraction Casein from milk
- 13 Extraction of polyphenols
- 14 Industrial /Institution visit

**Note: Minimum of eight experiments to be done.**

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**Reference:**

1. Plant Biochemistry (2008), Caroline Bowsher, Martin steer, Alyson Tobin, Garland science ISBN 978-0-8153-4121-5.
2. Biochemistry and molecular Biology of plant-Buchanan. (2005) 1 edition. Publisher: IK International. ISBN-10: 8188237116, ISBN-13: 978-8188237111.
3. Plant Biochemistry by P.M Dey and J.B. Harborne (Editors) (1997) Publisher: Academic Press ISBN-10:0122146743, ISBN-13:978-01221467.



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**Pattern of Question Paper**  
**Semester III to VI**  
**Paper III to V and VII (DSC and DSE)**

**Time : 3 Hrs**

**Max Marks: 70**

1. Answer all the questions

5 X 1 = 5

- a. -----
- b. -----
- c. -----
- d. -----
- e. -----

2. Answer any five of the following questions

5 X 3 = 15

- a. -----
- b. -----
- c. -----
- d. -----
- e. -----
- f. -----
- g. -----

3. Answer any four of the following questions

4 X 5 = 20

- a. -----
- b. -----
- c. -----
- d. -----
- e. -----
- f. -----

4. Answer any three questions of the following

3 X 10 = 30

- a. -----
- b. -----
- c. -----
- d. -----
- e. -----

( Note- 10 Marks may be divided in to 6+4 or 5+5)

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**Pattern of Question Paper**  
**Semester V**  
**Paper VI (SEC)**

Time : 2 Hrs

Max Marks: 35

1. Answer all the questions

5 X 1 = 5

- a. -----
- b. -----
- c. -----
- d. -----
- e. -----

2. Answer any five of the following questions

5 X 3 = 15

- a. -----
- b. -----
- c. -----
- d. -----
- e. -----
- f. -----
- g. -----

3. Answer any three of the following questions

3 X 5 = 15

- a. -----
  - b. -----
  - c. -----
  - d. -----
  - e. -----
-

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
OOTY ROAD, MYSORE – 25.**



**CURRICULUM FOR  
For B.Sc., (Basic/ Hons.) Degree  
BIOTECHNOLOGY  
(As per NEP-2020 Model Curriculum)  
Implementation Year 2022-23**

**2022-23**

YEAR	SEMESTER	CORE COURSE	COURSE CODE	TITLE OF THE PAPER	NO. OF CREDITS	LECTURE/ PRACTICAL/ HOUR/WEEK	TOTAL TEACHING HOURS
I BSc	I	DSC -1:Theory	FSA460	Cell biology & genetics	4	4	56
		DSC -1:Pract	FSA460	Cell biology & genetics	2	4	56
		OE-1:Theory	FSA900	Biotechnology for human welfare	3	3	42
		SEC-1: Theory		Biotechnological Skills and Analytical Techniques	1	1	14
	II	DSC-2:Theory	FSB460	Microbiological Methods and Techniques	4	4	56
		DSC-2: Pract	FSB460	Microbiological Methods and Techniques	2	4	56
OE-2:Theory		FSB900	Applications of Biotechnology in Agriculture	3	3	42	
II BSc	III	DSC -3:Theory	FSC460	Biomolecules	4	4	56
		DSC -3:Pract	FSC460	Biomolecules	2	4	56
		OE-3:Theory	FSC900	Nutrition and Health	3	3	42
	IV	DSC -4:Theory	FSD460	Molecular Biology	4	4	56
		DSC -4:Pract	FSD460	Molecular Biology	2	4	56
		OE-4:Theory	FSD900	Intellectual Property Rights	3	3	42

**B.Sc., (Basic/ Hons.) Degree**

**Scheme of study for B.Sc. Biotechnology As per NEP-2020 Model from 2021-22**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE**

**Scheme of Examination for B.Sc. Biotechnology As per NEP-2020 Model from 2021-22**

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
						L:T:P	IA			Total	Th
					C-1		C-2	C-3			
I B.Sc	I	DSC -1:Theory	FSA460	Cell biology & genetics	4: 0: 0	20	20	60	100	2h	3h
		DSC -1:Pract	FSA460	Cell biology & genetics	0: 0: 2	10	15	25	50		
		OE -1:Theory	FSA900	Biotechnology for human welfare	3:0:0	20	20	60	100	2h	-
	II	DSC-2:Theory	FSB460	Microbiological Methods and Techniques	4: 0: 0	20	20	60	100	2h	3h
		DSC-2: Pract	FSB460	Microbiological Methods and Techniques	0: 0: 2	10	15	25	50		
		OE-2:Theory	FSB900	Applications of Biotechnology in Agriculture	3:0:0	20	20	60	100	2h	-
II B.Sc	III	DSC-3:Theory	FSC460	Biomolecules	4: 0: 0	20	20	60	100	2h	3h
		DSC-3: Pract	FSC460	Biomolecules	0: 0: 2	10	15	25	50		
		OE-3:Theory	FSC900	Nutrition and Health	3:0:0	20	20	60	100	2h	-
	IV	DSC-4:Theory	FSD460	Molecular Biology	4: 0: 0	20	20	60	100	2h	3h
		DSC-4: Pract	FSD460	Molecular Biology	0: 0: 2	10	15	25	50		
		OE-4:Theory	FSD900	Intellectual Property Rights	3:0:0	20	20	60	100	2h	-

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE**  
**Scheme of Examination Programme – B.Sc., ZBt ; Programme code –BScBtZo36**

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
						L:T:P	IA			Total	Th
					C-1		C-2	C-3			
I B.Sc	I	DSC -1:Theory	FSA460	Cell biology & genetics	4: 0: 0	20	20	60	100	2h	3h
		DSC -1:Pract	FSA460	Cell biology & genetics	0: 0: 2	10	15	25	50		
		OE -1:Theory	FSA900	Biotechnology for human welfare	3:0:0	20	20	60	100	2h	-
	II	DSC-2:Theory	FSB460	Microbiological Methods and Techniques	4: 0: 0	20	20	60	100	2h	3h
		DSC-2: Pract	FSB460	Microbiological Methods and Techniques	0: 0: 2	10	15	25	50		
		OE-2:Theory	FSB900	Applications of Biotechnology in Agriculture	3:0:0	20	20	60	100	2h	-
II B.Sc	III	DSC-3:Theory	FSC460	Biomolecules	4: 0: 0	20	20	60	100	2h	3h
		DSC-3: Pract	FSC460	Biomolecules	0: 0: 2	10	15	25	50		
		OE-3:Theory	FSC900	Nutrition and Health	3:0:0	20	20	60	100	2h	-
	IV	DSC-4:Theory	FSD460	Molecular Biology	4: 0: 0	20	20	60	100	2h	3h
		DSC-4: Pract	FSD460	Molecular Biology	0: 0: 2	10	15	25	50		
		OE-4:Theory	FSD900	Intellectual Property Rights	3:0:0	20	20	60	100	2h	-

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE**  
**Scheme of Examination Programme – B.Sc., CBt ; Programme code –BScChBt37**

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
						L:T:P	IA			Total	Th
					C-1		C-2	C-3			
I B.Sc	I	DSC -1:Theory	FSA460	Cell biology & genetics	4: 0: 0	20	20	60	100	2h	3h
		DSC -1:Pract	FSA460	Cell biology & genetics	0: 0: 2	10	15	25	50		
		OE -1:Theory	FSA900	Biotechnology for human welfare	3:0:0	20	20	60	100	2h	-
	II	DSC-2:Theory	FSB460	Microbiological Methods and Techniques	4: 0: 0	20	20	60	100	2h	3h
		DSC-2: Pract	FSB460	Microbiological Methods and Techniques	0: 0: 2	10	15	25	50		
		OE-2:Theory	FSB900	Applications of Biotechnology in Agriculture	3:0:0	20	20	60	100	2h	-
II B.Sc	III	DSC-3:Theory	FSC460	Biomolecules	4: 0: 0	20	20	60	100	2h	3h
		DSC-3: Pract	FSC460	Biomolecules	0: 0: 2	10	15	25	50		
		OE-3:Theory	FSC900	Nutrition and Health	3:0:0	20	20	60	100	2h	-
	IV	DSC-4:Theory	FSD460	Molecular Biology	4: 0: 0	20	20	60	100	2h	3h
		DSC-4: Pract	FSD460	Molecular Biology	0: 0: 2	10	15	25	50		
		OE-4:Theory	FSD900	Intellectual Property Rights	3:0:0	20	20	60	100	2h	-



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE**  
**Scheme of Examination Programme – B.Sc., BcBt ; Programme code –BScBtBc40**

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
					L:T:P	IA			Total	Th	Pr
						C-1	C-2	C-3			
I B.Sc	I	DSC -1:Theory	FSA460	Cell biology & genetics	4: 0: 0	20	20	60	100	2h	3h
		DSC -1:Pract	FSA460	Cell biology & genetics	0: 0: 2	10	15	25	50		
		OE -1:Theory	FSA900	Biotechnology for human welfare	3:0:0	20	20	60	100	2h	-
	II	DSC-2:Theory	FSB460	Microbiological Methods and Techniques	4: 0: 0	20	20	60	100	2h	3h
		DSC-2: Pract	FSB460	Microbiological Methods and Techniques	0: 0: 2	10	15	25	50		
		OE-2:Theory	FSB900	Applications of Biotechnology in Agriculture	3:0:0	20	20	60	100	2h	-
II B.Sc	III	DSC-3:Theory	FSC460	Biomolecules	4: 0: 0	20	20	60	100	2h	3h
		DSC-3: Pract	FSC460	Biomolecules	0: 0: 2	10	15	25	50		
		OE-3:Theory	FSC900	Nutrition and Health	3:0:0	20	20	60	100	2h	-
	IV	DSC-4:Theory	FSD460	Molecular Biology	4: 0: 0	20	20	60	100	2h	3h
		DSC-4: Pract	FSD460	Molecular Biology	0: 0: 2	10	15	25	50		
		OE-4:Theory	FSD900	Intellectual Property Rights	3:0:0	20	20	60	100	2h	-

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE**  
**Scheme of Examination Programme – B.Sc., MbBt ; Programme code –BScMbBt41**

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
						L:T:P	IA			Total	Th
					C-1		C-2	C-3			
I B.Sc	I	DSC -1:Theory	FSA460	Cell biology & genetics	4: 0: 0	20	20	60	100	2h	3h
		DSC -1:Pract	FSA460	Cell biology & genetics	0: 0: 2	10	15	25	50		
		OE -1:Theory	FSA900	Biotechnology for human welfare	3:0:0	20	20	60	100	2h	-
	II	DSC-2:Theory	FSB460	Microbiological Methods and Techniques	4: 0: 0	20	20	60	100	2h	3h
		DSC-2: Pract	FSB460	Microbiological Methods and Techniques	0: 0: 2	10	15	25	50		
		OE-2:Theory	FSB900	Applications of Biotechnology in Agriculture	3:0:0	20	20	60	100	2h	-
II B.Sc	III	DSC-3:Theory	FSC460	Biomolecules	4: 0: 0	20	20	60	100	2h	3h
		DSC-3: Pract	FSC460	Biomolecules	0: 0: 2	10	15	25	50		
		OE-3:Theory	FSC900	Nutrition and Health	3:0:0	20	20	60	100	2h	-
	IV	DSC-4:Theory	FSD460	Molecular Biology	4: 0: 0	20	20	60	100	2h	3h
		DSC-4: Pract	FSD460	Molecular Biology	0: 0: 2	10	15	25	50		
		OE-4:Theory	FSD900	Intellectual Property Rights	3:0:0	20	20	60	100	2h	-

## MODEL CURRICULUM

<b>Name of the Degree Program</b>	<b>:</b>	<b>B.Sc. (Basic/Hons.)</b>
<b>Discipline Core</b>	<b>:</b>	<b>Biotechnology</b>
<b>Total Credits for the Program</b>	<b>:</b>	<b>B.Sc. Basic - 136 and B.Sc. Hons. - 176</b>
<b>starting year of implementation</b>	<b>:</b>	<b>2021-22</b>

### **Program Outcomes:**

Competencies need to be acquired by the candidate securing B.Sc. (Basic) or B.Sc. (Hons)

### **By the end of the program the students will be able to:**

Competencies need to be acquired by a candidate securing B.Sc. (Basic) or B.Sc. (Hons) degree in Biotechnology.

1. Understanding concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology.
2. Demonstrating the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects
3. Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.
4. Critically analyze the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.
5. Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.
6. Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.
7. Critically analyse, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health and Food.
8. Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology.
9. Learning and practicing professional skills in handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA technology, genetic engineering, animals handling, intellectual property rights, biosafety, and biohazards.
10. Exploring the biotechnological practices and demonstrating innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.
11. Thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries
12. Understanding and application of molecular biology techniques and principles in forensic

and clinical biotechnology.

13. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises or CROs.

### Continuous Formative Evaluation/ Internal Assessment

Total Marks for each course = 100%

Continuous assessment (C1) = 20% marks

Continuous assessment (C2) = 20% marks

Semester End Examination (C3) = 60% marks.

- The first component (C1) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, project work etc. This assessment and score process should be completed after completing 50% of syllabus of the course/s and within 45 working days of semester program.
- The second component (C2) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, field work, internship / industrial practicum / project work etc. This assessment and score process should be based on completion of remaining 50 percent of syllabus of the courses of the semester.
- During the 17th – 19th week of the semester, a semester end examination shall be conducted by the University for each course. This forms the third and final component of assessment (C3) and the maximum marks for the final component will be 60%.
- The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) of a course shall be as under.

#### Outline for continuous assessment activities for C1 and C2

Activities	C1 (% marks)	C2 (% marks)	C1 + C2 (% marks)	C3 (% marks)
Session Test	10	10	20	-
Seminars/Presentations/Assignment	10	10	20	-
Semester end Examination	-	-	-	60
<b>Total</b>	<b>20</b>	<b>20</b>	<b>40</b>	<b>60</b>

#### Practical assessment

Assessment			
Formative assessment		Summative Assessment	Total Marks
Assessment Occasion / type	Weightage in Marks	Practical Exam	
Test C1	10		50
Test C2	10		
Record	5		
<b>Total</b>	<b>25</b>	<b>25</b>	

- For practical course of full credits, Seminar shall not be compulsory. In its place, marks shall be awarded for Practical Record Maintenance. (the ratio is 50% : 50%)
- Conduct of Seminar, Case study / Assignment, etc. can be either in C1 or in C2 component at the convenience of the concerned teacher.

- The teachers concerned shall conduct test / seminar / case study, etc. The students should be informed about the modalities well in advance. The evaluated courses/assignments during component I (C1) and component II (C2) of assessment are immediately provided to the candidates after obtaining acknowledgement in the register by the concerned teachers(s) and maintained by the Chairman in the case of a University Post-Graduate Department and the Principal / Director in the case of affiliated institutions. Before commencement of the semester end examination, the evaluated test, assignment etc. of C1 and C2 shall be obtained back to maintain them till the announcement of the results of the examination of the concerned semester.
- e) The marks of the internal assessment shall be published on the notice board of the department / college for information of the students.
- f) The Internal assessment marks shall be communicated to the Registrar (Evaluation) at least 10 days before the commencement of the University examinations and the Registrar (E) shall have access to the records of such periodical assessments.
- g) There shall be no minimum in respect of internal assessment marks.
- h) Internal assessment marks may be recorded separately. A candidate, who has failed or rejected the result, shall retain the internal assessment marks.

## **Curriculum Structure for the Undergraduate Degree Program**

### **B.Sc. (Basic / Hons.)**

<b>Total Credits for the Program</b>	<b>:</b>	<b>176</b>
<b>Starting year of implementation</b>	<b>:</b>	<b>2021-22</b>
<b>Name of the Degree Program</b>	<b>:</b>	<b>B.Sc. (Basic/Hons.) BIOTECHNOLOGY</b>

#### **Program Articulation Matrix:**

#### **Curriculum Structure for the Undergraduate Degree Program - BSc**

Total Credits for the Program: 176

Starting year of implementation: 2021-22

Name of the Degree Program: B.Sc.

Discipline/Subject: **Biotechnology**

#### **Program Articulation Matrix:**

This matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory etc. Elective courses may be listed separately

## Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project-based learning/ case studies/self-study like seminar, term paper or MOOC

Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning).

## BSc Biotechnology (Basic / Hons.) Semester

1

<b>Course Title: DSC-1T, BTC 101, Cell Biology and Genetics</b>	
Total Contact Hours: <b>56</b>	Course Credits: <b>4+2</b>
Formative Assessment Marks: <b>40%</b>	Duration of ESA/Exam: <b>Hrs</b>
Model Syllabus Authors: <b>Curriculum Committee</b>	Summative Assessment Marks: <b>60%</b>

**Course Pre-requisite(s):** *Mention only course titles from the curriculum that are needed to be taken by the students before registering for this course.*

### Course Outcomes (COs):

At the end of the course the student should be able to:

*(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)*

1. Would be able to comprehend the structure of a cell with its organelles
2. \*Can explain the organization of genes and chromosomes, chromosome morphology and its aberrations

**Course Articulation Matrix:** Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Would be able to comprehend the structure of a cell with its organelles	*	*			*							
2. Can distinguish between the Structure of prokaryotic and eukaryotic cell.	*	*			*							
3. Can explain the organization of genes and chromosomes, chromosome morphology and its aberrations	*	*			*							

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

# BSc Biotechnology (Basic / Hons.)

## Semester 1

### Title of the Courses:

Course 1 : DSC-1T, Cell Biology and Genetics

Course 2 : OE 1T, Biotechnology for human welfare

Course 3 : SEC 1T, Biotechnological Skills and Analytical Techniques

Course 1 : DSC-1T, BTC 101, Cell Biology and Genetics		Course 2 : OE 1T, BTC 301, Biotechnology for human welfare		Course 3 : SEC 1T, BTC 701, Biotechnological Skills and Analytical Techniques	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	56	3	42	1	14

**Content of Course 1: Theory: DSC-1T, BTC 101, Cell Biology and Genetics 56 Hrs**

**Unit – 1: Cell as a Basic unit of Living Systems and Cellular Organelles 14Hrs**

Concept, Development and Scope of Biotechnology. Historical perspectives. Discovery of cell, the cell Theory, Ultra structure of prokaryotic and eukaryotic cell- (Both plant and animal cells),

**Surface Architecture:** Structural organization and functions of plasma membrane and cell wall of bacteria and plants.

**Cellular Organelles:** Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclearenvelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).

**Unit- 2. Chromosomes and Cell Division**

**14Hrs**

General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded and multi- stranded hypothesis, folded- fibre and nucleosome models.

Special type of chromosomes: Salivary gland and Lampbrush chromosomes.

**Cell Division:** Cell cycle, phases of cell cycle, Regulation of cell cycle-, checkpoints and enzymes involved. Significance of cell cycle, interphase nucleus, stages of mitosis and meiosis, achromatic apparatus, synaptonemal complex. Cell Senescence and programmed cell death.

**Unit-3.Genetics:**

**14Hrs**

**Mendelian Genetics:** Introduction and brief history of genetics. Mendelian theory: Laws of inheritance- dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, back cross.

**Gene interaction:** Deviations to Mendelian inheritance- Supplementary factors: comb pattern in fowls, Complementary genes- Flower colour in sweet peas, Multiple factors–Skin colour in human beings, Epistasis– Plumage colour in poultry (13:3), Multiple allelism: Blood groups in Humans- ABO and Rh.

**Maternal Inheritance:** Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa particles in Paramecium.

Sex-linked inheritance- Colour blindness, hemophilia, Y-linked traits.

Introduction, Chromosome theory of inheritance, Coupling and repulsion hypothesis, Linkage in maize and Drosophila, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize.

**Chromosomal variations:** A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton.

**Mutations:** Types of mutations, Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Applications of mutations- plants, animals and microbes.

**Sex Determination in Plants and animals:** Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types.

**Human Genetics:** Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).

**Epigenetics:** Plant and humans.

### **Course 1: Practical: DSC-1P, BTC 101, Cell Biology and Genetics**

- 1) Study and maintenance of simple and compound microscope
- 2) Use of Micrometer and calibration, measurement of onion epidermal cells and yeast
- 3) Study of stages in mitosis from onion root tips
- 4) Study of stages in meiosis in grasshopper testes/onion or Rhoeo flower buds.
- 5) Mounting of polytene chromosomes
- 6) Buccal smear – Barr bodies
- 7) Karyotype analysis - Human and Onion  
Human – Normal and Abnormal – Down and Turner's syndromes
- 8) Isolation and staining of Mitochondria
- 9) Isolation and staining of Chloroplast
- 10) RBC cell count by Haemocytometer
- 11) Simple genetic problems based on theory

### **Text Books / References**

#### **Reference:**

1. Molecular Biology of Cell - Bruce Alberts et al, Garland Publications.
2. Animal Cytology and Evolution- MJD, White Cambridge University Publications
3. Molecular Cell Biology-Daniel, Scientific American Books
4. Cell Biology - Jack d Bruke, The William Twilkins Company
5. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications
6. Cell Biology-Ambrose & Dorothy M Easty, ELBS Publications
7. Fundamentals of Cytology- L. W. Sharp, McGraw Hill Company
8. Cytology-Willson & Marrison, Reinform Publications
9. Molecular Biology- Christopher Smith, Faber & Faber Publications
10. Cell Biology & Molecular Biology – EDP De Robertis & EMF Robertis, Saunder College.
11. Cell Biology- C.B Powar, Himalaya Publications
12. Basic Genetics- Daniel L. Hartl, Jones & Barlett Publishers USA
13. Human Genetics and Medicine lark Edward Arnold PLondon
14. Genetics – Monroe W Strickberger, Macmillain Publishers, New York
15. Genes V - Benjamin Lewin, Oxford University Press.
16. Genes I - Benjamin Lewin, Wiley Eastern Ltd., Delhi
17. Principles of Genetics- Sinnott, L.C. Dunn, Dobzhansky, McGraw-Hill.
18. Genetics – Edgar Altenburg Oxford & IBH publications
19. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Son Publications
20. Genetics- P.K.Gupta, Rastogi Publication, Meert, India



## Course 2: Theory: OE 1T, Biotechnology for Human Welfare 42Hrs

### Unit – 1: Industry

14Hrs

Introduction, Scope, branches and applications of Biotechnology.

Biotechnology in industry: Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase)

Applications of biotechnology in food, detergent and pharmaceutical industries

### Unit – 2: Environment

14Hrs

Application of biotechnology in environmental aspects :

Bioremediation: Degradation organic pollutants, hydrocarbons and agricultural wastes, Superbug  
Bioplastics and Biofuels.

### Unit – 3: Forensic and Health Sciences

14Hrs

Application of biotechnology in forensic science:

Solving crimes of murder and rape, paternity testing and theft using DNA finger printing techniques

Application of biotechnology in health:

Genetically engineered insulin, recombinant vaccines, gene therapy, diagnostics-ELISA and PCR, human genome project.

Summative Assessment = 60 Marks	
Formative Assessment Occasion / type	Weightage in Marks
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	60 marks + 40 marks = 100 marks

### References:

1. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
2. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2<sup>nd</sup> edition, Elsevier Science Ltd.
4. Environmental Biotechnology, Pradipta Kumar Mohapatra
5. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
6. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
7. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
8. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
9. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).

## Course 3: Theory: SEC 1T, Biotechnological Skills and Analytical Techniques

### LEARNING OUTCOMES

- Skill enhancement as per National Occupational Standards (NOS) of Lab Technician/ Assistant” Qualification Pack issued by Life Sciences Sector Skill Development Council - LFS/Q0509, Level 3.
- Knowledge about major activities of biotech industry, regulations, and compliance, environment, health, and safety (EHS), good laboratory practices (GLP), standard operating procedures (SOP) and GMP as per the industry standards.
- Demonstrate soft skills, such as decision making, planning, organizing, problem solving, analytical thinking, critical thinking, and documentation.

## Course 3: Theory: SEC 1T, Biotechnological Skills and Analytical Techniques 14Hrs

### 1. Insights into biotechnology industry:

Biotechnology Industry in Indian and Global context - organization in context of large/medium/small enterprises, their structure and benefits.

### 2. Industry professional skills to be acquired:

Planning and organising skills, decision-making, problem-solving skills, analytical thinking, critical thinking, team management, risk assessment.

### 3. Interpersonal skills:

Writing skills, reading skills, oral communication, conflict-resolution techniques, interpretation of research data, trouble shooting in workplace

### 4. Digital skills:

Basic Computer Skills (MS Office, Excel, PowerPoint, Internet) for Workplace. Professional Email drafting skills and PowerPoint presentation skills

### Analytical Skills in laboratory:

**Solutions:** Molarity, Molality, Normality, Mass percent % (w/w), Percent by volume (% v/v), parts per million (ppm), parts per billion (ppb), Dilution of concentrated solutions. Standard solutions, stock solution, solution of acids. Reagent bottle label reading and precautions

### Course 3 :Practicals: SEC 1P, Biotechnological Skills and Analytical Techniques

#### 1. **Methods and practices of cleaning and management of lab**

Learning and Practice of Integrated clean-in-place (CIP) and sterilize-in-place (SIP) as per industry standards, material requirements for cleaning specific area, equipment, ventilation area, personal protective requirements

#### 2. **Procedure of cleaning and storage of Lab ware:**

Methodology for storage area, Cleaning procedure and materials to be used for various surfaces. Sign boards, labelling do's& don'ts

Knowledge about standard procedures of cleaning or glass ware, plastic ware.

Maintenance of inventory

#### 3. **Principles and practices of lab safety:**

Knowledge about safety symbols and hazard signs. Personal safety gears, utility, and disposal. Equipment safety protocols, chemical safety protocols. Documentation of chemical and equipment usage records. Handling hazardous chemicals.

#### 4. **Best practices of usage and storage of chemicals:**

Knowledge and practice in handling of chemicals, labelling and stock maintenance. SOP and material handling. Procedures to maintain chemicals, labelling, storage, and disposal.

#### 5. **Record maintenance as per SOPs**

Labelling of samples and reagents as per SOPs.

Recording detail of work done for research experiments. Importance of study of manuals, health and safety instructions.

#### 6. **Usage and maintenance of basic equipment of biotechnology lab:** Principles, calibrations, and SOPs of weighing balances, pH meters, autoclaves, laminar flows and biosafety cabinets (levels), basic microscopes, homogenizers, stirrers, colorimeters, UV, and Visible spectrophotometers.

#### 7. **Preparation of solutions and standards** - Properties and uses of chemicals commonly used in life sciences laboratories. Maintaining safety standards for handling various solutions and chemicals. Preparation of test reagents and buffers, Protocols for proper mixing of chemicals. Safety precautions while preparation and storage of incompatible chemicals and reagents.

#### 8. **Preparation of media:** Maintenance and storage of purified water for media (Plant Tissue culture media, Microbiological media, and Animal cell culture media) preparation. Preparation and storage of concentrated stock solutions. Documentation and disposal of expired stocks.

Collection of indents of media requirement, preparation, and storage. Media coding, documentation, and purpose of usage.

#### 9. **Practical methods for decontamination and disposal:**

Decontamination methods, Safe disposal practices of decontaminated media or materials.

## **10. Laboratory record writing**

Method of record writing , data collection and recording , reporting of result, discussion of result , summary writing, effective power point presentation taking any experiment as example

## **11. Industry visit or Analytical laboratory visit**

### **Pedagogy:**

The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual, Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation, and Innovative methods.

Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level

Case studies about application of microbial biomolecules in various industries. Seminar on topics of microbial biochemist

## BSc Biotechnology (Basic / Hons.) Semester 2

### Title of the Courses:

**Course 1 : DSC-2T, Microbiological Methods and Techniques**

**Course 2 : OE- 2T, Applications of Biotechnology in Agriculture**

Course 1: DSC-2T, <b>Microbiological Methods and Techniques</b>		Course 2: OE- 2T, <b>Applications of Biotechnology in Agriculture</b>	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
<b>4</b>	<b>56</b>	<b>3</b>	<b>42</b>

**Content of Course: DSC-2T, BTC 102, Microbiological Methods and Techniques 56 Hrs**

### **Unit - 1 General Microbiology and Instrumentation**

14Hrs

General Introduction to Microbiology: Scope and relevance of microbiology, important contributions by Robert Koch, Leeuwenhoek, Jenner, Pasteur, Flemming, Ivanowsky

General account on structure, classification and reproduction of bacteria, virus and fungi

**Microscopy:** Principles and applications of Compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence Microscope, Confocal microscope, Electron Microscopes- TEM and SEM.

**Analytical techniques:** Working principles and applications: Centrifuge, Ultracentrifuge, Spectrophotometer, Chromatography: Paper, TLC, Column (adsorption, gel-filtration, ion exchange, affinity), HPLC, GC.

### **Unit - 2 Sterilization techniques**

14Hrs

Definition of terms-sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agent and antimicrobial agent.

**Physical methods of control:** Principle, construction and applications of moist heat sterilization- Pasteurization, Boiling, Fractional sterilization-Tyndallization and autoclave. Dry heat sterilization- Incineration and hot air oven.

Filtration – Diatomaceous earth filter, seitz filter, membrane filter and HEPA

Radiation: Ionizing radiation- $\gamma$  rays and non ionizing radiation- UVrays

**Chemical methods:** Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds and sterilizing gases as antimicrobial agents.

### **Unit – 3: Microbiological techniques**

14Hrs

**Culture Media:** Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media

**Pure culture methods:** Serial dilution and plating methods (pour, spread, streak); cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria

**Microbial growth and its measurements:** Growth curve, enumeration methods (turbidity, cell counting, colony counting)

**Stains and staining techniques:** Principles of staining, Types of stains-simple stains, structural stains, negative stain and differential stains.

**Antibiotic sensitivity testing methods:** Disc and Agar well diffusion techniques

**Five modes of action with one example each:** Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism

**Antifungal agents:** Mechanism of action of Amphotericin B, Griseofulvin

**Antiviral agents:** Mechanism of action of Amantadine, Acyclovir, Azidothymidine Antibiotic resistance, MDR, XDR, MRSA, NDM-1

### **Course 1: Practicals: DSC-2 P, Microbiological Methods and Techniques**

1. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology and Biotechnology laboratory.
2. Sterilization of medium using Autoclave and assessment for sterility
3. Sterilization of glassware using Hot Air Oven and assessment for sterility
4. Sterilization of heat sensitive material by membrane filtration and assessment for sterility
5. Preparation of culture media for bacteria, fungi and their cultivation.
6. Plating techniques: Spread plate, pour plate and streak plate.
7. Isolation of bacteria and fungi from soil, water and air
8. Study of Rhizopus, Penicillium, Aspergillus using temporary mounts
9. Colony characteristics study of bacteria from air exposure plate
10. Staining techniques: Bacteria – Gram, Negative, Capsule, Endospore staining Fungi – Lactophenol cotton blue staining
11. Bacterial cell motility Water analysis - MPN test
12. Biochemical Tests – IMViC, Starch hydrolysis, Catalase test, Gelatin hydrolysis
13. - hanging drop technique

## Text Books / References

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.
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5. 5th edition Tata McGraw Hill.
6. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht
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8. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
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11. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications
12. Fundamentals of Microbiology –Frobisher, Saunders & Toppan Publications
13. Introductory Biotechnology-R.B Singh C.B.D. India(1990)
14. Fundamentals of Bacteriology -Salley
15. Frontiers in Microbial technology-P.S. Bison, CBS Publishers.
16. Biotechnology, International Trends of perspectives A. T. Bull, G.
17. General Microbiology –C.B. Powar

## **Course 2: Theory: OE- Applications of Biotechnology in Agriculture 42 Hrs**

### **Unit – 1: Agricultural Biotechnology** 14 Hrs

Concepts and scope of biotechnology in Agriculture. Plant tissue culture, micro propagation, entrepreneurship in commercial plant tissue culture. Banana tissue culture - primary and secondary commercial setups, Small scale bio enterprises: Mushroom cultivation

### **Unit – 2: Transgenic plants** 14 Hrs

The GM crop debate – safety, ethics, perception and acceptance of GM crops  
GM crops case study: Bt cotton, Bt brinjal, Biopesticides: Baculovirus pesticides, Mycopesticides  
Genetic Engineering for quality improvement: Golden rice, Seed storage proteins, Flavours– capsaicin, vanillin

### **Unit – 3: Molecular pharming and post-harvest protection** 14 Hrs

Plants as bio factories for molecular pharming: edible vaccines, plant bodies, nutraceuticals  
Post-harvest Protection:  
Antisense RNA technology for extending shelf life of fruits and shelf life of flowers.  
Biosafety, bioethics and IPR.

#### **References**

1. Chrispeels M.J.et al. Plants, Genes and Agriculture-Jones and Bartlett Publishers, Boston.1994.
2. Gamborg O.L. and Philips G.C.Plant cell, tissue and organ culture (2nd Ed.) Narosa Publishing House. NewDelhi.1998
3. Hammound J, P McGravey&Yusibov.V. Plant Biotechnology, Springerverlag.2000
4. Heldt. Plant Biochemistry and Molecular Biology.Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.1997
5. LydianeKyte and John Kleyn.Plants from test tubes. An introductionto
6. Micropropagation (3 rd. Ed.). Timber Press, Portland.1996
7. Murray D.R. Advanced methods in plant breeding and biotechnology.Panima Publishing Corporation.1996
8. NickoloffJ.A.Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana press incorp, USA.1995.
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11. Sateesh M.K. 2008. Biosafety and Bioethics. Oxford and IBH Publishers, New Delhi.



## BSc Biotechnology (Basic / Hons.) Semester 3

### Title of the Courses:

Course 1 : DSC-3T, Biomolecules

Course 2 : OE- 3T, Nutrition and Health

Program Name	BSc Biotechnology		Semester	Third Sem
Course Title	Biomolecules			
Course code	FSC460	DSC -3T	No. of Theory Credits	4
Contact hours	56 hrs		Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40		Summative Assessment Marks	60

### Course Pre-requisite (s):

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Acquire knowledge about types of biomolecules, structure, and their functions
2. Will be able to demonstrate the skills to perform bioanalytical techniques
3. Apply comprehensive innovations and skills of biomolecules to biotechnology field

### Content

#### Hrs

#### Unit-I

14

**Carbohydrates:** Introduction, sources, classification of carbohydrates. Structure, function and properties of carbohydrates. Monosaccharides – Isomerism and ring structure, Sugar derivatives – amino sugars and ascorbic acid Disaccharides –

Maltose, Lactose and Sucrose

Polysaccharides – Classification as homo and heteropolysaccharides, Homopolysaccharides - storage polysaccharides (starch and glycogen- structure, reaction, properties), structural polysaccharides (cellulose and chitin-structure, properties), Heteropolysaccharides - glycoproteins and proteoglycans. Metabolism: Glycolysis and gluconeogenesis, Krebs's cycle, ETC- oxidative phosphorylation.

**Amino Acids, Peptides and Proteins:** Introduction, classification and structure of amino acids; Zwitterion, isoelectric point, pK values. Essential and nonessential amino acids.

Peptide bond and peptide, Structural organization of proteins - primary, secondary ( $\alpha$  helix,  $\beta$  sheets) tertiary and quaternary. Fibrous and globular proteins, Denaturation and renaturation of proteins. General aspects of amino acid metabolism: Transamination, deamination, decarboxylation and urea cycle.

#### Unit-II

14 Hrs

**Lipids:** Classification and function of lipids, Saturated and unsaturated fatty acids, properties (saponification value, acid value, iodine number, rancidity), Hydrogenation of fats and oils. General structure and biological functions of phospholipids, sphingolipids, glycolipids, lipoproteins, prostaglandins, cholesterol, ergosterol. Metabolism:  $\beta$  oxidation of fatty acids. Biosynthesis of palmitate.

**Enzymes:** Introduction, nomenclature and classification, enzyme kinetics, factors influencing enzyme activity, metalloenzymes, activation energy and transition state, enzyme activity, specific activity. Coenzymes, cofactors and their functions (one reaction involving TPP, FAD, NAD). Enzyme inhibition- Irreversible and reversible (competitive, non-competitive and uncompetitive inhibition with an example each) Zymogens (trypsinogen, chymotrypsinogen and pepsinogen),

Isozymes (LDH, Creatine kinase and their clinical significance).

### Unit–III

14 Hrs

**Vitamins:** Water- and fat-soluble vitamins, dietary source and biological role of vitamins Deficiency manifestation of vitamin A, B, C, D, E and K

**Nucleic acids:** Structure of nucleosides, nucleotides in DNA and RNA. Structure and functions of DNA and RNA, Watson and Crick model of DNA and other forms of DNA (A and Z). Types of RNA (rRNA, tRNA, mRNA, snRNA, hnRNA, miRNA), ribozymes. Metabolism- Overview of biosynthesis and degradation of purine and pyrimidine, salvage pathway.

**Hormones:** Classification of hormones based on chemical nature and mechanism of action. Chemical structure and functions of the following hormones: Glucagon, insulin, Epinephrine ,Testosterone and Estradiol.

### Unit–IV

14 Hrs

**Electrophoresis:** Principle, procedure and applications of electrophoresis (paper electrophoresis, gel electrophoresis -PAGE, SDS- PAGE & agarose electrophoresis) and isoelectric focusing.

**Spectroscopy:** Colorimetry, UV-Vis spectrophotometry, Spectrofluorimetry, IR and NMR spectroscopy, atomic absorption spectroscopy, mass spectroscopy

**Radioisotope techniques:** Radioactivity, half life, radioisotopes, GM counter, scintillating counting, autoradiography, applications, biosafety.

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Acquire knowledge about types of biomolecules, structure, and their functions	✓				✓							✓
Will be able to demonstrate the skills to perform bioanalytical techniques			✓								✓	✓
Apply comprehensive innovations and skills of biomolecules to biotechnology field	✓				✓							✓

**Pedagogy:** Lectures, Seminars, Industry Visits and Assignment.

Course Title	<b>Biomolecules</b>	Practical Credits	<b>2</b>
Course No.	<b>DSC-3P</b>	Contact hours	48 h

### Content

1. Introduction to basic instruments (Principle, standard operating procedure) with demonstration.
2. Definitions and calculations: Molarity, Molality, Normality, Mass percent (w/w), Percent by volume (v/v), parts per million (ppm), parts per billion (ppb), Dilution of concentrated solutions. Standard solutions, stock solution, solution of acids. Reagent bottle label reading and precautions.
3. Preparation of standard buffers by Henderson-Hasselbalch equation – Acetate, phosphate, Tris and determination of pH of solution using pH meter.
4. Estimation of glucose by DNS method
5. Determination of  $\alpha$ -amylase activity by DNS method
6. Estimation of proteins by Biuret method
7. Estimation of amino acid by Ninhydrin method
8. Extraction of protein from soaked/sprouted green gram by salting out method
9. Separation of amino acids by circular paper chromatography
10. Demonstration of PAGE
11. Determination of iodine number of lipids

References
An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India
Biochemical Methods, 1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing. House, New Delhi, ISBN 81-7319-302-9
Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed). I.K International Pvt. LTD, New Delhi. ISBN 81-88237-41-8
Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067

Program Name	<b>BSc Biotechnology</b>		Semester	<b>Third Sem</b>
Course Title	<b>Nutrition and Health</b>			
Course Code	<b>FSC900</b>	<b>OE-3</b>	No. of Theory Credits	<b>3</b>
Contact hours	<b>Lecture</b>	42 h	Duration of ESA/Exam	<b>2 Hours</b>
	<b>Practical</b>	-		
Formative Assessment Marks	40		Summative Assessment Marks	60

### Course Pre-requisite(s):

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Study the concepts of food, nutrition, diet and health
2. To apply the best practices of food intake and dietary requirements
3. Acquire knowledge about various sources of nutrients and good cooking practices

### Content

**42 Hrs**

#### Unit-I – Introduction

**14 Hrs**

Concepts of nutrition and health. Definition of Food, Diet and nutrition, Food groups. Food pyramids. Functions of food. Balanced diet. Meal planning. Eat right concept. Functional foods, Prebiotics, Probiotics, and antioxidants

#### Unit -II – Nutrients

**14 Hrs**

Macro and Micronutrients - Sources, functions and deficiency. Carbohydrates, Proteins, Fats – Sources and calories. Minerals –Calcium, Iron, Iodine. Vitamins – Fat soluble vitamins –A, D, E & K. Water soluble vitamins – vitamin C, Thiamine, Riboflavin, Niacin. Water–Functions and water balance. Fibre –Functions and sources. Recommended Dietary Allowance, Body Mass Index and Basal Metabolic Rate.

#### Unit -III – Nutrition and Health

**14 Hrs**

Methods of cooking affecting nutritional value. Advantages and disadvantages. Boiling, steaming, pressure cooking. Oil/Fat – Shallow frying, deep frying. Baking. Nutrition through lifecycle. Nutritional requirement, dietary guidelines: Adulthood, Pregnancy, Lactation, Infancy- Complementary feeding, Pre-school, Adolescence, geriatric. Nutrition related metabolic disorders- diabetes and cardiovascular disease.

**Pedagogy:** Lectures, Seminars, Industry Visits and Assignments

References	
1	Sri Lakshmi B, (2007), Dietetics. New Age International publishers. New Delhi
2	Sri Lakshmi B, (2002), Nutrition Science. New Age International publishers. New Delhi
3	Swaminathan M. (2002), Advanced text book on food and Nutrition. Volume I. Bappco
4	Gopalan.C., RamaSastry B.V., and S.C.Balasubramanian (2009), Nutritive value of Indian Foods.NIN.ICMR.Hyderabad.
5	Mudambi S R and Rajagopal M V, (2008), Fundamentals of Foods, Nutrition & diet therapy by New Age International Publishers, New Delhi

## BSc Biotechnology (Basic / Hons.) Semester 4

### Title of the Courses:

#### Course 1 : DSC-4T, Molecular Biology

Program Name	BSc Biotechnology	Semester	Fourth Sem
Course Title	Molecular Biology		
Course No.	DSC -4T	No. of Theory Credits	4
Contact hours	56 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

#### Course 2 : OE- 4T, Intellectual Property Rights

##### Course Pre-requisite (s):

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Study the advancements in molecular biology with latest trends.
2. Will acquire the knowledge of structure, functional relationship of proteins and nucleic acids.
3. Aware about the basic cellular processes such as transcription, translation, DNA replication and repair mechanisms.

### Content

#### Hrs

##### Unit-I

14 Hrs

**DNA as genetic material, Replication and Repair:** Experimental proof of DNA as genetic material (Griffith's, Avery-McCleod-McCarty, Martha-Chase). Central dogma, Replication of DNA in prokaryotes and eukaryotes– semiconservative mode (Messelson and Stalh experiment), Theta, linear and rolling circle models. Enzymes and proteins involved in replication-DNA polymerases, helicases, gyrases, ligase, SSB proteins, RNase H  
The replication complex: Pre-priming proteins, primosome, replisome, unique aspects of eukaryotic chromosome replication, Fidelity of replication.

DNA damage and Repair mechanism: types of damage, photo reactivation, excision repair, mismatch repair and SOS repair.

##### Unit-II

14 Hrs

**Transcription and RNA processing:** Transcription in prokaryotes- RNA polymerase, sigma factor, promoter, initiation, elongation and termination.

Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance, elongation and termination. RNA processing of pre-mRNA: 5' cap formation, polyadenylation, splicing. Processing of rRNA and tRNA.

##### Unit-III

14 Hrs

**Translation:** Genetic code and its characteristics, Wobble hypothesis. Translation- in prokaryotes and eukaryotes- ribosomes, enzymes and factors involved in translation. Activation of amino acids, aminoacyl tRNA synthetases. Mechanism of translation- initiation, elongation and termination of polypeptide chain. Fidelity of translation, Inhibitors of translation. Post translational modifications of proteins, Protein folding and targeting- to mitochondria and lysosomes.

##### Unit-IV

14 Hrs

**Regulation of gene expression:** Prokaryotic gene regulation- operon concept- regulation of *lac* operon and *trp* operon, attenuation control. Eukaryotic gene regulation- Activators, repressors binding to enhancers,

coordinated control (tissue specific gene expression), DNA methylation, chromatin remodeling, Translational control of gene expression-ferritin mRNA regulation, RNAi- miRNA and siRNA.

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)												
	1	2	3	4	5	6	7	8	9	10	11	12	
Study the advancements in molecular biology with latest trends	✓				✓								✓
Will acquire the knowledge of structure, functional relationship of proteins and nucleic acids					✓	✓							✓
Aware about the basic cellular processes such as transcription, translation, DNA replication and repair mechanisms	✓				✓				✓				✓

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

Course Title	<b>Molecular Biology</b>	Practical Credits	<b>2</b>
Course No.	<b>DSC-4P</b>	Contact hours	48

### Content

1. Preparation of DNA model
2. Estimation of DNA by DPA method
3. Estimation of RNA by Orcinol method
4. DNA isolation from plant/ animal/ microbial sources
5. Concentration and purity of isolated DNA samples
6. Agarose gel electrophoresis of DNA
7. Charts on- DNA replication, transcription, translation, Types of DNA, RNA

References
Glick, B.R and Pasternak J.J (1998) Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press
Howe. C. (1995) Gene cloning and manipulation, Cambridge University Press, USA
Lewin, B., Gene VI New York, Oxford University Press
Rigby, P.W.J. (1987) Genetic Engineering Academic Press Inc. Florida, USA
Sambrook et al (2000) Molecular cloning Volumes I, II & III, Cold spring Harbor Laboratory Press New York, USA
Walker J. M. and Ging old, E.B. (1983) Molecular Biology & Biotechnology (Indian Edition) Royal Society of Chemistry U.K
Karp. G (2002) Cell & Molecular Biology, 3rdEdition, John Wiley & Sons; I

## Course 2 : OE- 4T, Intellectual Property Rights

Program Name	<b>BSc Biotechnology</b>		Semester	<b>Fourth Sem</b>
Course Title	<b>Intellectual Property Rights</b>			
Course Code	<b>FSD900</b>	<b>OE-4</b>	No. of Theory Credits	<b>3</b>
Contact hours	<b>Lecture</b>	42 h	Duration of ESA/Exam	<b>2 Hours</b>
	<b>Practical</b>	-		
Formative Assessment Marks	40		Summative Assessment Marks	60

### Course Pre-requisite(s):

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Knowledge about need and scope of Intellectual property rights
2. Acquire knowledge about filing patents, process, and infringement
3. Knowledge about trademarks, industrial designs, and copyright

### Content

**42 Hrs**

#### **Unit-I - Introduction to Intellectual property rights (IPR):**

**14 Hrs**

Genesis and scope. Types of Intellectual property rights - Patent, Trademarks, Copyright, Design, Trade secret, Geographical indicators, Plant variety protection. National and International agencies – WIPO, World Trade Organization (WTO), Trade-Related Aspects of Intellectual Property Rights (TRIPS), General Agreement on Tariffs and Trade (GATT).

#### **Unit -II - Patenting, process, and infringement**

**14 Hrs**

Basics of patents - Types of patents; Patentable and Non-Patentable inventions, Process and Product patent. Indian Patent Act 1970; Recent amendments; Patent Cooperation Treaty (PCT) and implications. Process of patenting. Types of patent applications: Provisional and complete specifications; Concept of “prior art”, patent databases (USPTO, EPO, India). Financial assistance, schemes, and grants for patenting. Patent infringement- Case studies on patents (Basmati rice)

#### **Unit -III - Trademarks, Copy right, industrial Designs**

**14 Hrs**

Trademarks- types, Purpose and function of trademarks, trademark registration, Protection of trademark. Copy right- Fundamentals of copyright law, Originality of material, rights of reproduction, industrial Designs: Protection, Kind of protection provided by industrial design.

References
Manish Arora. 2007. Universal's Guide to Patents Law (English) 4th Edition) -Publisher: Universal Law Publishing House
Kalyan C. Kankanala. 2012. Fundamentals of Intellectual Property. Asia Law House
Ganguli, P. 2001. Intellectual Property Rights: Unleashing the knowledge economy. New Delhi: Tata McGraw-Hill Pub
World trade organization - <a href="http://www.wto.org">http://www.wto.org</a>
World Intellectual Property organization – <a href="http://www.wipo.int">www.wipo.int</a> Office of the controller general of Patents, Design & Trademarks - <a href="http://www.ipindia.nic.in">www.ipindia.nic.in</a>

## **B.Sc. Biotechnology 5<sup>th</sup> Semester**

Program Name	<b>B.Sc. Biotechnology</b>	Semester	<b>5<sup>th</sup> Semester</b>
Course Title	<b>Genetic Engineering (Theory + Practical)</b>		
Course Code:	<b>DSC –A9 (T)</b>	No. of Theory Credits	<b>04</b>
Contact hours	<b>60 hrs</b>	Duration of ESA/Exam	<b>03 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### **Course Objectives**

1. Understand the fundamental principles and techniques of genetic engineering.
2. Explore the applications of genetic engineering in agriculture, medicine, biotechnology, and environmental science.
3. Develop practical skills in genetic engineering techniques and laboratory procedures.
4. Gain knowledge of gene expression regulation and genetic modification methods.
5. Enhance critical thinking and problem-solving skills through discussions and case studies.
6. Stay updated on emerging trends and advancements in genetic engineering.

### **Course Outcomes:**

1. Demonstrate a thorough understanding of the fundamental principles and techniques of genetic engineering.
2. Apply the knowledge of genetic engineering to diverse applications in agriculture, medicine, biotechnology, and environmental science.
3. Perform laboratory procedures and develop practical skills in genetic engineering techniques.
4. Explain gene expression regulation mechanisms and apply genetic modification methods effectively.
5. Evaluate genetic engineering's ethical, social, and legal implications and propose responsible solutions.
6. Stay updated with recent advancements in genetic engineering, critically evaluate emerging trends, and assess their potential impact on various fields.



**Unit I- Fundamentals of Genetic Engineering****15**

Definition, scope, and historical overview of genetic engineering. Importance and applications in various fields.

**DNA Structure and Manipulation** - Techniques for DNA isolation and purification. Methods for quantification and characterization of DNA samples.

**RNA Analysis and Gene Expression**- Methods for RNA isolation and purification. Analysis of gene expression.

**Recombinant DNA technology** – Introduction to molecular cloning. Overview of cloning vectors. Plasmids, phage, cosmid, BAC, and YAC. Features and applications of cloning vectors in genetic engineering. Enzymes used in recombinant DNA technology: Restriction endonucleases, Polymerases, Ligase, kinases, and phosphatases. Techniques for molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems.

**Unit II- Practices in Genetic Engineering****15**

Recombinant Protein Expression and Purification, affinity tags. Techniques for expressing recombinant proteins using bacterial, animal, and plant expression systems. Strategies for protein purification and characterization. Hybridization techniques, Southern, Northern, Western, FISH, Polymerase Chain Reaction (PCR) and its types, molecular probes, DNA sequencing- Sanger's, Next Generation Sequencing.

**Gene Manipulation Techniques** - Methods of gene delivery. Physical, chemical, and biological methods. Transformation, transfection, electroporation and micro-injection. Gene knockout techniques in bacterial and eukaryotic organisms.

**Genome Editing** - Introduction to genome editing techniques- Principles and applications of genome editing techniques. CRISPR-Cas9, site-directed mutagenesis, and other genome editing methods.

**Unit III- Applications of Genetic Engineering****15**

Introduction to Applications. Overview of the diverse applications of genetic engineering. Gene therapy and its potential in treating genetic disorders. Strategies for gene delivery in therapeutic applications. Diagnostic Applications. DNA fingerprinting and its applications in forensics. Molecular diagnostic techniques and their role in disease diagnosis. Use of genetic engineering in the development of therapeutics and vaccines. Production of biopharmaceuticals using recombinant DNA technology.

**Unit IV- Advances in Genetic Engineering and Ethics****15**

Industrial Applications. Industrial applications of genetic engineering, such as enzyme production, biofuel production, and bioremediation. Scale-up techniques and process optimization in industrial settings. Introduction to synthetic biology and its integration with genetic engineering. Design and construction of artificial biological systems.

**Ethical and Regulatory Considerations** - Discussion of ethical implications associated with genetic engineering. Introduction to regulatory guidelines and safety considerations for genetic engineering research and applications

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

<b>Summative Assessment = 60 Marks</b>	
<b>Formative Assessment / type</b>	<b>Weightage in Marks</b>
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
<b>Total FA</b>	<b>40</b>
<b>Total (FA + SA)</b>	<b>100 marks</b>

Course Title	<b>Genetic Engineering</b>	Practical Credits	<b>02</b>
Course Code:	<b>DSC–A10 (P)</b>	Contact hours	<b>60 hrs</b>

### Practical Content

- 1. Introduction to Laboratory Techniques** - Safety guidelines and laboratory protocols  
Aseptic techniques and proper handling of materials. Basic equipment and instrument operation  
Preparation of reagents and media
- 2. Nucleic Acid Extraction and Quantification**- DNA extraction from different sources (e.g., bacteria, plant, animal). RNA extraction and purification methods. Quality assessment and quantification of nucleic acids (spectrophotometry, gel electrophoresis).
- 3. Polymerase Chain Reaction (PCR)**  
Primer design and optimization PCR setup and cycling conditions  
Agarose gel electrophoresis for PCR product analysis
- 4. Cloning and Plasmid Manipulation**  
Isolation of Plasmid Restriction enzyme digestion Ligation reactions  
Transformation of bacterial cells with recombinant plasmids Colony selection and screening for successful cloning
- 5. Gel Electrophoresis and DNA Analysis**  
Agarose gel electrophoresis for DNA fragment separation and analysis DNA size determination using molecular weight markers  
DNA band visualization techniques (e.g., Ethidium bromide staining, DNA intercalating dyes)

<b>Practical Assessment</b>			
<b>Formative Assessment</b>			
<b>Assessment Occasion/ type</b>	<b>Weightage in Marks</b>	<b>Summative Assessment</b>	<b>Practical Exams</b>
Record	05	25	

Test	10		50
Attendance	05		
Performance	05		
<b>Total</b>	<b>25</b>	<b>2</b> <b>5</b>	

## References

1. Principles of Gene Manipulation and Genomics (2016) 8th ed., Primrose, SB, and Twyman, R, Wiley Blackwell, ISBN: 978-1405156660.
2. Gene Cloning and DNA Analysis: An Introduction (2019) 7th ed., Brown, TA, Wiley Blackwell, ISBN: 978-1119072560.
3. Genome 4 (2017) 4th ed., Brown, TA, Garland Science, ISBN: 978-0815345084.
4. Introduction to Genomics (2015) 2nd ed., Lesk, AM, Oxford University Press India, ISBN: 978-0198745891.
5. Genomics and Personalized Medicine: What Everyone Needs to Know (2016) 1st ed., Snyder, M, OUP-USA, ISBN: 978-0190234768.
6. Molecular Biology of the Gene (2014) 7th ed., Watson, JD, Baker, TA, Bell, SP, Gann, A, Levine, M, and Losick, R, Pearson, ISBN: 978-0321762436.
7. Principles of Gene Manipulation and Genomics (2019) 9th ed., Primrose, SB, and Twyman, R, Wiley Blackwell, ISBN: 978-1119163774.
8. Genomes (2018) 4th ed., Brown, TA, Garland Science, ISBN: 978-0815345084.
9. Introduction to Genomics and Proteomics (2015) 2nd ed., Burrell, MM, Wiley, ISBN: 978-0470850075.
10. Genomics: The Science and Technology Behind the Human Genome Project (2019) 2nd ed., Gibson, G, and Muse, SV, Oxford University Press, ISBN: 978-0198786207.
11. Genomics and Evolution of Microbial Eukaryotes (2019) 1st ed., Katz, LA, and Bhattacharya, D, Oxford University Press, ISBN: 978-0198830202.
12. Essentials of Genomic and Personalized Medicine (2016) 2nd ed., Ginsburg, GS, and Willard, HF, Academic Press, ISBN: 978-0124078652.
13. Genomic Medicine: Principles and Practice (2014) 2nd ed., Ginsburg, GS, and Willard, HF, Oxford University Press, ISBN: 978-0199334468.
14. Genomic Medicine in Resource-limited Countries: Genomics for Every Nation (2019) 1st ed., Wonkam, A, Puck, JM, and Marshall, CR, Academic Press, ISBN: 978-0128133003.
15. Molecular Genetics and Genomics (2020) 1st ed., Krebs, JE, and Goldstein, ES, Jones & Bartlett Learning, ISBN: 978-1284154544.
16. Bioinformatics and Functional Genomics (2015) 3rd ed., Pevsner, J, Wiley-Blackwell, ISBN: 978-1118581780.
17. Genomic Approaches for Cross-Species Extrapolation in Toxicology (2019) 1st ed., Wichard, J, and Maertens, A, CRC Press, ISBN: 978-0815348023.
18. Introduction to Genetic Analysis (2020) 12th ed., Griffiths, AJF, Wessler, SR, Carroll, SB, and Doebley, J, W.H. Freeman, ISBN: 978-1319149609.
19. Genetic Engineering: Principles and Methods (2019) 3rd ed., Fowler, MR, CABI, ISBN: 978-1789240605.

## B.Sc. Biotechnology 5<sup>th</sup> Semester

Program	B.Sc. Biotechnology		Semester	5 <sup>th</sup> Semester
Course Title	Plant and Animal Biotechnology (Theory + Practical)			
Course Code:	DSC-A11 (T)	No. of Theory Credits	04	
Contact hours	60 hrs	Duration of ESA/Exam	3 Hours	
Formative Assessment Marks	40	Summative Assessment Marks	60	

### Course Objectives

1. To understand the fundamental aspects of plant and animal biotechnology.
2. Learn about biotechnological tools and techniques used in plant and animal research.
3. Explore methods of introducing foreign genes into plants and animals through transformation techniques.
4. Gain practical skills in plant tissue culture and animal cell culture for improvement.
5. Design strategies for plant genetic manipulation against biotic and abiotic stressors.
6. Hypothesize strategies to increase plant yield and fruit/seed quality.
7. Apply knowledge to real-world challenges in agriculture, veterinary medicine, conservation, and biomedical research
8. Understand the need for animal biotechnology for human welfare.

### Course Outcomes:

**After completing this course, the student is expected to learn the following:**

1. Demonstrate a comprehensive understanding of plant biology, physiology, genetics, and molecular biology.
2. Apply biotechnological tools and techniques used in plant research and agriculture, such as plant tissue culture, genetic engineering and transgenics.
3. Execute plant tissue culture techniques for callus induction, somatic embryogenesis, and micropropagation, and apply them in plant breeding and propagation.
4. Perform plant transformation methods and demonstrate the ability to introduce foreign genes into plants using different techniques.
5. Apply knowledge about ethical considerations and regulatory frameworks associated with plant biotechnology and genetically modified crops.
6. Understand the biology and characterization of cultured cells, including their adhesion, proliferation, differentiation, morphology, and identification.
7. Gain practical skills in basic mammalian cell culture techniques, measuring growth parameters, assessing cell viability, and understanding cytotoxicity.

8. Learn about germplasm conservation techniques and the establishment of gene banks, along with large-scale culture methods for cell lines.
9. Explore organ and histotypic culture techniques, biotransformation, 3D cultures, whole embryo culture, somatic cell cloning, and the ethical considerations surrounding stem cells and their applications.

## **Plant and Animal Biotechnology - Content of Theory**

**60 hrs**

### **Unit-I – Plant Tissue culture methods**

**15**

Introduction, history, definition, hypothesis, and concept of totipotency. Principles of plant tissue culture, media and laboratory organization, types of culture, morphogenesis, differentiation, callus, direct, indirect organogenesis, and somatic embryogenesis, synthetic seeds. *In vitro* propagation and micropropagation, Seed culture, embryo culture, Meristem culture, bud culture, limitations and applications. Secondary metabolites, *In vitro* secondary metabolite production, Suspension cultures, cell cultures, growth vs secondary metabolite production, bioreactors and scaling up of secondary metabolite production, limitations, and applications.

### **Unit -II Transgenic Plants and biosafety**

**15**

Overview of transgenic plants and their significance in agriculture. - Techniques for introducing foreign genes into plants: Agrobacterium-mediated transformation, biolistics, and other methods. Selection and screening of transformed plants. Applications of Transgenic Plants - Improved crop traits through genetic engineering: pest resistance, herbicide tolerance, disease resistance, and abiotic stress tolerance. Biosafety assessment of transgenic plants: potential risks and benefits. International regulatory frameworks for releasing and commercializing genetically modified organisms (GMOs). Ethical and socio-economic impacts of transgenic crops. Intellectual property rights and access to transgenic technologies.

### **Unit-III Animal Cell culture methods**

**15**

History and laboratory organisation, Media. Cell types and culture characters. Pluripotency, Multipotency, Differentiation, Trans differentiation Reprogramming, Biology and characterization of cultured cells- cell adhesion, proliferation, differentiation, morphology of cells, and identification. The basic technique of mammalian cell culture *in vitro*, Measuring parameters of growth in cultured cells, cell viability, and cytotoxicity. Large-scale culture of cell lines- monolayer, suspension, and immobilized cultures. Organ and histotypic culture: Technique, advantages, limitations, applications. Stem cells: types (embryonic, adult, induced pluripotent), isolation, identification, expansion, differentiation and uses, stem cell engineering, ethical issues.

### **Unit -IV Gene transfer in animals and applications**

**15**

Gene constructs promoter/ enhancer sequences for transgene expression in animals. Selectable markers for animal cells- thymidine kinase. Transfection of animal cells- calcium phosphate coprecipitation, electroporation, lipofection, peptides, direct DNA transfer, viral vectors, Retrovirus, microinjection. Transgene identification methods. Transgenic and genome-edited animals. Ethical issues in transgenesis. Recent advances and applications in the field.

Manipulation of animal reproduction and characterization of animal genes, Embryo transfer in cattle and applications. Somatic cell cloning - cloning of Dolly. Ethical issues. Production of recombinant vaccines.

<b>Formative Assessment /type</b>	<b>Weightage in Marks</b>
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
<b>Total</b>	<b>60 marks + 40 marks = 100 marks</b>

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz, and Assignments. Case studies highlight successful applications and challenges in transgenic crop development.

Course Title	<b>Plant and Animal Biotechnology</b>	Practical Credits	<b>2</b>
Course Code	<b>DSC-A-12 (P)</b>	Contact hours	<b>60 hrs</b>

### **Content of Practical**

1. Laboratory organization of basic and commercial plant tissue culture
2. Media preparation (MS, B5), solid media preparation, and Liquid media preparation
3. Explant preparation – Leaf, bud, rhizome, and meristem
4. Synthetic seed production
5. Callus culture- Initiation and establishment of different types of callus cultures
6. Micropropagation with a suitable example – Stage 0, 1, 2, 3, and 4
7. Staining, cell viability, and cell count of cell cultures
8. Preparation of cell culture media: Preparation of basic cell culture media, such as Dulbecco's Modified Eagle Medium (DMEM), supplemented with fetal bovine serum (FBS), antibiotics, and other required additives.
9. Aseptic techniques and sterile handling: Practicing aseptic techniques, including properly handling tools and equipment, working in a laminar flow hood, and maintaining sterility throughout the cell culture process.
10. Filter sterilization: Practice filter sterilization for sensitive media ingredients.
11. Cell counting and viability assessment: Count cells using a hemocytometer or automated cell counter, and perform viability assays (e.g., trypan blue exclusion) to determine the percentage of viable cells.
12. Cell staining and microscopy: Staining the cultured cells using dyes such as hematoxylin and eosin (H&E), and observe them under a light microscope to study cell morphology and structure.
13. Contamination identification and troubleshooting: Learn to identify and troubleshoot common issues in cell culture, such as contamination by bacteria, fungi, or mycoplasma, and implement appropriate

corrective measures.

14. Experimental design and data analysis: Students can design and execute simple experiments, record and analyze data, and interpret the results based on their observations and measurements.

<b>Practical Assessment</b>			
<b>Formative Assessment</b>		<b>Summative Assessment</b>	<b>Total Marks</b>
<b>Assessment Occasion/ type</b>	<b>Weightage in Marks</b>	<b>Practical Exams</b>	
Record	05	25	<b>50</b>
Test	10		
Attendance	05		
Performance	05		
<b>Total</b>	<b>25</b>	<b>25</b>	

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Program Name	<b>B.Sc. Biotechnology</b>	Semester	<b>5<sup>th</sup> Semester</b>
Course Title	<b>Biotechnology Skills and Analytical Techniques</b>		

Course No.	<b>SEC- 4</b>	No. of Theory Credits	<b>2+1 (Theory+Practical)</b>
Contact hours	<b>45 hrs</b>	Duration of ESA/Exam	<b>2 hrs</b>
Formative Assessment Marks	<b>20</b>	Summative Assessment Marks	<b>30</b>

**Course Outcomes (COs):** At the end of the course the student should be able to:

1. Demonstrate skills as per National Occupational Standards (NOS) of the “Lab Technician/Assistant” Qualification Pack issued by the Life Sciences Sector Skill Development Council-LFS/Q0509.
2. Develop knowledge of laboratory safety procedures and protocols and acquire skills



- in handling and maintaining laboratory equipment and instruments.
- Operate analytical equipment and instruments as per standard operating procedures (SOP)
  - Knowledge about major activities of the biotech industry, regulations and compliance, environment, health and safety (EHS), good laboratory practices (GLP), and Good Manufacturing Practices (GMP) as per the industry standards.
  - Demonstrate soft skills, such as decision-making, planning, organizing, problem-solving, analytical thinking, critical thinking, and documentation.

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-13)**

Course Outcomes (COs)/Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	13
Develop knowledge of laboratory safety procedures and protocols and acquires skills in handling and maintaining laboratory equipment and instruments.	✓	✓											
Operate analytical equipment and instruments as per standard operating procedures (SOP)		✓	✓									✓	
Knowledge about major activities of the biotech industry, regulations and compliance, environment, health and safety (EHS), good laboratory practices (GLP), and Good Manufacturing Practices (GMP) as per the industry standards.		✓							✓		✓		
Demonstrate soft skills, such as decision making, planning, organizing, problem solving, analytical thinking, critical thinking and documentation.	✓	✓						✓	✓				

<b>Biotechnology Skills and Analytical Techniques Content</b>	<b>30 Hrs</b>

**Unit-I Insights into the biotechnology industry and basic professional skills**

**15**

Biotechnology Industry in Indian and Global Context- Organization in the context of large/medium/small enterprises, their structure, and benefits.

**Industry-oriented professional skills:** Planning and organizing skills, decision-making, problem-solving skills, analytical thinking, critical thinking, team management, and risk assessment. **Interpersonal skills:** Writing skills, reading skills, oral communication, conflict resolution techniques, interpretation of research

data, and troubleshooting in the workplace.

**Digital skills:** Basic computer skills (MS Office, excel, power point, internet) for the workplace.

Professional E-mail drafting skills and PowerPoint presentation skills. Overview of good manufacturing practices (GMP), Good Documentation practices (GDP), and good laboratory practices (GLP).

## Unit- II Basic laboratory skills and Analytical Techniques

15

**Analytical skills in the laboratory:** Preparations of solutions, molarity, molality, normality, mass percent % (w/w), percent by volume (%v/v), parts per million (ppm), parts per billion (ppb), dilution of concentrated solutions. Standard solutions, stock solution, and solution of acids. Reagent bottle label reading and precautions.

**Analytical techniques:** Basic principle, operation, application, maintenance, calibration, validation, and troubleshooting of instruments- Microscope-Simple, compound, TEM, SEM, fluorescence. Centrifuge and different types, Hot air oven, pH meter, different types of pH electrodes Autoclave, Incubator, BOD, COD, cell counter, Laminar airflow. Spectroscopy- Colorimeter, UV-Visible spectroscopy. Electrophoresis- Agarose Gel electrophoresis, SDS-PAGE, PCR, Conductivity meter, and Potentiometer. Biosafety cabinets.

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz, and Assignments

Course title	Quality control methods in biology (Practical)	Practical credits-1	5 <sup>th</sup> Semester
Course No.	SEC -4	Contact hours	4hrs/week
<b>Content</b>			

### Unit-1

**Methods and practices of cleaning and management of lab:** Learning and Practice of Integrated clean-in-place (CIP) and sterilize-in-place (SIP) as per industry standards, material requirements for cleaning specific areas, equipment, ventilation area, personal protective requirements Calibration of and use of micropipette.

### Unit-2

Preparation of Standard Operating Procedure (SOP) for various equipment in the QC Lab, Best practices of using and storing chemicals: Knowledge and practice in handling chemicals, labeling, and stock maintenance. SOP and material handling. Procedures to maintain chemicals, labeling, storage, and disposal.

**Handling and calibration of lab equipment-** weighing balance, Autoclave, Hot air Oven, Incubator, Centrifuge, Water bath, Colony Counter, and stability chamber, Preparation of Normality, Molarity, and buffer solutions

### Unit-3

**Preparation of media:** Maintenance and storage of purified water for media (plant tissue culture media, microbiological media, and animal cell culture media) preparation. Preparation and storage of

concentrated stock solutions. Documentation and disposal of expired stocks. Collection of findings of media requirement, preparation, and storage. Media coding, documentation, and purpose of usage. Demonstration, handling, and troubleshooting of High-Performance Liquid Chromatography and Gas chromatography. Demonstration of Polymerase Chain Reaction (PCR), Hands-on training on colorimeter and spectrophotometer, Industry visit, or analytical laboratory visit.

**Note:** Semester end examination is only in the theory component; questions from the practical part could be included, if any.

#### References:

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### B.Sc. Biotechnology 6<sup>th</sup> Semester

Program Name	<b>B.Sc. Biotechnology</b>		Semester	<b>6<sup>th</sup> Semester</b>
Course Title	<b>Immunology (Theory + Practical)</b>			
Course Code:	<b>DSC-A13(T)</b>	No. of Theory Credits	<b>04</b>	
Contact hours	<b>60 hrs</b>	Duration of ESA/Exam	<b>3 Hours</b>	
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>	

### Course Objectives:

- 1 To understand the various aspects of immunity, elicitation of immune responses, factors determining the outcome of immune responses and major players of immunity, relevance between nutritional support and immunity, and immunological techniques.
- 2 To provide knowledge on essential features of antigens and antibodies and their types and different theories of Antibody formation.
3. To acquire knowledge on types of immunity, phagocytosis, interferons, and the complement system.
- 4 To explain the concept of hypersensitivity, autoimmunity, and transplantation.
- 5 To provide knowledge on immune deficiencies and several immunological techniques

### Course Outcomes:

At the end of the course, the student should be able to:

- i. Demonstrate comprehension of the underlying structure and function of the immune system and related disorders.
- ii. Demonstrate an understanding of the role of cells and molecules in immune reactions and responses
- iii. Demonstrate technical skills in immunological tools and techniques
- iv. Apply the domain-specific knowledge and skills acquired in immunology for innovative therapies and Immunotechnologies
- v. Understand the fundamental concepts of immunity, and the contributions of the organs and cells in immune responses.
- vi. Realize how the MHC molecule's function and host encounters an immune insult.
- vii. Understand the antibodies and complement system
- viii. Understand the mechanisms involved in the initiation of specific immune responses
- ix. Differentiate the humoral and cell-mediated immune mechanisms
- x. Comprehend the overreaction by our immune system leading to hypersensitive conditions and its consequences
- xi. Understand unique properties of cancer cells, immune recognition of tumors, immune evasion of cancers

### Immunology - Content of Theory

60 Hrs

#### Unit-I Cells and Organs of the Immune System

15

Introduction to the Immune System: History of Immunology, Types of Immunity: first and second line of defense, innate and acquired/adaptive immunity, specificity, diversity.

Cells of the immune system: Antigen-presenting cells (APCs), Role of B and T-lymphocytes in Humoral immunity and cell-mediated immunity, primary and secondary immune response, Immunization, memory.

Organs of the Immune system: Thymus, bone marrow, spleen, Lymph Node, peripheral lymphoid organs

#### Unit -II Molecules of the Immune System

Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). Adjuvants. Antigenicity and Immunogenicity. Affinity and Avidity. B and T cell epitopes, superantigens Immunoglobulins:

Classification, structure, and function. Antibody diversity, Monoclonal and polyclonal antibodies.

Major histocompatibility complexes: Classification, structure, and function. Antigen processing pathways – Cytosolic and Endocytic, Complement Pathways, Cytokines: Classification and function, Hypersensitivity: Reactions – Types I, II, and III. Delayed Type Hypersensitive Response.

### Unit -III Immunotechniques and vaccines

Structure and properties of antigens- iso- and allo-antigens, antigen specificity, Cross-reactivity, Precipitation, Immunodiffusion reactions: Radial immunodiffusion, Ouchterlony double diffusion, Immunoelectrophoresis. Agglutination: Agglutination reactions. ELISA, RIA. Immunocytochemistry, Fluorescent Techniques.

Vaccines: Conventional, peptide vaccines, subunit, DNA vaccines. Toxoids, antisera, edible vaccines, plantibodies, and Cancer vaccines.

### Unit – IV

Transplantation immunology: Phases in graft rejection and immuno-suppressors. Autoimmune Disorders: Systemic and Organ-specific Autoimmune disorders with examples Immunodeficiencies: Primary and secondary immunodeficiencies; acquired immunodeficiency syndrome  
Cancer and the immune system – immune surveillance, immunological escape, cancer antigens, cancerimmunotherapy

Microbial diseases in humans: Mode of infection, symptoms, epidemiology and control measures of diseases caused by Viruses ( Hepatitis-B), Bacteria (Typhoid), Fungi (Aspergillosis), Protozoa (Malaria).

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

<b>Summative Assessment = 60 Marks</b>	
<b>Formative Assessment Occasion/ type</b>	<b>Weightage in Marks</b>
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
<b>Total</b>	<b>60 marks + 40 marks = 100 marks</b>

Course Title	<b>Immunology (Practical)</b>	Practical Credits	<b>02</b>
Course No.	<b>DSC-A14 (P)</b>	Contact hours	<b>60 hrs</b>
<b>Content of Practical</b>			

1. Hemagglutination of ABO Blood groups
2. Determination of Rh factor

3. Whole Count of WBC using Hemocytometer
4. Cells of the Immune System
5. Radial immunodiffusion
6. Ouchterlony double diffusion
7. ELISA – Demonstrate
8. Serum Immunoelectrophoresis
9. Western Blotting

<b>Practical Assessment</b>			
<b>Formative Assessment</b>		<b>Summative Assessment</b>	<b>Total Marks</b>
<b>Assessment Occasion/ type</b>	<b>Weightage in Marks</b>	<b>Practical Exams</b>	
Record	05	25	<b>50</b>
Test	10		
Attendance	05		
Performance	05		
<b>Total</b>	<b>25</b>		

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Program Name	<b>B.Sc. Biotechnology</b>	Semester	<b>6<sup>th</sup> Semester</b>
Course Title	<b>Bioprocess and Environmental Biotechnology (Theory)</b>		
Course Code:	<b>DSC-A15 (T)</b>	No. of Theory Credits	<b>04</b>
Contact hours	<b>60 hrs</b>	Duration of ESA/Exam	<b>03 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### **Course Objectives:**

1. Perform simulations of microbial growth and metabolism
2. Design bioreactors for the production of various products.
3. Present knowledge about major metabolic pathways and those related to biofuel production from microbes.
4. Understand the fundamental concepts and principles of environmental biotechnology and Explore the interrelationship between biotechnology and the environment.
5. Gain knowledge of the various applications of biotechnology in environmental conservation, pollution control, and sustainability.
6. Learn about microbial processes and their role in environmental biotechnology.
7. Understand the principles of bioremediation and its application in the clean-up of environmental pollutants.
8. Explore the potential of bioenergy production and waste management through biotechnological approaches.
9. Identify and characterize the most important contaminants in the Bioprocess and other industrial wastes.
10. Reuse/recycle the biological waste to clean technology such as energy, biofuel, bio fertilizer through bioremediation

### **Course out comes:**

1. Exploitation of microorganisms for industrial use and their improvement, and formulation of media for efficient growth and production of microbial or cell-based products.
2. The design, operation, and specific applications of various bioreactors.
3. Demonstrate a comprehensive understanding of the fundamental concepts and principles of environmental biotechnology.
4. Apply knowledge of biotechnological techniques to address environmental challenges, such as pollution control and waste management.
5. Analyze and evaluate environmental biotechnology case studies, research findings, and real-world applications.
6. Design and implement biotechnological approaches for environmental remediation, utilizing microbial processes and biodegradation principles.

7. Evaluate the ethical and sustainable aspects of environmental biotechnology practices and make informed decisions regarding their application in environmental conservation.
8. Communicate scientific concepts and research findings related to environmental biotechnology effectively, both in written and oral forms, to diverse audiences.

<b>Bioprocess and Environmental Biotechnology – Content of Theory</b>	<b>60 hrs.</b>
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### **UNIT- I – Introduction to bioprocess technology**

**15**

Basic principle components of fermentation technology. Strain improvement of industrially important microorganisms. Types of microbial culture and its growth kinetics– Batch, Fed-batch, and Continuous culture. Principles of upstream processing – Media preparation, Inocula development, and sterilization.

### **UNIT- II-Bioreactors and downstream processing**

Bioreactors- Significance of Impeller, Baffles, Sparger; Specialized bioreactors- design and their functions: airlift bioreactor, tubular bioreactors, membrane bioreactors, tower bioreactors, fluidized bed reactor, packed bed reactors

Downstream processing- cell disruption, precipitation methods, solid-liquid separation, liquid-liquid extraction, filtration, centrifugation, chromatography, drying devices (Lyophilization and spray dry technology), crystallization, biosensors-construction and applications, Microbial production of ethanol, amylase and Single Cell Proteins.

### **Unit III- Fundamentals of Environmental Biotechnology**

Introduction to Environmental Biotechnology- Principles of Environmental Science. Role of Biotechnology in Environmental Conservation. Microbial Processes in Environmental Biotechnology. Pollution and Biotechnology – Major issues in environmental pollution and the role of biotechnology in addressing them. Biotechnological Methods of Pollution Detection-General bioassay methods for pollution detection. Cell biological methods for assessing pollution levels. Use of biosensors in pollution monitoring. Biotechnological Methods in Pollution Abatement-Reduction of CO<sub>2</sub> emission using biotechnological approaches. Addressing eutrophication through biotechnological interventions. Application of cell immobilization techniques in pollution abatement.

### **Unit IV-Bioremediation and Waste Management**

Importance of bioremediation in environmental cleanup. Types of contaminants suitable for bioremediation. Microorganisms used in bioremediation. *In-situ* Bioremediation Methods. – Bioaugmentation. Biostimulation. Bioventing. Phytoremediation. *Ex-situ* Bioremediation Methods – Composting, Land farming, Biopile and bioslurry systems. Xenobiotics. Bio metallurgy and bio- mining. Waste water Management. Waste water Characterization and Composition. Biological Processes in Waste water Treatment. Activated Sludge Process and Biological Nutrient Removal, Anaerobic Digestion and Biogas Production. Solid Waste Management.



**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

<b>Summative Assessment = 60 Marks</b>	
<b>Formative Assessment Occasion/ type</b>	<b>Weightage in Marks</b>
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
<b>Total</b>	<b>60 marks + 40 marks = 100 marks</b>

Course Title	<b>Bioprocess and Environmental Biotechnology (Practical)</b>	Practical Credits	<b>02</b>
Course No.	<b>DSC-A16 (P)</b>	Contact hours	<b>60 hrs</b>

### Content of Practical

1. Bacterial growth curve.
2. Calculation of the thermal death point (TDP) of a microbial sample.
3. Study of fermentor- Demonstration.
4. Production of wine.
5. Estimation of the percentage of alcohol, total acidity & volatile acidity in wine.
6. Production and analysis of ethanol.
7. Production and analysis of amylase.
8. Production and analysis of lactic acid.
9. Isolation of industrially important microorganisms from natural resources.
10. Standard analysis of Water.

<b>Practical Assessment</b>			
<b>Formative Assessment</b>		<b>Summative Assessment</b>	<b>Total Marks</b>
<b>Assessment Occasion/ type</b>	<b>Weightage in Marks</b>	<b>Practical Exams</b>	
Record	05	25	<b>50</b>
Test	10		
Attendance	05		
Performance	05		
<b>Total</b>	<b>25</b>		

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## PATTERN OF THEORY EXAMINATION

**B.Sc – BIOTECHNOLOGY**

**Theory Question Paper Pattern for DSC, DSE, and OE Courses**

**Duration: 2 Hours**

**Maximum: 60 Marks**

**All questions are compulsory**

**Draw neat labeled diagrams wherever necessary**

I Answer any EIGHT of the following

2X8=16

- (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- (7)
- (8)
- (9)
- (10)

II Answer any SIX of the following

4X6=24

- (11)
- (12)
- (13)
- (14)
- (15)
- (16)
- (17)
- (18)

III Answer any TWO of the following

10X2=20

- (19)
- (20)
- (21)
- (22)

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**PATTERN OF PRACTICAL EXAMINATION**

**Practical examination – B. Sc BIOTECHNOLOGY**

**Duration: 3 hours**

**Max. Marks: 25**

Q. 1 Major question	08 Marks
Q. 2 Minor question	04 Marks
Q. 3 Identify and comment	2X4 = 08Marks
Q. 4 Viva-voce	05 Marks

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### **PATTERN OF FORMATIVE**

#### **ASSESMENT – PRACTICALS**

**Max. Marks: 25**

1 IA 1	10 Marks
2 IA 2	10 Marks
3 Record	05 Marks

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**JSS COLLEGE OF ARTS, COMMERCE AND  
SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSORE – 25.**



# **DEPARTMENT OF BIOTECHNOLOGY**

**SCHEMATIC SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM (CBCS)**

**For B.Sc., programmes**

**Chemistry, Zoology and Biotechnology**

**Biochemistry, Microbiology and Biotechnology**

**2020-21**

**B.Sc., UG SYLLABUS- PROGRAMME – CZBt**

Scheme of study for B.Sc. Biotechnology under CBCS scheme from 2019-20

YEAR	SEMESTER	CORE COURSE	COURSE CODE	TITLE OF THE PAPER	NO. OF CREDITS	LECTURE/ PRACTICAL/ HOUR/WEEK	TOTAL TEACHING HOURS
I BSc	I	DSC -I:Theory	DMA22005	Cell biology & genetics	4	4	60
		DSC -I:Pract	DMA22105	Cell biology & genetics	2	4	60
	II	DSC-II:Theory	DMB22005	Biomolecules and Bio-analytical techniques	2	4	60
		DSC-II: Pract	DMB22105	Biomolecules and Bio-analytical techniques	2	4	60
II BSc	III	DSC-III:Theory	DMC22005	Molecular biology and Genetic engineering	2	4	60
		DSC-III: Pract	DMC22105	Molecular biology and Genetic engineering	2	4	60
	IV	DSC-IV:Theory	DMD22005	Plant Tissue culture and Animal Cell culture	2	4	60
		DSC-IV: Pract	DMD22105	Plant Tissue culture and Animal Cell culture	2	4	60
III BSc	V	DSE Elective 1: Theory	DME22005	Elective 1: Immunology and Medical Biotechnology	2	4	60
		Elective 1: Pract	DME22105	Elective 1: Immunology and Medical Biotechnology	2	4	60
		Elective 2: Theory	DME22205	Elective 2: Microbial technology and Agricultural Biotechnology	2	4	60
		Elective 2: Pract	DME22305	Elective 2: Microbial technology and Agricultural Biotechnology	2	4	60
		SEC 1	DME22405	SEC 1:Microbial Techniques	2	2	30
		SEC 2	DME22505	SEC 2:Enzymology	2	2	30
	VI	DSE Elective 1: Theory	DMF22005	Elective 1: Environmental Biotechnology and Biostatistics	2	4	60
		Elective 1: Pract	DMF22105	Elective 1: Environmental Biotechnology and Biostatistics	2	4	60
		Elective 2: Theory	DMF22205	Elective 2: Bioinformatics and Bioprocess technology	2	4	60
		Elective 2: Pract	DMF22305	Elective 2: Bioinformatics and Bioprocess technology	2	4	60

**B.Sc., UG SYLLABUS- PROGRAMME – BMBt**

Scheme of study for B.Sc. Biotechnology under CBCS scheme from 2019-20

YEAR	SEMESTER	CORE COURSE	COURSE CODE	TITLE OF THE PAPER	NO. OF CREDITS	LECTURE/ PRACTICAL/ HOUR/WEEK	TOTAL TEACHING HOURS
I BSc	I	DSC -I:Theory	DMA22006	Cell biology & genetics	4	4	60
		DSC -I:Pract	DMA22106	Cell biology & genetics	2	4	60
	II	DSC-II:Theory	DMB22006	Biomolecules and Bio-analytical techniques	2	4	60
		DSC-II: Pract	DMB22106	Biomolecules and Bio-analytical techniques	2	4	60
II BSc	III	DSC-III:Theory	DMC22006	Molecular biology and Genetic engineering	2	4	60
		DSC-III: Pract	DMC22106	Molecular biology and Genetic engineering	2	4	60
	IV	DSC-IV:Theory	DMD22006	Plant Tissue culture and Animal Cell culture	2	4	60
		DSC-IV: Pract	DMD22106	Plant Tissue culture and Animal Cell culture	2	4	60
III BSc	V	DSE Elective 1: Theory	DME22006	Elective 1: Immunology and Medical Biotechnology	2	4	60
		Elective 1: Pract	DME22106	Elective 1: Immunology and Medical Biotechnology	2	4	60
		Elective 2: Theory	DME22206	Elective 2: Microbial technology and Agricultural Biotechnology	2	4	60
		Elective 2: Pract	DME22306	Elective 2: Microbial technology and Agricultural Biotechnology	2	4	60
		SEC 1: Theory	DME22406	SEC 1:Microbial Techniques	2	2	30
		SEC 2: Theory	DME22506	SEC 2:Enzymology	2	2	30
	VI	DSE Elective 1: Theory	DMF22006	Elective 1: Environmental Biotechnology and Biostatistics	2	4	60
		Elective 1: Pract	DMF22106	Elective 1: Environmental Biotechnology and Biostatistics	2	4	60
		Elective 2: Theory	DMF22206	Elective 2: Bioinformatics and Bioprocess technology	2	4	60
		Elective 2: Pract	DMF22306	Elective 2: Bioinformatics and Bioprocess technology	2	4	60

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE**  
**Scheme of Examination Programme – B.Sc., CZBt ; Programme code –BSC05**

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration			
						L:T:P	IA(Theory)			Total	Th	Pr	
							C-1	C-2	C-3				
I B.Sc	I	DSC-I :Theory	DMA22005	Cell Biology and Genetics	4: 0: 0	15	15	70	100	3h	3h		
		DSC-I: Pract	DMA22105	Cell Biology and Genetics	0: 0: 2	7.5	7.5	35	50				
	II	DSC-II:Theory	DMB22005	Biomolecules and Bio-analytical techniques	4:0:0	15	15	70	100	3h	3h		
		DSC-II: Pract	DMB22105	Biomolecules and Bio-analytical techniques	0:0:2	7.5	7.5	35	50				
II B.Sc	III	DSC-III:Theory	DMC22005	Molecular biology and Genetic engineering	4:0:0	15	15	70	100	3h	3h		
		DSC-III: Pract	DMC22105	Molecular biology and Genetic engineering	0:0:2	7.5	7.5	35	50				
	IV	DSC-IV: Theory	DMD22005	Plant Tissue culture and Animal Cell culture	4:0:0	15	15	70	100	3h	3h		
		DSC-IV: Pract	DMD22105	Plant Tissue culture and Animal Cell culture	0:0:2	7.5	7.5	35	50				
III B.Sc.	V	DSE: Elective 1:Theory	DME22005	Elective 1: Immunology and Medical Biotechnology	4:0:0	15	15	70	100	3h	3h		
		Elective 1: Pract	DME22105	Elective 1: Immunology and Medical Biotechnology	0:0:2	7.5	7.5	35	50				
		Elective 2: Theory	DME22205	Elective 2: Microbial technology and Agricultural Biotechnology	4:0:0	15	15	70	100				
		Elective 2: Pract	DME22305	Elective 2: Microbial technology and Agricultural Biotechnology	0:0:2	7.5	7.5	35	50				
		SEC 1: Theory	DME22405	SEC 1:Microbial Techniques	2:0:0	7.5	7.5	35	50			2h	-
		SEC 2: Theory	DME22505	SEC 2:Enzymology	2:0:0	7.5	7.5	35	50			2h	-
	VI	DSE: Elective 1:Theory	DMF22005	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100	3h	3h		
		Elective 1: Pract	DMF22105	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100				
		Elective 2: Theory	DMF22205	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100				
		Elective 2: Pract	DMF22305	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100				



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE**  
**Scheme of Examination Programme – B.Sc., BMBt ; Programme code –BSC06**

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration			
						L:T:P	IA(Theory)			Total	Th	Pr	
							C-1	C-2	C-3				
I B.Sc	I	DSC-I :Theory	DMA22006	Cell Biology and Genetics	4: 0: 0	15	15	70	100	3h	3h		
		DSC-I: Pract	DMA22106	Cell Biology and Genetics	0: 0: 2	7.5	7.5	35	50				
	II	DSC-II:Theory	DMB22006	Biomolecules and Bio-analytical techniques	4:0:0	15	15	70	100	3h	3h		
		DSC-II: Pract	DMB22106	Biomolecules and Bio-analytical techniques	0:0:2	7.5	7.5	35	50				
II B.Sc	III	DSC-III:Theory	DMC22006	Molecular biology and Genetic engineering	4:0:0	15	15	70	100	3h	3h		
		DSC-III: Pract	DMC22106	Molecular biology and Genetic engineering	0:0:2	7.5	7.5	35	50				
	IV	DSC-IV: Theory	DMD22006	Plant Tissue culture and Animal Cell culture	4:0:0	15	15	70	100	3h	3h		
		DSC-IV: Pract	DMD22106	Plant Tissue culture and Animal Cell culture	0:0:2	7.5	7.5	35	50				
III B.Sc.	V	DSE: Elective 1:Theory	DME22006	Elective 1: Immunology and Medical Biotechnology	4:0:0	15	15	70	100	3h	3h		
		Elective 1: Pract	DME22106	Elective 1: Immunology and Medical Biotechnology	0:0:2	7.5	7.5	35	50				
		Elective 2: Theory	DME22206	Elective 2: Microbial technology and Agricultural Biotechnology	4:0:0	15	15	70	100				
		Elective 2: Pract	DME22306	Elective 2: Microbial technology and Agricultural Biotechnology	0:0:2	7.5	7.5	35	50				
		SEC 1: Theory	DME22406	SEC 1:Microbial Techniques	2:0:0	7.5	7.5	35	50			2h	-
		SEC 2: Theory	DME22506	SEC 2:Enzymology	2:0:0	7.5	7.5	35	50			2h	-
	VI	DSE: Elective 1:Theory	DMF22006	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100	3h	3h		
		Elective 1: Pract	DMF22106	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100				
		Elective 2: Theory	DMF22206	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100				
		Elective 2: Pract	DMF22306	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100				

## **Programme Outcomes for Bachelor of Science in Chemistry, Zoology and Biotechnology:**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1. Demonstrate the ability to justify, explain, and/or approach the concept both in written and oral forms
- PO2. Demonstrate the ability to present clear, logical and succinct arguments
- PO3. Develop state-of-the-art laboratory skills and professional communication skills.
- PO4. Apply the scientific method to design, execute, and analyze an experiment.
- PO5. Appreciate the central role of chemistry in the society and use this as a basis for ethical behaviour in issues facing chemists/drugs.
- PO6. Understand Chemistry as an integral part for addressing social, economic, and environmental problems.
- PO7. Identify the major groups of organisms with an emphasis on animals and plants.
- PO8. Compare and contrast the characteristics of animals that differentiate themselves from other living and non-living creatures.
- PO9. Give specific examples of physiological adaptations.
- PO10. Design and develop solution to Biotechnology problems keeping in mind the safety measures for environment and society.
- PO11. Support Biotechnology research activity with strong technical background knowledge.

## **Programme Outcomes for Bachelor of Science in Biochemistry, Microbiology and Biotechnology:**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1. Demonstrate the ability to justify and explain their thinking approach, both written and oral.
- PO2. Develop state-of-the-art laboratory skills and professional communication skills.
- PO3. Apply the scientific method to design, execute, and analyze an experiment, to explain their scientific procedures and experimental observations.
- PO4. Demonstrate an understanding of fundamental biochemical principles, structure and biological function and metabolic pathways.
- PO5. Work as a laboratory technician, biochemists or medical scientist.
- PO6. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment and host populations.
- PO7. Explain the theoretical basis of the tools, technologies and methods common to microbiology.
- PO8. Design and develop solution to Biotechnology problems by applying appropriate tools while keeping in mind safety factor for environment & society.
- PO9. Create, select, and apply appropriate techniques, resources, and modern tools with an understanding of the limitations.
- PO10. Support biotechnology research activity with strong technical background knowledge.

## **Programme Specific Outcomes**

### **Bachelor of Science in Chemistry, Zoology and Biotechnology:**

After completing the graduation in the Bachelor of Science the students are able to:

PSO1. Find jobs at all level of chemical, pharmaceutical, food products and life oriented material Industries

PSO2. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO3. Recognize the relationship between different structures and functions at different levels.

PSO4. Characterize the biological, chemical and physical features of environments that Animals inhabit.

PSO5. Demonstrate effectively the applications of biochemical and biological sciences.

PSO6. Know and apply appropriate tools and techniques in biotechnological manipulation

PSO7. Understand his or her responsibilities in biotechnological practices.

## **Programme Specific Outcomes**

### **Bachelor of Science in Biochemistry, Microbiology and Biotechnology:**

After completing the graduation in the Bachelor of Science the students are able to;

**PSO 1:** Gain and understand biochemical and molecular processes that occur in and between cells to expand understanding of biology

**PSO2:** Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals.

**PSO3:** Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues.

**PSO4:** Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods.

**PSO5:** Demonstrate effectively the applications of biochemical and biological sciences

**PSO6:** Decide and apply appropriate tools and techniques in biotechnological manipulation.

**POS7:**Justify societal, health, safety and legal issues and understand his or her responsibilities in biotechnological practices.

**SEMESTER I  
CELL BIOLOGY AND GENETICS (4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.** Develop an understanding of the structure and functions of organelles.

**CO2.** Understand the structure of chromosomes, types, cell differentiation and features of cancer cells.

**CO3.** Gain comprehensive understanding of the chemical basis of heredity and methods.

**CO4.** Understand effect of mutation, mechanism and Chromosomal Aberrations.

**CELL BIOLOGY**

**NO. HOURS**

**UNIT I**

**15**

Cell: Introduction and Historical perspective, the cell theory, ultra structure of plant and animal cell.

Cell organelles: Structure and functions of – cell wall, plasma membrane, membrane protein, cytoplasm, mitochondria, chloroplast, Golgi complex, endoplasmic reticulum, ribosome, lysosomes, peroxisomes, nucleus.

Cell division: Cell cycle and phases, regulation of cell cycle and significances of cell cycle. Mitosis and meiosis, interphase nucleus, achromatic apparatus, synaptosomal complex and significances of mitosis and meiosis.

**UNIT II**

**15**

Eukaryotic chromosomes: Types, chromatin structure, nucleosomes, and higher order chromatin organization.

Special chromosomes – Polytene and B chromosome, lamp brush chromosome.

Cell interaction and motility: Cell motility flagellar and ciliary motion. Structure and function of muscle cells, muscle contraction, nerve cell structure and function.

Stem cells, differentiation of stem cells (eg: Haematopoietic stem cells) and their application. Special cells: Blood cells, identification, structure and different types of blood cells and cancer cells.

**GENETICS**

**UNIT III**

**15**

Introduction: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance. Mendelian Theory: Law of dominance, Mendel's experimental on monohybrid and di-hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses. Deviation to Mendelian inheritance of genes (13:3 ratio), incomplete dominance (Flower colour in sweet peas), co dominance (Blood groups in human beings), epistasis (Dominant & recessive epistasis). Sex-linked inheritance (colour blindness), linkage, crossing over and cytoplasmic inheritance (Plastid inheritance in *Mirabilis*).

**UNIT IV**

**15**

Mutation: Natural and induced mutations, chemical, physical and biological mutagens with an example each.

Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin.

Chromosomal aberrations: Deletion, duplication, inversion and translocation. Chromosomal disorders in human beings, abnormalities – Aneuploidy and Euploidy.

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

1. Cell counting methods: using Haemocytometer.
2. Measurements with the help of light microscope.
  - a. Calibration of ocular micrometer
  - b. Measurement of biological materials (cells/spores etc.).
  - c. Demonstration-Separation of cell organelles by differential centrifugation
3. Study of Mitosis -onion root tips.
4. Study of Meiosis –onion flowers buds/rheo flowers
5. Demonstration of plasmolysis and deplasmolysis
6. Isolation of chloroplast from leaves
7. Study of at least five simple mutants of Drosophila-Photographic demonstration
8. Preparation of polytene chromosome from salivary glands of Drosophila
9. Genetic Problems; Monohybrid, Di hybrid and interactions of Genes
10. Special Chromosomes; Lampbrush and Polytene chromosomes
11. Comment (Types of chromosome (slide/picture), chromosomal disorders in humans- Humans -Down's Turner's and Klinefelter's Syndrome

## **REFERENCES**

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
5. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
6. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.

**SEMESTER II**  
**BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES** **(4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

- CO1.** Understand the properties, mechanisms and biological importance of Bio-molecules .
- CO2.** Comprehend the mechanism of enzyme action, factors affecting it and its applications.
- CO3.** Understand and able to relate the principles underlying various instruments in the field of Biology.
- CO4.** Compare and contrast the role of bio -molecules and enzymes.

**BIOMOLECULES** **NO. HOURS**

**UNIT I:** **15**  
Carbohydrates: Structure (Fischer and Haworth structure), function and properties of Monosaccharide's (Glucose, Fructose), disaccharides (Sucrose, Maltose and Lactose) and Heteropolysaccharide's- hyaluronic acid and heparin. Reducing and Non reducing Sugars, Stereochemistry- Epimers, Enantiomers, Anomers and Isomers.  
Proteins: Amino acids- General structure , essential and non essential amino acids , classification based on polarity , zwitter ionic structure, pka value. D and L amino acids, optical activity. Peptide bond, primary, secondary, tertiary and quaternary structural organization of proteins. Globular and fibrous proteins with special reference to structure of haemoglobin and collagen.

**UNIT II:** **15**  
Lipids: Classification of lipids with examples. Simple and compound lipids, unsaturated and saturated fatty acids, physical and chemical properties of fats and oils. Structure and biological importance of phospholipids and cholesterol.  
Nucleic acids: Structure of bases, nucleosides, nucleotides and secondary structure of DNA and different forms of DNA. Types and functions of RNA, cloverleaf structure of tRNA.

**UNIT III:** **15**  
General characteristics of enzymes, nomenclature and classification of enzymes. Mechanism of enzyme action: active site, enzyme substrate complex formation-lock and key and induced fit theory. Concept of co-enzymes and cofactors with an example. Factors influencing enzyme activity: pH, temperature, substrate concentration, metal ion, inhibitors (allosteric) and activators, energy of activation. Isozymes, multienzyme complex and multifunctional enzymes with an example to each

**BIO-ANALYTICAL TECHNIQUES**

**UNIT IV:** **15**  
Bio-analytical Techniques: Lambert-Beer Law, working principles of UV-Visible spectrophotometry and colorimetry.  
Centrifugation: Basic principle of centrifugation, ultracentrifuge and its application.  
Chromatography: Principles of chromatography, Types- Partition chromatography- paper and thin layer chromatography & Adsorption chromatography - column chromatography, ion exchange & molecular sieve (principle & application).  
Isotopes: Their importance in biological studies, measure of radioactivity, GM counters

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

1. Qualitative analysis of Carbohydrates.
2. Qualitative analysis of Lipids.
3. Estimation of reducing sugar by DNS method.
4. Estimation of Protein by Biuret method.
5. Estimation of amino acid by ninhydrin method /formal titration
6. Determination of activity and specific activity of enzyme-Salivary amylase.
7. Effect of pH on enzyme activity
- 8.. Effect of temperature on enzyme activity.
9. Effect of metal ions on enzyme activity.
10. Preparation of buffer solution.
11. Identification of amino acids by circular paper chromatography.

## **REFERENCES**

1. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.
2. Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.
3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.
4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley and Sons, 1995.
5. Biochemistry by Mary K. Campbell & Shawn O. Farrell, 5th Edition, Cengage Learning, 2005.
6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999
7. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004
8. Practical Enzymology Hans Bisswanger Wiley-VCH 2004



**SEMESTER III**  
**MOLECULAR BIOLOGY & GENETIC ENGINEERING** **(4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.** Display a broad understanding of core molecular Biology.

**CO2.** Discuss and differentiate the process of Transcription and Translation

**CO3** Explain key concepts of genome organization and manipulation.

**CO4.** Demonstrate working knowledge in a defined skill set of molecular biology and biotechnology protocols.

**MOLECULAR BIOLOGY** **NO. HOURS**

**UNIT I** **15**

DNA as genetic material: Experiments of Griffith and Hershey & Chase. Central Dogma of Molecular biology.

Concept of gene: Definition, generalized structure of Prokaryotes and Eukaryotes.

DNA Replication: Modes of DNA replication- Semiconservative, conservative and dispersive method.

Replication of DNA in prokaryotes and eukaryotes. Components of replication –lagging strand leading strand Okazaki fragment, role of SSBP, gyrase, helicase, RNA polymerase, DNA polymerase. Inhibitors of replication- role of actinomycin, acriden, novobiocin, novobiocin, amphidicolin and N-ethyl maleimide.

Genetic code: Major features of genetic code, outline of Deciphering of genetic code and Wobble hypothesis.

**UNIT II** **15**

Transcription and RNA processing : RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains. Inhibitors of Transcription- rifampicin, actinomycin, alpha amanitin and platinum antitumor drugs. Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.

Translation: Activation of amino acids, ribosome (composition & components), formation of initiation complex. Initiation, elongation and termination, inhibitors of protein synthesis.

**GENETIC ENGINEERING**

**UNIT III** **15**

Enzymes in Genetic engineering and its importance-Restriction endonucleases-types of restriction enzymes, ligases, alkaline phosphatases, polynucleotide kinase, terminal deoxynucleotidyltransferase, S1 nuclease, Klenow fragment, taq DNA polymerases, ribonuclease, reverse transcriptase

Gene cloning vectors: Types of vectors –Cloning vector and expression vector . Plasmids (pBR322, pUC 19) and cosmids (pLFR5, pJB8). Importance of plasmids as cloning vectors, stability of plasmids, different forms of plasmid, concepts of YAC and BAC.

**UNIT IV** **15**

Recombinant DNA technology: Isolation of gene, construction and preparation of complementary DNA. Probes- types, preparation and hybridization, genomic library.

Genetic engineering techniques: Gel electrophoresis, southern and northern blotting techniques, PCR and

its types, Sanger's, Maxam & Gilbert method of DNA sequencing.

Applications of Genetic Engineering: Therapeutic products produced by genetic engineering-blood proteins, human hormones. Genetic engineering in plants: Use of *Agrobacterium tumefaciens* and *A. rhizogenes*, Ti plasmids, Direct DNA transfer to plants.

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

1. Preparation of stock solution for molecular biology experiments.
2. Colorimetric estimation of DNA.
3. Colorimetric estimation of RNA.
4. Demonstration of  $T_m$  value of DNA.
5. Extraction of DNA from plant and microbial source.
6. Quantification of DNA by spectrophotometry.
7. Determination of purity of DNA.
8. Agarose gel electrophoresis of DNA.
9. Southern blotting (demonstration).
10. Isolation of plasmid DNA.

## **REFERENCES**

1. Russell, P.J. 2009 Genetics – A Molecular Approach. 3rd edition. Benjamin Co. 7. Sambrook & Russell. Molecular Cloning: A laboratory manual. (3rd edition) 8. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
2. Brown, T.A. (1998). Molecular biology Labfax II: Gene analysis. II Edition. Academic Press, California, USA.
3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.
4. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA genes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.
5. Brown, T. A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication.

**DMD22005/ DMD22006**

**SEMESTER IV**

**PLANT TISSUE & ANIMAL CELL CULTURE**

**(4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.**Develop concept of plant tissue and animal cell culture techniques and their application in biotechnology.

**CO2.** Comprehend the knowledge of transgenic plants in industrial and agricultural applications.

**CO3.**Establish and maintain various cell lines used in tissue culture.

**PLANT CELL CULTURE**

**NO. HOURS**

**UNIT I**

**15**

Plant tissue culture introduction: History and development, Importance of plant tissue culture.

Laboratory organization and culture techniques: general requirements and aseptic conditions. Media preparation, culture media, sterilization, and pre-treatment to explants.

Principles of tissue culture: Callus culture- Definition of callus, initiation, maintenance, sub culture and organogenesis .Factors affecting organogenesis .

organ culture- culture protocols and importance of root and meristem culture.

Micropropagation in plants: stages of micropropagation, methods, advantages, applications.

**UNIT- II**

**15**

Somaclonal variation for disease resistance and agronomic traits.

Somatic embryogenesis: Embryoid and embryogenesis. Protocol and importance of somatic embryogenesis, Synthetic seeds and its applications, germplasm conservation and preservation.

Suspension culture: Batch and continuous cell suspension culture. Importance of suspension culture in production of secondary metabolites. Protoplast culture and fusion: Definition of protoplast, isolation principle, culture protocol, action of enzymes, regeneration of plants, protoplast fusion, somatic cell hybridization and its application.

**ANIMAL TISSUE CULTURE**

**UNIT - III**

**15**

Introduction: History, developments and importance of animal cell culture. Characteristics of animal cell growth, Advantages and disadvantages of tissue culture methods and laboratory facilities.

Culture procedure and culture media: Preparation and sterilization of glasswares and media. Culture media containing naturally occurring ingredients, blood plasma, blood serum, serum-free media, tissue extracts, complex natural media, chemically defined media, and basal salt solution –HBSS.

**UNIT – IV**

**15**

Primary culture, cell lines and cloning: Preparation of primary culture –mechanical and enzymatic method. Primary and established cell lines, somatic cell fusion.

Tissue cultures- cover slip method, watch glass method and use of agar.

Whole embryo culture. (e.g. Chick embryo).

Hybridoma technology: Production of monoclonal antibodies.

Animal propagation –Artificial insemination, superovulation, embryo transfer, in-vitro fertilization, embryo splitting.

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

1. Media preparation and sterilization techniques.
2. Callus cultures: choice of explants, preparation of explants, callus induction, subculture and maintenance.
3. Regeneration of plants from growth hormones.
4. Meristem culture for pathogen free plants.
5. Preparation synthetic seed
6. Suspension culture – initiation of suspension culture from callus.
7. Plant protoplast Isolation.
- 8 . Cell viability test by tryphan blue method.
9. Preparation of HSS and glasswares of cell culture experiments
- 10.Isolation of PMN leucocytes from human peripheral blood sample and staining and identification.(lishman stain).
11. Demonstration of dissegration of cells by mechanical and enzymatic methods.
12. Photographic Demonstration of Animal Cell culture Lab equipments

## **REFERENCES**

1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.
2. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.
3. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
4. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.

**SEMESTER V**  
**DSE: IMMUNOLOGY AND MEDICAL BIOTECHNOLOGY (4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.** Understand the role of different types of Cells in immune system .

**CO2.** Discuss the principles and applications of immunological techniques.

**CO3.** Understand to diagnose diseases.

**CO4.** Comprehend the knowledge of therapeutic applications of enzyme and hormone.

**IMMUNOLOGY**

**NO. HOURS**

**UNIT I**

**15**

Historical account and chronological events of Edward Jenner and Louis Pasteur.

Antigens: Definition, chemical nature, haptens, epitopes, antigenicity, blood group antigens.

Antibodies: Definition, types, structure of IgG.

Types of immunity – Innate- mechanism of innate immunity. Adaptive immunity – active and passive and adoptive immunity.

Cells and organs involved in immune system – T- cells, B-cells, antigen presentation and macrophages, their role in antigen recognition, clonal selection, and immunological memory. Immunological aspects of viral (HIV), bacterial and parasitic infection ( one example each)

**UNIT II**

**15**

Immune disorders: Hypersensitivity, auto immune disorders- organ specific and systemic specific Grave's diseases, Hashimoto's disease , systemic lupus erythematosus.

Immuno techniques: Precipitation reaction, immuno diffusion-ODD and RID, RIA, Hemagglutination, ELISA, immunofluorescent, Western blotting. Major Histocompatibility complexes – class I & class II MHC antigens, antigen processing. Vaccines & Vaccination – adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization.

**MEDICAL BIOTECHNOLOGY**

**UNIT III**

**15**

Vaccine production: Introduction, new developments, types of vaccines – Inactivate, Attenuated and Recombinant Vaccines-Peptide and DNA, production of vaccines using genetically engineered microorganisms (Ex:HBV).

Enzymes in diagnosis: Enzymes used to detect and quantify blood glucose, cholesterol, triglycerides, urea and uric acid. Immobilized enzymes as diagnostic tools.

Nucleic acid analysis: Features of DNA probes and its applications in diagnosis, identification of *Mycobacterium tuberculosis* in clinical samples using PCR.

Enzymes in therapy: List of enzymes and their therapeutic applications.(Ex: DNase, debriding enzymes, asparaginase, superoxide dismutase, rennin, streptokinase, urokinase ,lipase and adenosine deaminase)

**UNIT IV**

**15**

Hormone therapy: List of hormones and their therapeutic applications (Ex: Insulin, human growth hormone, erythropoietin, calcitonin, lipocortin, somatotropin and alpha melanocyte stimulating hormone), production of humulin by recombinant DNA technology.

Therapeutic proteins: Cytokines as therapeutic proteins, production of interferon by recombinant DNA technology.

Human gene therapy: Definition, differences between somatic and germ line gene therapy, embryo, ex vivo, in vivo and antisense gene therapy -one example each, principle and applications.

Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

1 Determination of blood group

a) ABO blood grouping

b) Rh blood grouping.

2 Immuno diffusion :

a) ODD

b) RID.

3 Separation of serum from blood

4 Demonstration of ELISA

5 Demonstration of Western blotting

6 MIC assay

7 Isolation of antibiotic resistant strains using gradient plate method

8 Estimation of urea by BAMO method

9 Qualitative analysis of normal and abnormal constituents of urine

10 Photographic demonstration of transgenic animals and plants for production of biopharmaceutical

## **REFERENCES**

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.

2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh.

6. Richard C and Geoffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

**DME22205/DME22206**

**SEMESTER V**

**DSE: MICROBIALTECHNOLOGY & AGRICULTURAL BIOTECHNOLOGY (4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.**Develop skills associated with screening of Industrially Important Strains.

**CO2.**Understand principles underlying design of Fermentor, Fermentation Process and downstream processing

**CO3.**Discuss the various aspects for the improvement of crop plants.

**CO4.** Understand the application of r-DNA technology to enhance the production of crop plant .

**MICROBIALTECHNOLOGY**

**NO. HOURS**

**UNIT I**

**15**

Introduction to biotechnological importance of microorganisms.

Metabolic pathway involved in microbial products (EMP,PPP and ED), primary and secondary metabolites, enzymes and microbial biomass.

Microbial production: Use of microbes in production of vitamins (vit-C), enzymes (Amylase), organic acids (citricacid),amino acids (glutamicacid),polysaccharides (xanthan),growth regulators (auxins), colorants (phycocyanin) ,flavors (diactyl), antibiotics (penicillin).

**UNIT II**

**15**

Kinetics of microbial growth and product formation: Phase of cell growth in batch cultures and continuous culture. Growth associated and non-growth associated product formation kinetics, substrate and product inhibition on cell growth and product formation.

Bioreactors- Types and functions. Purification & characterization of proteins, Upstream and downstream processing, solids and liquid handling. Disruption of microbial cells- centrifugation, filtration of fermentation broth, ultra centrifugation, liquid extraction, ion-exchange recovery of biological products.

Immobilization of cell- Introduction and methods of microbial cell immobilization.

**AGRICULTURAL BIOTECHNOLOGY**

**UNIT III**

**15**

Introduction: Biotechnology for crop improvement, future prospects of biotechnology for agriculture.

Biological nitrogen fixation: Nitrogen fixing microorganisms, role of nitrogenase, genetics of nitrogen fixing microorganisms, regulation of nif gene expression and mechanism of nitrogen fixation.

Bio fertilizers and phyto-stimulations: Mechanism of growth promotion by microbial inoculants- microbial production and application methods of microbial inoculants- *Rhizobium*, *azospirillum*, *azotobacter*, *mycorhizae*.

**UNIT IV**

**15**

Genetic engineering of crop plant: Gene transfer technique for desirable traits in crop plants. Agro bacterium mediated gene transfer, Direct gene transfer methods to protoplast. Few examples of transgenic plants, plants obtained through gene transfer techniques –BT cotton, herbicide tolerant soybean, virus resistance (papaya ring spot).

Microbial pesticides: Fungicides and herbicides. Bacterial, fungal and viral bio agents- *Bacillus*

*Thurengensis* (BT) and *BeaveriaBassiana*. Mechanism of control of plant disease-hypo virulence, competition antibiotics, induced resistance, mycoparasitism.

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

- 1 .Identification of important microorganisms relevant to biotechnology: E.coli, sacchromycescervisiae, spirulina.
- 2 .Demonstration of commercial products-single cell proteins microbial flavours.
- 3 .Entrapment of yeast for enzyme action & estimation of invertase activity
4. Preparation of wine.
5. Estimation of percentage of alcohol by Specific gravity method .6 .Seed inoculation with rhizobium culture and observation for root nodulation.
7. Preparation of bio control formulations.
8. Biofertilizers formulation.
9. Isolation and identification of *Rhizobium*.
10. Isolation and identification of *azospirillum*. Isoalation and Identification of *azotobacter*. Study of morphology of *mycorhizae*.
11. Photographic demonstration of BT cotton, herbicide tolerant soybean, virus resistance (papaya ring spot).
12. Demonstration of steps involved in large scale production of biofertilizers.

## **REFERENCES**

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.
4. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
5. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
6. Agricultural Biotechnology, S.S. Purohit



**DMF22005/ DMF22006**

**SEMESTER VI**

**DSE: ENVIRONMENTAL BIOTECHNOLOGY AND BIOSTATISTICS**

**(4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.** Gain an understanding of the causes, types and control methods for Environmental Pollution.

**CO2.** Differentiate the application of different life forms in Environmental Remediation.

**CO3.** Apply Statistical Tools for Analysis of Biological Data.

**ENVIRONMENTAL BIOTECHNOLOGY**

**NO. HOURS**

**UNIT I**

**15**

Introduction: Major issues in environment pollution. Role of Biotechnology to solve the problems.

Biotechnological methods of pollution detection: General bioassay, cell biological methods, immunoassay, DNA based methods, use of biosensor.

Biotechnological methods in pollution abatement: reduction of CO<sub>2</sub> emission, Waste water treatment – conventional waste treatment, Use of Algae, Eutrophication, Use of Cell Immobilization.

**UNIT II**

**15**

Biotechnology and biodegradation: Degradation of Xenobiotic compounds-organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides and surfactants.

Biohydrometallurgy and Biomining: Bioleaching, biosorption, oil degradation and creation of super bugs. Treatment of Industrial wastes: Pulp, Dye, leather and solid waste management. Genetically engineered microbes for waste treatment.

Ecofriendlybioproducts: Biomass resources, biogas, and alcohol as a fuel, biological hydrogen generation and biodegradable plastics.

**BIOSTATISTICS**

**UNIT III**

**15**

Introduction, Basic concepts- population, data, sample and variable. Types of data-primary and secondary, methods of data collection- direct personal interview, indirect oral interview, through correspondence, questionnaire and census. Classification of data- qualitative, quantitative and simple classification. Sampling methods- random and non-random. Tabulation of data- structure of a table, simple and complex table.

**UNIT IV**

**15**

Graphical and diagrammatic representation of data- histogram, bar graph and pie diagram. Frequency of distribution- without class intervals, with class intervals and cumulative frequency distribution. Measures of central tendency- mean, median and mode. Measure of dispersion- range, mean deviation, co-efficient of deviation and standard deviation.

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

- 1 & 2. Analysis of sewage water for BOD & COD.
- 3 Estimation of Hydrogen sulphides in the sewage water.
  - b. Estimation of chloride in sewage water sample.
  - c. Estimation of residual chloride in sewage water sample.
  - d. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
- 5 . Estimation of percentage of alcohol by specific gravity bottle method
- 6 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
  - b. Photographic demonstration of creation of superbug.
  - c. Photographic demonstration of genetically modified microbes.
  - d. Photographic demonstration of genetically modified plants.
  - e. Photographic demonstration of genetically modified animals.

Biostatistics problems

- 7 Problems on graphical and diagrammatic representation of data ( histogram, bar graph and pie chart)
- 8 Calculation of mean, median, mode, standard deviation

## **REFERENCES**

1. Environmental Science, S.C. Santra
2. Environmental Biotechnology, Pradipta Kumar Mohapatra
3. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jeseff Winter
4. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
5. Glaser AN (2001) High Yield™ Biostatistics. Lippincott Williams and Wilkins, USA
6. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
7. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.

**DMF22205/ DMF22206**

**SEMESTER VI**

**DSE: BIOINFORMATICS AND BIOPROCESS TECHNOLOGY**

**(4 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.** Understand the basic concepts and tools used in Bioinformatics.

**CO2.** Comprehend the knowledge of Genomics and Proteomics.

**CO3.** Develop an understanding of the various aspects of Bioprocess Technology.

**CO4.** Enhance the skills associated in Fermentation Process.

**BIOINFORMATICS**

**NO. HOURS**

**UNIT I**

**15**

Bioinformatics and the Internet: Introduction, Internet basics, connecting to the internet electronic mail, File transfer protocol, The World Web.

Database- DNA, protein, genomic mapping database, sequence alignment software-pair wise & multiple alignments, gene families

**UNIT II**

**15**

Information retrieval from databases: Databases similarity searching, FASTA, BLAST SEARCH, Clustal W, Clustal X, DIALIGN2, Multalign Navigating the NCBI web site.

Genomics and Proteomics: Types of genomes, bacterial genome sequence project.

Human genome project, Micro array technologies-types and applications.

**BIOPROCESS TECHNOLOGY**

**UNIT-III**

**15**

Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics- Batch, Fed batch and Continuous culture.

**UNIT IV**

**15**

Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes.

Principles of upstream processing – Media preparation, Inoculation, development and sterilization.

Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting K<sub>L</sub>a.

Bioprocess measurement and control system with special reference to computer aided process control.

## **PRACTICALS**

**(2 CREDITS)**

**HOURS : 4 HOURS /WEEK**

1. Sequence information resource
2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.
7. Multiple sequence alignment using Clustal W.
8. Bacterial growth curve.
9. Production and analysis of ethanol.
10. Production and analysis of amylase.
11. Production and analysis of lactic acid.
12. Isolation of industrially important microorganism from natural resource.

## **REFERENCES**

1. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
2. Salisbury, Whitaker and Hall. Principles of fermentation Technology,
4. Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
5. Wong, K.C. (2016). Computational biology and bioinformatics: gene regulation, CRC press/ Taylor & Francis Group.
6. Joyce, A. P.; Zhang, C.; Bradley, P.; Havranek, J. J. (2015). “Structure –based modeling of protein : DNAspecificity”. Briefings in Functional Genomics.

**DME22405/ DME22406**

**SEC  
MICROBIAL TECHNIQUES**

**(2 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.** Understand and demonstrate basic sterilization techniques.

**CO2.** Analyze the anatomy of prokaryotic cell and structural detail of eukaryotic cell.

**CO3.** Acquire the knowledge of Culture media and their applications.

**CO4.** Assess the growth measurement and pattern of microorganism.

**MICROBIAL TECHNIQUES**

**NO. HOURS**

**UNIT I**

**07**

General introduction. Concept of Prokaryotes and Eukaryotes. General account on Structure, Classification & Reproduction of Bacteria, Fungi & Viruses.

**UNIT II**

**08**

Microbial Techniques: Sterilization: Principles and applications of  
a. Physical Methods: Autoclave, Hot air oven, Laminar airflow, Seitz filter, Sintered glass Filter, membrane filter.  
b. Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents.  
c. Radiation Methods: UV rays and Gamma rays.

**UNIT III**

**08**

Microscopy: working principle and applications of Light microscopy, phase contrast microscopy and electron microscopy.  
Staining-Types, Simple and differential (Gram's and acid fast)

**UNIT IV**

**07**

Microbial nutrition and growth: nutritional classes of microorganisms, culture media, pure culture, microbial growth pattern and methods of growth measurements, method of maintenance and preservation of cultures.

**REFERENCES**

- 1 Prescott L.M. Harley J.P and Klein D.A (Microbiology 5th Edition)
2. Pelzar Jr, M.J. Chan, E.C.S. and Krieig N.R (Microbiology)
3. Salle. A.J Fundamental Principles of Bacteriology .
4. Caldmell, D.R. Microbial Physiology and metabolism

**DME22505/ DME22506:**

**SEC  
ENZYMOLOGY**

**(2 CREDITS)**

**Course Outcomes:**

After completing the course students are able to:

**CO1.** Understand relationship between the structure and function of enzymes.

**CO2.** Interpret mechanisms of enzymatic action kinetics and molecular interactions and specifies importance of enzymes.

**CO3.** Characterise the inhibitor affects on enzyme kinetics.

**CO4.** Enumerate methods in immobilization of enzymes.

<b>ENZYMOLOGY</b>	<b>NO. HOURS</b>
<b>UNIT – I</b>	<b>7</b>
Enzyme classification . Enzyme substrate complex: concept of E-S complex, binding sites, active site, specificity, factors affecting initial rate, E, S, temp. &pH.	
<b>UNIT – II</b>	<b>8</b>
Kinetics of enzyme activity, Michaelis-Menten equation, Different plots for the determination of Km and Vmax and their physiological significance. Enzyme inhibition types of inhibition, Mechanism of enzyme action: General mechanistic principle.	
<b>UNIT – III</b>	<b>7</b>
Allosteric enzymes with special reference to phosphofructokinase. Kinetics of allosteric enzymes. Isoenzymes– multiple forms of enzymes with special reference to lactate dehydrogenase. Multienzyme complexes. Ribozymes. Multifunctional enzyme- eg Fatty Acid synthase.	
<b>UNIT – IV</b>	<b>8</b>
Enzyme Technology: Methods for large scale production of enzymes. Immobilized enzyme and their comparison with soluble enzymes, Methods for immobilization of enzymes. Immobilized enzyme reactors. Application of Immobilized and soluble enzyme in health and industry.	

**REFERENCES**

- 1.Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.
2. Biochemistry, LubertStryer, 6th Edition, WH Freeman, 2006.
3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.
4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.
5. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cenage Learning,2005.
6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

**Pattern of Question Paper  
Semester I to VI  
Paper I to VI (DSC)**

Time : 3 Hrs

Max Marks: 70

I. Answer all the questions

5 X 1 = 5

- 1 .....
- 2.....
- 3.....
- 4.....
- 5.....

II. Answer any five questions

5 X 3 = 15

- 6.....
- 7.....
- 8.....
- 9.....
- 10.....
- 11.....

III. Answer any four questions

4 X 5 = 20

- 12.....
- 13.....
- 14.....
- 15.....
- 16.....

IV. Answer any three questions

3 X 10 = 30

- 17.....
- 18.....
- 19.....
- 20.....

( Note- 10 Marks may be divided in to 6+4 or 5+5)

**Pattern of Question Paper  
Semester V  
(SEC)**

Time : 2 Hrs

Max Marks: 35

I. Answer all the questions

5 X 1 = 5

- 1 .....
- 2 .....
- 3 .....
- 4 .....
- 5 .....

II. Answer any five questions

5 X 3 = 15

- 6 .....
- 7 .....
- 8 .....
- 9 .....
- 10 .....
- 11 .....

III. Answer any four questions

4 X 5 = 20

- 12 .....
- 13 .....
- 14 .....
- 15 .....
- 16 .....

IV. Answer any one question

1 X 10 = 10

- 17 .....
- 18 .....

( Note- 10 Marks may be divided in to 6+4 or 5+5)



**Scheme for Practical Examination**

**I B.Sc., I Semester**

**CELL BIOLOGY & GENETICS**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Determine the total no. of cells in the given sample by haemocytometer **18**  
or  
Measure the length of the given material by micrometry  
or  
Identify any three mitotic stages from root tip squash preparation.
2. Identify and comment on the spotter A, B and C. **3x4=12**

**I B.Sc., II Semester**

**BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Estimate the amount of glucose in the given sample by DNS method. **18**  
or  
Estimate the amount of protein in the given sample by biuret method.  
or  
Determine the optimum ph for the given enzyme.  
or  
Identify the given biomolecule by performing qualitative analysis.
2. Identify and comment on the spotter A, B and C. **3x4=12**

**II B.Sc., III Semester**

**MOLECULAR BIOLOGY & GENETIC ENGINEERING**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Estimate the amount of DNA in the given sample by DPA method. **18**  
or  
Estimate the amount of RNA in the given sample by orcinol method.  
or  
Isolate DNA from the given material .
2. Identify and comment on the spotter A, B and C. **3x4=12**

**II B.Sc.,**

**IV Semester**

**PLANT TISSUE & ANIMAL CELL CULTURE**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Determine the total no. of living and dead cells in the given sample by tryphen blue exclusion method. **18**  
or  
Demonstrate the production of synthetic seeds. Write the principle and procedure for the same.  
or  
Demonstrate the initiation of suspension culture from callus. Write the principle and procedure for the same. Or  
Demonstrate the surface sterilization of explants. Write the principle and procedure for the same.
- 2 . Identify and comment on the spotter A, B and C. **3x4=12**

**III B.Sc.,**

**V Semester**

**IMMUNOLOGY & MEDICAL BIOTECHNOLOGY**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Determine the blood group of the given sample. **18**

or

Determine the antigen antibody reaction by conducting ODD.

or

Demonstrate MIC assay. Write the principle and procedure for the same.

2. Identify and comment on the spotter A, B and C. **3x4=12**

**III B.Sc., VI Semester**

**MICROBIALTECHNOLOGY & AGRICULTURAL BIOTECHNOLOGY**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Estimate the invertase activity from the given immobilised cells. **18**

or

Estimate the percentage of alcohol in the given sample by specific gravity bottle method.

2. Identify and comment on the spotter A, B and C. **3x4=12**

**III B.Sc., VI Semester**

**ENVIRONMENTAL BIOTECHNOLOGY & BIostatISTICS**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Determine the BOD of the given water sample. **10**

or

Estimate the amount of hydrogen sulphide present in the given water sample.

Or

Estimate the amount of carbon di oxide and chloride present in the given water sample.

Or

Estimate the percentage of alcohol in the given sample by specific gravity bottle method.

2. Identify and comment on the spotter A, B and C. **3x4=12**

3. Statistics problem

**III B.Sc., VI Semester**

**BIOINFORMATICS AND BIOPROCESS TECHNOLOGY**

**Duration : 3 hours**

**Max. Marks :35**

**Practical paper :30 and Record:05**

1. Estimate the amylase activity. **18**

Or

Identify and write critical note on the given microorganism.

2. Identify and comment on the spotter A, B and C. **3x4=12**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
Ooty road, Mysuru - 570025.**



## **DEPARTMENT OF BOTANY**

**Schematic Syllabus under Choice Based Credit  
System (CBCS) & Continuous Assessment Grading  
Pattern (CAGP) as per UGC template**

**w.e.f.**

**2019-2020**

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**DEPARTMENT OF BOTANY**  
**PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR B.Sc. PROGRAMME IN BOTANY (CBCS)**  
**DURATION OF THE COURSE: 3YEARS (6SEMESTER)**  
**PROGRAMME: BSc BBM/CBZ, PROGRAMME CODE: BSc07/08 (2019-20)**

Year	Sem	Core course	Title of the paper	Course Code	Lecture + Practical's hours per week	No. of credits			Total credit s	Total hours		Maximum Marks in exam/Assessment				
						L	T	P		Th	Pr	IA(Theory)		Total		
												C-1	C-2			
I B.Sc	I	<b>DSC-I :Theory</b>	Biodiversity of Microbes and Archegoniate	<b>DMA23007/08</b>	04	4: 0 : 0			<b>06</b>	60	60	70	15	15	100	3h
		<b>DSC-I: Pract.</b>	Biodiversity of Microbes and Archegoniate	<b>DMA23107/08</b>	04	0: 0: 2						35	7.5	7.5	50	3h
	II	<b>DSC-II: Theory</b>	Plant Ecology Morphology and Angiosperm Taxonomy	<b>DMB23007/08</b>	04	4: 0 : 0			<b>06</b>	60	60	70	15	15	100	3h
		<b>DSC-II: Pract.</b>	Plant Ecology Morphology and Angiosperm Taxonomy	<b>DMB23107/08</b>	04	0: 0: 2						35	7.5	7.5	50	3h
II B.Sc	III	<b>DSC-III:Theory</b>	Plant Anatomy and Embryology of Angiosperm	<b>DMC23007/08</b>	04	4: 0 : 0			<b>06</b>	60	60	70	15	15	100	3h
		<b>DSC-III:Pract.</b>	Plant Anatomy and Embryology of Angiosperm	<b>DMC23107/07</b>	04	0: 0: 2						35	7.5	7.5	50	3h
	IV	<b>DSC-IV: Theory</b>	Plant Physiology and Metabolism	<b>DMD23007/08</b>	04	4: 0 : 0			<b>06</b>	60	60	70	15	15	100	3h
		<b>DSC-IV:Pract.</b>	Plant Physiology and Metabolism	<b>DMD23107/08</b>	04	0: 0: 2						35	7.5	7.5	50	3h
III B.Sc.	V	<b>DSEA: Theory</b>	No. of courses:1 DSE- A: Cell and Molecular Biology	<b>DME23007/08</b>	04	4: 0 : 0			<b>06</b>	60	60	70	15	15	100	3h
		<b>DSE:Practicals</b>	Based on theory	<b>DME23107/08</b>												
		<b>DSEB: Theory</b>	DSE-B: Economic Botany and Biotechnology	<b>DME23207/08</b>												
		<b>DSE:Practicals</b>	Based on theory	<b>DME23307/08</b>												
	SEC	No. of courses:1 SEC-A : Ethnobotany	<b>DME23407/08</b>	02	2:0:0			<b>02</b>	30	-	35	7.5	7.5	50	2h	
		SEC-B : Floriculture	<b>DME23607/08</b>													
	VI	<b>DSEB: Theory</b>	No. of courses:1 DSE-A: Genetics and Plant Breeding	<b>DMF23007/08</b>	04	4: 0 : 0			<b>06</b>	60	60	70	15	15	100	3h
		<b>DSE:Practicals</b>	Based on theory	<b>DMF23107/08</b>												
<b>DSEB: Theory</b>		DSE -B : Analytical Techniques and Plant Sciences	<b>DMF23207/08</b>													
<b>DSE:Practicals</b>		Based on theory	<b>DMF23307/08</b>													



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
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**DEPARTMENT OF BOTANY**

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**PROCEEDINGS OF THE MEETING OF BOARD OF STUDIES FOR THE PROGRAMMES  
B. Sc. IN BOTANY, BIOCHEMISTRY, MICROBIOLOGY (B.Sc. 07) AND CHEMISTRY,  
BOTANY, ZOOLOGY, (B.Sc. 08) HELD ON 14 JUNE 2019 AT 11.00 AM IN THE CHAMBER  
OF THE CHAIRMAN, DEPARTMENT OF BOTANY, JSS COLLEGE, OOTY ROAD,  
MYSURU-25**

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MEMBERS	SIGNATURE
<b>Dr. S Prathibha</b> Associate Professor, Dept. of Botany, JSS College, Ooty Road Mysuru Chairman	
<b>Dr. Sowmya</b> Associate Professor, Department of Botany Yuvaraja's college, Mysuru  Member (VC Nominee)	
<b>Dr. Syed Fasihuddin</b> Associate professor of Botany Govt. Science College Bengaluru- 560001  Member (AC Nominee)	
<b>Dr. V. N. Muralidhar</b> Associate professor of Botany Govt. first grade College Sira- 572137 Tumkur District  Member (AC Nominee)	

At the outset, the Chairman, BOS in Botany, welcomed the members to the meeting of BOS and briefed about the agenda to be discussed. The following agenda were placed by the Chairman which were discussed and resolved as follows:

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**Agenda 1:** To frame/ revise, discuss and approve the Scheme/ Syllabus under Choice Based Credit System for the programmes: B.Sc. in Botany, Biochemistry, Microbiology and Chemistry, Botany, Zoology from the academic year 2019-20 onwards.

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The Chairman appraised the members about the introduction of Choice Based Credit System to the above said programmes with the course matrix in 2017-18. Accordingly, a draft revised/ modified Scheme/ Syllabus was presented and placed before the Board for their opinion and approval.

**Resolution:** The BOS went through the Scheme/ Syllabus and discussed in length about various aspects of the same. After incorporation of the changes suggested by the members of BOS, the Syllabus was approved. Details of changes made with respect to the introduction of revised/ modified Scheme/ Syllabus in the existing courses is shown in Annexure-I.

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**Agenda 2:** To prepare the Panel of Examiners for the examinations for the year 2019-20.

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The Chairman presented the proposed Panel of Examiners to I to VI Semester examinations of 2019-20.

**Resolution:** After incorporating of certain changes suggested by the members, the Panel of Examiners was approved.

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**Agenda 3:** Approval of Reference Books

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The Chairman presented the proposed list of Reference Books to the Members.

**Resolution:** After incorporating of certain changes suggested by the members, the list of Reference Books was approved.

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**Agenda 4:** Any other matter with the permission of the Chairman

---

The career oriented course Horticulture syllabi was thoroughly analysed and the contents were restructured according to the present day requirement. Question paper pattern, Maximum marks allotted and the hours per unit are also changed as per the BOS member's corroboration to bring uniformity

Finally the meeting was concluded with the Chairman thanking the Members for their active participation in the deliberations of the meeting.

Chairman

## Annexure-I:

Revision/ modification made in the existing Syllabus for 2019-2020 batch onwards:

Existing	Proposed	Justification	Approved
<b>I B.Sc. I Sem DSC-I</b>			
<b>Biodiversity of Microbes and Archegoniate (CMA23007/08):</b>	<b>Biodiversity of Microbes and Archegoniate (DMA23007/08):</b>		
<b>Unit 1: Microbial diversity:</b>			
A. Virus- replication	Deleted	Repetition	<b>Approved</b>
<b>D. Fungi- <i>Puccinia</i></b>	Yeast	Yeast is most important from economic point of view	<b>Approved</b>
<b>Unit 2: Archegoniate:</b>			
<b>A. Pteridophytes -<i>Marsilea</i></b>	Deleted	Better to study in higher level	<b>Approved</b>
<b>Practicals:</b> Gram's Staining of Bacteria	Deleted	Repetition in Microbiology	<b>Approved</b>
Study of <i>Marsilea</i>		Better to study in higher level	
Study of <i>Puccinia</i>		Yeast is most important from economic point of view	
<b>I B.Sc. II Sem DSC-II</b>			
<b>Plant Ecology Morphology and Angiosperm Taxonomy</b>	<b>Plant Ecology Morphology and Angiosperm Taxonomy</b>		

<b>(CMB23007/08):</b>	<b>(DMB23007/ 08):</b>		
<b>Unit-3: Taxonomy:</b> <b>C. Angiosperm families: Apiaceae</b>	Arecaceae	To Represent Monocot family	<b>Approved</b>
<b>Practicals:</b>  Apiaceae	Solanaceae & Arecaceae	Routinely used vegetables belong Solanaceae family & to represent Monocot family	<b>Approved</b>
<b>II B.Sc. III Sem-DSC III</b>			
<b>Plant Anatomy Embryology (CMC23007/08):</b>	<b>Plant Anatomy and Embryology of Angiosperm (DMC23007/ 08):</b>		
<b>Unit 3: Adaptive and protective systems</b>	Brief Account of Epidermis, cuticle, Stomata & Trichome. Added	Blown up syllabi	<b>Approved</b>
<b>Practicals:</b>	Content Restructured	Appropriate	
<b>Unit 4: Embryology</b>	<b>Unit 4: Embryology of Angiosperms</b>		
Structure of pollen grains	Types of Tetrad, Male gametophyte & Embryosac development- Monosporic, Bisporic, Tetrasporic added	For detailed embryological studies.	
Mechanism & Adaptation of Pollination	deleted	Studied previously in lower levels	<b>Approved</b>
<b>Practicals:</b>	Content Restructured	Appropriate	
<b>III B.Sc. V Sem-DSC IV</b>			
<b>Plant Physiology and Metabolism. (CMD23007/08):</b>	<b>Plant Physiology and Metabolism</b>		

	(DMD23007/08):		
<b>Unit 1: Plant-water relations:</b> <b>Unit 2: Mineral nutrition</b> <b>Unit 3: Translocation in phloem</b> <b>Unit 4: Photosynthesis</b> <b>Unit 5: Respiration</b> <b>Unit 6: Enzymes</b> <b>Unit 7: Nitrogen metabolism</b> <b>Unit 8: Plant growth regulators</b> <b>Unit 9: Plant response to light and temperature</b>	<b>UNIT 1 Plant – Water Relations:</b> <b>1.Fundamental concepts,</b> <b>2.Short Distance Transport,</b> <b>3. Long distance Transport,</b> <b>4.Transpiration,</b> <b>5.Mineral nutrition,</b> <b>6.Translocation of solutes</b> <b>UNIT 2 – Enzymes:</b> <b>UNIT 3 – Bioenergetics:</b> <b>UNIT 4 -Nitrogen Metabolism:</b> <b>UNIT 5 - Plant Growth and Movements:</b>	Content Restructured	<b>Approved</b>
<b>Practicals:</b>	Content Restructured	Appropriate	<b>Approved</b>
<b>III B.Sc. V Sem-DSE I</b>			
<b>DSE-1: Cell and Molecular Biology (CME23007/08):</b>	<b>DSE-1: Cell and Molecular Biology (DME23007/08):</b>		
<b>Unit 1-Techniques in Biology:</b> Sample Preparation for light microscopy; Sample Preparation for electron microscopy; X-ray diffraction analysis.	<b>deleted</b>	Repetition in microbiology	<b>Approved</b>
<b>Unit 2-Cell Membrane and Cell Wall :</b> Carbohydrates in the membrane; Faces of the membranes;	<b>deleted</b>	Better to study in higher classes	<b>Approved</b>

<b>Unit 7-Genetic material:</b> DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi-conservative method	<b>Unit 7-Gene concept:</b> Semi-conservative method required	Appropriate	<b>Approved</b>
<b>III B.Sc. V Sem SEC-I</b>			
<b>Floriculture</b>	<b>Contents restructured</b>	Appropriate	<b>Approved</b>
<b>III B.Sc. VI Sem DSE-II</b>			
<b>DSE-2: Genetics and Plant Breeding (CMF23007/08)</b>	<b>DSE-2: Genetics and Plant Breeding (DMF23007/08)</b>		
<b>Unit 1- Heredity:</b> lethal genes Pleiotropism, co- dominance 9:7; 9:4:3; 13:3; 12:3:1	<b>deleted</b>	Repetition in Zoology	<b>Approved</b>
<b>Practicals:</b>	Complementary factors; supplementary factors, Duplicate factors, Epistasis	Proper terminologies have been used instead of ratios	<b>Approved</b>
	Genetic problems on Mendel's laws included	For better elucidation of theoretical concepts	<b>Approved</b>

**Chairman**

## **Programme Outcomes for BSc. in Chemistry, Botany, Zoology:**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1.** Demonstrate the ability to justify and explain their thinking and/or approach, both written and oral. Demonstrate the ability to present clear, logical and succinct arguments, including prose and mathematical language. Write and speak using professional norms, and demonstrate an ability to collaborate effectively.
- PO2.** Develop state-of-the-art laboratory skills and professional communication skills.
- PO3.** Apply the scientific method to design, execute, and analyze an experiment and also to explain their scientific procedures as well as their experimental observations.
- PO4.** Appreciate the central role of chemistry in our society and use this as a basis for ethical behaviour in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.
- PO5.** Explain why chemistry is an integral activity for addressing social, economic, and environmental problems.
- PO6.** Identify the taxonomic position of plants using principles and methods of nomenclature and classification in Botany.
- PO7.** Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8.** Use interdisciplinary approaches with quantitative skills to work on biological problems.
- PO9.** Identify the major groups of organisms with an emphasis on animals and be able to classify them within a phylogenetic framework.
- PO10.** Compare and contrast the characteristics of animals that differentiate them from other forms of life.
- PO11.** Give specific examples of the physiological adaptations, development, reproduction and behaviour of different forms of life.

## **Programme specific Outcomes for BSc. in Chemistry, Botany and Zoology**

After completing the graduation in the Bachelor of Science the students are able to:

**PS01:** Communicate effectively the fundamentals and applications of chemical and Biological sciences

**PS02:** Possess deeper understanding of Natural laws, accuracy and validity of both theoretical and practical knowledge

**PS03:** Explicate ecological interconnectedness of life, by tracing energy and nutrient flows through the environment

**PS04:** Analyse the avenues and remedies for burning environmental issues

**PS05:** Pursue, enhance and appreciate conservation practices for sustainable use of plants and development

**PS06:** Interact with the social activities with ethical approach due to collaborative field visits, botanical tours and academic trips.

## **Programme Outcome for Bachelor of Science in Botany, Biochemistry & Microbiology**

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Identify the taxonomic position of plants using principles and methods of nomenclature and classification in Botany

PO2. Understand the impact of the plant diversity in societal and environmental context

PO3. Demonstrate the knowledge of, and need for sustainable development

PO4. Use interdisciplinary approaches with quantitative skills to work on biological problems

PO5. Demonstrate the ability to justify and explain their thinking and/or approach

PO6. Develop state-of-the-art laboratory and professional communication skills

PO7. Apply the scientific method to design, execute, and analyze an experiment

PO8. Explain scientific procedures and their experimental observations

PO9. Demonstrate an understanding of fundamental biochemical principles, structure and function

PO10. Work as a laboratory technician, biochemists or medical scientist

PO11. Explain the processes used by microorganisms for the growth

PO12. Explain the theoretical basis of the tools, technologies and methods of microbiology



## **Programme Specific Outcome**

### **Bachelor of Science in Botany, Biochemistry & Microbiology**

After completing the graduation in the Bachelor of Science the students are able to;

**PSO1:** Demonstrate applications of biochemical and biological sciences

**PSO2:** Inculcating proficiency in all experimental techniques and methods of analysis

**PSO3:** Acquire, articulate, retain and demonstrate laboratory safety skills

**PSO4:** Communicate scientific information effectively, relating to microbes and their role in ecosystem and health

**PSO5:** Gain proper procedures and regulations in handling and disposal of chemicals

**PSO6:** Understand biochemical and molecular processes that occur in and between the cells

## LIST OF APPROVED PANEL OF EXAMINERS:

Sl. No	Name	Designation and DOB	Joining Date
<b>Internal Examiners</b>			
1.	Dr.Prathibha S Jss College, Ooty Road, Mysore	Asso. Prof. 28/04/1964	28/08/1986
2.	Kiran B L Jss College, Ooty Road, Mysore	Asst. Prof. 30/12/1992	23/09/2015
3.	Divya gouda Jss College, Ooty Road, Mysore	Asst. Prof.	
<b>External Examiners</b>			
4.	Shivanna M Bharathi College, Bharathi Nagarar	Asso. Prof. 30/06/1958	19/11/1985
5.	Ravikumar B S AVK College For Women, Hassan	Asso. Prof. 13/07/1962	16/07/1987
6.	Nagarathnamma Govt College For Women, Mandya	Asso. Prof. 01/06/1959	10/08/1992
7.	Mallikarjunamiah M N Govt. first grade boys college, Mandya.	Asso. Prof. 05/11/1963	14/08/1992
8.	Hemavathi C Maharani`s Science College For Women, Mysore	Asso. Prof. 05/04/1966	17/08/1992
9.	Vijay C R Maharani`s Science College For Women, Mysore	Asso. Prof. 01/10/1962	29/12/1992
10.	Shivalingaiah Maharani`s Science College for Women, Mysore	Asst. Prof. 01/06/1968	08/01/1996
11.	Purushotham S P Maharani`s Science College for Women, Mysore	Asst. Prof. 15/05/1967	02/08/1996
12.	Lingaraju D P AVK College for Women, Hassan	Asst. Prof. 26/02/1965	23/10/2002
13.	Basavaraju G L Govt College for Women, Mandya	Asst. Prof. 21/07/1976	30/01/2004
14.	Devika M Saradavilas College, Mysore	Asst. Prof. 14/03/1970	14/12/2005
15.	Suresh N S Maharani`s Science College for Women, Mysore	Asst. Prof. 25/02/1975	02/05/2006
16.	Jayalakshmi B Maharani`s Science College for Women, Mysore	Asst. Prof. 18/11/1974	14/07/2006
17.	Sowmya H K Govt Science College,Hassan	Asst. Prof. 18/06/1970	22/12/2007
18.	Thoyajaksha Govt Science College, Hassan	Asst. Prof. 20/07/1970	24/12/2007
19.	Sandhya Rani D Maharani`s Science College for Women, Mysore	Asst. Prof. 24/08/1972	24/12/2007
20.	Pushpalatha H G Maharani`s Science College for Women, Mysore	Asst. Prof. 23/12/1979	26/12/2007
21.	Ashok N Pyati Maharani`s Science College for Women, Mysore	Asst. Prof. 22/04/1970	28/12/2007
22.	Indushree PES College, Mandya	Asst. Prof.	
23.	Lalitha V Maharani`s Science College for Women, Mysore	Asst. Prof.	

24.	Gayathri Devi N Jss College for women Chamarajanagar	Asst. Prof.	
25.	Revanamaba B Maharani`s Science College for Women, Mysore	Asst. Prof.	
26.	Dr.M.K. Mahesh Yuvarajas college, Mysore.	Asso. Prof.	
27.	Shravani, K.A Yuvarajas college, Mysore.	Asst. Prof.	
28.	Dr.krishna Yuvarajas college, Mysore.	Asst. Prof.	
29.	Dr.krishnamurthy Yuvarajas college, Mysore.	Asst. Prof.	
30.	Kalpashree Yuvarajas college, Mysore	Asst. Prof.	
31.	Dr. Sowmya, R Yuvarajas college, Mysore	Asst. Prof.	
32.	Deepa hebbar Maharani`s Science College for Women, Mysore	Asst. Prof.	

I B.Sc., I Semester DSC-I  
**Biodiversity of Microbes and Archegoniate**  
Theory (Credits: 4)

Lectures: 60 Hours  
(4 hours/week)

**Course outcome:**

After completion of the course the student is able to:

- CO1 Understand the characteristics of viruses
- CO2 Learn the classification and characteristics of bacteria
- CO3 Identify the classification and characteristics of archegoniate
- CO4 Identify the characteristics of algae
- CO5 Understand the classification and characteristics of fungi.

**Unit 1- Microbial diversity:**

**A. Virus (4 Lectures)**

General structure, DNA virus (T<sub>4</sub>-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance.

**B. Bacteria (5 Lectures)**

Definition, Classification (Based on Shape, Arrangement and flagellation) and Economic importance; ultra structure, Reproduction – vegetative (fission, Budding) asexual (Endospore) Sexual (Genetic recombination-Conjugation, Transformation and Transduction).

**C. Algae (14 Lectures)**

General characteristics; Classification, Reproduction and Economic importance of algae. Type study- *Nostoc*, *Spirogyra*, *Sargassum*.

**D. Fungi (16 Lectures)**

1. General characteristics, classification, nutrition, reproduction and economic importance. Type Study - *Rhizopus*, *Saccharomyces* (Yeast), *Penicillium*,
2. Lichens: Distribution, classification and Economic importance, structure and reproduction.

**Unit 2- Archegoniate:**

**A. Bryophytes (7 Lectures)**

General characteristics, Classification and Economic importance. Type Study- *Marchantia* and *Polytrichum*

**B. Pteridophytes (7 Lectures)**

General characteristics and classification, Stellar evolution. Type Study - *Selaginella* and *Equisetum*.

**C. Gymnosperms (7 Lectures)**

General characteristics, classification and Economic importance. Type Study- *Cycas* and *Pinus*.

I B.Sc., I Semester DSC-I  
Biodiversity of Microbes and Archegoniate  
Practical (Credits: 2)

Lectures: 60 Hours  
(4 hours/week)

1. Study of TMV and of T<sub>4</sub>- Phage through Microphotographs
2. Study of Bacteria.
3. Study of *Nostoc* (Specimen and permanent slides)
4. Study of *Spirogyra* (Specimen and permanent slides)
5. Study of *Sargassum* (Specimen and permanent slides)
6. Study of *Rhizopus*
7. Study of *Yeast*
8. Study of *Penicillium*
9. Study of Lichens
10. Study of *Marchantia*
11. Study of *Polytrichum*
12. Study of *Selaginella*
13. Study of *Equisetum*
14. Study of *Cycas*
15. Study of *Pinus*

**Suggested Readings**

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

**I B.Sc., I Semester DSC-I**  
**Scheme of theory question paper**  
**Biodiversity of Microbes and Archegoniate**

**Time: 3.00 Hours**

**Max. Marks: 70**

**Blue print:**

Units	Hours Allotted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)=40	
<b>Unit I :Microbial Diversity</b>					
A&B.Virus and Bacteria	09	2X1=2	5X1=5	10X1=10	17
C. Algae	14	2X2=4	5X2=10	10X1=10	24
D. Fungi	16	2X1=2	5X3=15	10X1=10	27
<b>Unit II: Archegoniate</b>					
A. Bryophytes	07	2X1=2	-	10X1=10	12
B. Pteridophytes	07	2X1=2	-	10X1=10	12
C. Gymnosperms	07	2X2=4	-	10X1=10	14
<b>Total</b>	<b>60</b>	<b>8X2=16</b>	<b>4X6=30</b>	<b>6X6=60</b>	<b>106</b>

**Biodiversity of Microbes and Archegoniate****Scheme of practical question paper****Time: 4 Hours****Max. Marks: 35(25+05+05)****I. Identify the specimens 'A' and 'B' with reasons and labeled sketches****3x2=06 marks**

(A-Algae and B-Microphotographs of virus/Bacteria/fungi)

Identification – 1 mark

Reasons with labelled sketch – 2 marks

**II. Prepare a stained temporary slide of 'C'. Sketch, label and Identify with reasons.****Leave the preparation for evaluation.****4x01=04 marks**(C-*Nostoc/Rhizopus/Saccharomyces* (yeast) / *Penicillium*)

Identification – 1 marks

Preparation/staining and mounting– 2 marks

Reasons with labelled sketch – 1 marks

**III. Write critical notes on 'D', 'E' and 'F'****3x3=09 marks**

(D-Algae/Fungi, E-Lichens/Bryophytes, F- Pteridophytes /Gymnosperms)

Identification – 1 mark

Reasons with lablled sketch – 2 marks

**IV. Identify the Microslides 'G', 'H', and 'I' with reasons and labeled****Sketches****02x03=06 marks**

(G-Algae/Fungi, H-Lichens/Bryophytes, I- Pteridophytes /Gymnosperms)

Identification – 1 mark

Reasons with lablled sketch – 1 marks

**V. Practical record****05marks****VI. Viva- Voce****05marks****Note:** Each student should submit the **duly valued and certified practical record** at the time of practical examination.

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I B.Sc., I Semester DSC-I  
Biodiversity of Microbes and Archegoniate  
Practical Question paper

Time: 4 Hours

Max. Marks: 35 (25+05+05)

- I. Identify the specimens 'A' and 'B' with reasons and labeled sketches 3x2=06 marks
- II. Prepare a stained temporary slide of 'C'. Sketch, label and Identify with Reasons leave the preparation for evaluation. 4x1=04 marks
- III. Write critical notes on 'D', 'E' and 'F' 3x3=09 marks
- IV. Identify the Microslides 'G', 'H' and 'I' and with reasons and labeled Sketches 2x3=06 marks
- V. Practical record 05 marks
- VI. Viva- Voce 05marks

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**I B.Sc., II Semester DSC-II**  
**Plant Ecology, Morphology and Angiosperm Taxonomy**  
**Theory (Credits: 4)**

**Lectures: 60 Hours**  
**(4 hours/week)**

**Course outcome:**

After completion of the course the student is able to:

- CO1 Specify the characteristics of ecosystem
- CO2 Learn the classification and characteristics of Plant communities
- CO3 Understand in details with examples plant morphology
- CO4 Understand in depth Herbarium

**Unit 1- Plant Ecology:**

**A. Introduction to Ecology and Ecological factors: (6 Lectures)**

Introduction to ecology, Climatic factors- Light, temperature and water. Edaphic factors- soil formation, types and profile. Shelford law of tolerance.

**B. Ecosystem (6 Lectures)**

Structure and components of an ecosystem, study of pond and forest ecosystem, energy flow and trophic levels; Food chains, food webs, Ecological pyramids. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.

**C. Plant communities (6 Lectures)**

Morphological Adaptations of hydrophytes and xerophytes. Plant Succession, Hydrosere and Xerosere.

**Unit 2- Leaf and Floral Morphology: (15 Lectures)**

- A. Leaf- Structure, types and phyllotaxy.
- B. Types of Inflorescence
- C. Flower- structure of a typical flower (*Tribulus terrestris* / *Muntingia calabura*), Variation in floral morphology and floral organs in detail.
- D. Types of Inflorescence
- E. Types of fruits

**Unit-3: Taxonomy:**

**A. Introduction to plant taxonomy (8 Lectures)**

- 1. Taxonomic hierarchy
- 2. Types of classification (artificial, natural and phylogenetic)
- 3. Systems of classification- Bentham and Hooker, Engler and Prantl
- 4. Plant Nomenclature-Binomial system and ICBN principles.

**B. Herbarium technique: (5 Lectures)**

1. Herbarium- Techniques and importance
2. Botanical gardens

**C. Angiosperm families:**

**(14 Lectures)**

Study of the following families according to Bentham and Hooker's system of classification.--Malvaceae, Leguminosae (Papilionaceae, Caesalpiniaceae and Mimosaceae), Apocynaceae Asteraceae and Arecaceae.

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**I B.Sc., II Semester DSC-II**  
**Plant Ecology, Morphology and Angiosperm Taxonomy**  
**Practical (credits: 2)**

**Lectures: 60 Hours**  
**(4 hours/week)**

1. Study of Ecological instruments used to measure microclimatic variables: Soil thermometer, Maximum and Minimum Thermometer, Anemometer, Psychrometer/Hygrometer, Rain gauge.
2. Study of morphological adaptations of the following
  - a. Hydrophytes                   Eg: *Hydrilla. Pistia and Eichhornia*
  - b. Xerophytes                   Eg: *Opuntia, Euphorbia Tirucalli, Nerium and Casuarina*
3. Study of biotic interactions of the following:
  - a. Stem parasite                   Eg: *Cuscuta.*
  - b. Root parasite                   Eg: *Striga.*
  - c. Epiphytes,                   Eg: *Vanda*
  - d. Predatory plants (Insectivorous plants) Eg: *Nepenthes.*
4. Study of root modifications
5. Study of stem modifications
6. Study of leaf-structure, types, phyllotaxy and modifications.
7. Parts of a typical flower (*Tribulus terrestris / Muntingia calabura*)
8. Floral organs in detail with their variations.
9. Types of inflorescence
10. Types of fruits
11. Study of families Malvaceae, Apocynaceae
12. Study of families Leguminosae (Papilionaceae, Caesalpiniaceae and Mimosaceae)
13. Study of families and Asteraceae
14. Study of Solanaceae and Arecaceae
15. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label

**Suggested Readings:**

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.

**I B.Sc., II Semester DSC-II**  
**Plant Ecology, Morphology and Angiosperm Taxonomy**  
**Scheme of theory question paper**

Time: 3.00 Hours

Max. Marks: 70

Units	Hours Allotted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)=40	
Unit 1: A. Plant Ecology	06	-	-	10x1=10	10
B. Ecosystem	06	-	5x2=10	-	10
C. Plant communities	06	2x1=2	-	10x1=10	12
Unit II: Leaf and Floral Morphology, Fruits	15	2x3=6	5x2=10	10x1=10	26
Unit III: Taxonomy					
A. Introduction to plant taxonomy	08	2x2=4	-	10x1=10	14
B. Herbarium technique	05	2x1=2	5x1=5	-	07
C. Angiosperm families	14	2x1=2	5x1=5	10x2=20	27
<b>Total</b>	<b>60</b>	<b>8x2=16</b>	<b>5x6=30</b>	<b>10x6=60</b>	<b>106</b>

**I B.Sc., II Semester DSC-II**  
**Plant Ecology, Morphology and Angiosperm Taxonomy**  
**Scheme of practical question paper**

**Time: 4 Hours**

**Max. Marks: 35 (25+05+05)**

**I. Write critical notes on 'A' 'B' and 'C' with reasons and labeled Sketches. 3x3=9 marks**

(A-Ecological instruments, B-Hydrophytes/xerophytes/parasites/epiphytes, C-Underground root & stem modifications/Leaf phyllotaxy /leaf types/)

Identification – 1 mark

Labeled sketch with reasons – 2 marks

**II. Assign the plant 'D' to its respective family giving reasons. 4x1=4 marks**

(D- Malvaceae/Apocynaceae/Asteraceae/Arecaceae)

Family name – 1 mark

Salient features – 3 marks

**III. Describe the plant 'E' in technical terms. 4x1=4 marks**

(Papilionaceae /Caesalpiniaceae)

Family name – 1 mark

Technical terms – 3 marks

**IV. Draw the floral diagram and write the floral formula of the give plant 'F' 4x1=4 marks**

(Malvaceae, Solanaceae, Apocynaceae)

Floral formula -1mark

Floral diagram -3marks

**V. Identify the specimen 'G' and 'H' 2x2=4marks**

(J-Inflorescence, H- Fruits)

Identification – 1 mark

Reasons – 1mark

**VI. Practical 05marks**

**VII. Viva- Voce 05marks**

Note: each student should submit the **duly valued and certified practical record** at the time of practical examination.

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**I B.Sc., II Semester DSC-II**  
**Plant Ecology, Morphology and Angiosperm Taxonomy**  
**Practical Question Paper**

**Time: 4 Hours**

**Max. Marks: 35 (25+05+05)**

**I. Write critical notes on 'A' 'B' and 'C' with reasons and labeled Sketches**

**3x3=9 marks**

**II. Assign the plants 'D' to its respective family giving reasons.**

**4x1=4marks**

**III. Describe the plant 'E' in technical terms.**

**4x1=4 marks**

**IV. Draw the floral diagram and write the floral formula of the give plant 'F'**

**4x1=4marks**

**V. Identify the specimen 'G' and 'H'**

**2x2=4marks**

**VII. Practical record**

**05marks**

**VIII. Viva-Voce**

**05marks**

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**Plant Anatomy and Embryology of Angiosperms  
Theory (Credits: 4)**

**Lectures: 60 Hours  
(4 hours/week)**

**Course outcome:**

After completion of the course the student is able to:

- CO1 Understand the details of histology
- CO2 Understand the details of anatomy
- CO3 Understand the characteristics of secondary growth
- CO4 Learn the details of embryology

**Unit 1: Histology and Anatomy (18 Lectures)**

Meristem- structure, classification, based on origin, position and function. Study of Simple and complex tissues.

Internal Structure of dicot and monocot root, stem and leaf.

**Unit 2: Secondary Growth (4 Lectures)**

Process of secondary growth in dicot stem.

**Unit 3: Adaptive and protective systems (7 Lectures)**

Anatomical adaptations in xerophytes (Nerium & Causarina) and Hydrophytes (Hydrilla & Eichhornia). Epidermis, cuticle, Stomata & Trichome. (Brief Account)

**Unit 4: Embryology of Angiosperms (8 Lectures)**

T.S of mature anther, Microsporogenesis, types of tetrads and Male gametophyte, Megasporogenesis- types of ovules, L.S of Anatroous ovule, Embryosac development- Monosporic (Polygonum), Bisporic (Allium), Tetrasporic (Frittilaria) structure of Mature Embryo sac.

**Unit 5: Pollination and fertilization (11 Lectures)**

Definition, types, contrivances for self and cross pollinations

Process of Double Fertilization, Post Fertilization changes

**Unit 6: Embryo and endosperm (6 Lectures)**

Structure and development of Dicot (Capsella) and Monocot embryo (Maize). Endosperm- nucellar, cellular, helobial and ruminant.

**Unit 7: Experimental Embryology (6 Lectures)**

Brief account of apomixis (recurrent and non-recurrent), apospory, polyembryony, parthenocarpy.

1. Study of Meristems through permanent slides and photographs- apical, intercalary and lateral meristems.
2. Study of simple Tissues (parenchyma, collenchyma and sclerenchyma) through Permanent slides and photographs.
3. Study of complex Tissue (xylem and phloem) through Permanent slides and photographs.
4. Study of Anatomical characteristics of Root: Monocot- *Zea mays* and Dicot- *Helianthus*.
5. Study of Anatomical characteristics of Stem: Monocot- *Zea mays*; Dicot-*Helianthus*.
6. Study of Anatomical characteristics of Monocot and Dicot Leaf.
7. Adaptive anatomy: Xerophyte (*Nerium & Causaurina*); Hydrophyte (*Hydrilla & Eichhornia*).
8. Structure of anther (young and mature) and mounting of Pollen grains.
9. Calculation of percentage of germinated pollen in a given medium (Hanging drop method).
10. Types of ovules: Anatropous, Orthotropous, Circinotropous, Amphitropous/ Campylotropous.
11. Female gametophyte: Polygonum (monosporic) type of Embryo sac Development.
12. Pollination types and seed dispersal mechanisms. (Photographs and specimens).
13. Dissection/ mounting of embryo/endosperm from seeds.

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#### **Suggested Readings**

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

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**II B.Sc., III Semester DSC-III**  
**Plant Anatomy and Embryology of Angiosperms**  
**Scheme of theory question paper**

Time: 3.00 Hours

Max. Marks: 70

Blue print:

Units	Hours Allotted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)=40	
<b>Unit 1: Histology and Anatomy</b>	18	2X1=2	5X2=10	10X2=20	<b>32</b>
<b>Unit 2: Secondary Growth</b>	04	2X1=2	5X1=5	-	<b>07</b>
<b>Unit 3: Adaptive and protective systems</b>	07	2X1=2	5X2=10	-	<b>12</b>
<b>Unit 4: Embryology</b>	08	2X1=2	-	10X1=10	<b>12</b>
<b>Unit 5: Pollination and fertilization</b>	11	2X1=2	-	10X2=20	<b>22</b>
<b>Unit 6: Embryo and endosperm</b>	06	2X1=2	-	10X1=10	<b>12</b>
<b>Unit 7: Experimental Embryology</b>	06	2X2=4	5X1=5	-	<b>09</b>
<b>Total</b>	<b>60</b>	<b>8X2=16</b>	<b>5X6=30</b>	<b>10X6=60</b>	<b>106</b>

**Time: 4 Hours****Max. Marks: 35 (25+05+05)**

**I. Write critical notes on 'A' 'B' and 'C' with reasons and labeled sketches**      **2x3=6 marks**  
(A-Meristem- Apical, intercalary and lateral, B-Simple tissues,  
C-Complex tissues)

Identification                                      – 1 mark  
Labeled sketch with reasons                  – 1marks

**II. Prepare a stained temporary slide of 'D. Sketch, label and identify with reasons Leave the preparation for evaluation**                                      **5x1=5 marks**  
(D-Dicot stem/ Monocot stem Anatomy)

Identification                                      – 1 mark  
Mounting and Preparation                      -2 marks  
Labeled sketch with reasons                  – 2 marks

**III. Identify the microslides/ photographs 'E' 'F' & 'G' sketch, label with reasons**                                      **3x3=09 marks**

(E-root/ leaf, F-Xerophytes/ Hydrophytes, G-T.S of anther/ types of ovule  
Identification                                      – 1 mark  
Labeled sketch with reasons                  – 2marks

**IV. 'H'- Dissect Embryo/Endosperm, sketch label with reasons/ Mounting of Pollen grains / calculate the percentage of germinated pollen**                                      **5x1=5 marks**

Identification                                      – 1 mark  
Labeled sketch with reasons                  – 4marks

**V. Practical record**                                      **05 marks**

**VI. Viva-Voce**                                      **05 marks**

Note: Each student should submit the **duly valued and certified practical record** at the time of practical examination.

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DMC23108/DMC23107

**II B.Sc., III Semester DSC-III  
Plant Anatomy and Embryology of Angiosperms  
Practical question paper**

**Time: 4 Hours**

**Max. Marks: 35 (25+05+05)**

**I. Write critical notes on 'A' 'B' and 'C' with reasons and labeled sketches 2x3=6 marks**

**II. Prepare a stained temporary slide of 'D. Sketch, label and identify with reasons.**

**Leave the preparation for evaluation**

**05marks**

**III. Identify the microslides/ photographs 'E' 'F' & 'G', sketch, label with reasons**

**3x3=9 marks**

**IV. 'H'- Dissect Embryo/Endosperm, sketch label with reasons/ Mounting of Pollen grains / calculate the percentage of germinated pollen.**

**V. Practical record**

**5 marks**

**VI. Viva-Voce**

**5 marks**

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**Course outcome:**

After completion of the course the student is able to:

- CO1 Learn in depth translocation in phloem
- CO2 Specify the classification and characteristics of enzyme
- CO3 Understand the details of photosynthesis
- CO4 Identify the characteristics of plant response to light and temperature

**UNIT 1 - Plant – Water Relations: (20 Lectures)**

1. **Fundamental concepts:** Importance of water to plants, Diffusion, Imbibition, Osmosis, Endosmosis and Exosmosis, Plasmolysis, Osmotic Pressure, Water potential and its components.
2. **Short Distance Transport:** Absorption of water – Active and passive absorption, Absorption of minerals – Donnan's equilibrium (Passive absorption), Carrier-ion concept (Active absorption)
3. **Long distance Transport:** Ascent of sap; Root pressure theory (Vital theory), TCT Theory (Physical theory), Soil plant atmospheric continuum (SPAC)
4. **Transpiration:** Types, Mechanism of stomatal movement; Starch-sugar interconversion theory, Potassium ion pump theory, Significance of transpiration, Antitranspirants, Guttation.
5. **Mineral nutrition:** Macro and Micro nutrients; Role of Nitrogen, Phosphorous, Potassium, Sulphur, Manganese and Zinc, Hydroponics.
6. **Translocation of solutes:** Path of translocation, Munch's mass flow hypothesis with merits and demerits.

**UNIT 2 – Enzymes: (4 Lectures)**  
Properties, Classification and Mode of action (Lock & Key theory, Induced fit theory)**UNIT 3 – Bioenergetics: (18 Lectures)**

1. **Photosynthesis :** Introduction, Photosynthetic apparatus, Mechanism – Light and Dark reactions (C<sub>3</sub> pathway/Calvin Cycle), C<sub>4</sub> pathway, Significance of Photosynthesis.
2. **Respiration :** Introduction,,Types, Ultrastructure of Mitochondrion, Mechanism of Aerobic respiration – Glycolysis, Krebs' cycle and Terminal Oxidation of reduced coenzymes , Anaerobic respiration – alcoholic & lactic acid fermentation, Significance .

**UNIT 4 -Nitrogen Metabolism: (6 Lectures)**

Nitrogen fixation (Symbiotic and Non Symbiotic), Nitrate reduction, Aminoacids & their synthesis  
(Transamination & Reductive amination)

**UNIT 5 - Plant Growth and Movements: (12 Lectures)**

1. Growth: Definition, Phases of growth and Growth curve
2. Growth regulators Chemical nature, application of Auxins, Gibberellins, Cytokinins, Abcissic acid (ABA) & Ethylene.
3. Photoperiodism and Vernalisation : A brief account.
4. Plant movements : Tropisms & their types ( Phototropism, Thigmotropism, Hydrotropism & Geotropism)

**I. Minor Experiments:**

1. a) Root pressure experiment
- b) Ganong's Potometer experiment
2. c) Ganong's light screen experiment
- d) Mohl's half leaf experiment
3. f) Kuhne's experiment to demonstrate fermentation.
- g) Phototropism
4. h) Geotropism
- i) Arc Auxanometer experiment
5. j) Bolting.
- k) Effect of auxins on rooting.

**II. Major Experiments:**

1. Determination of Osmotic Potential by Plasmolytic method using *Rhoeo discolor* (Epidermal peel)
2. Experiment to demonstrate the Relationship between Absorption and Transpiration.
3. Experiment to demonstrate the Suction force due to transpiration.
4. Separation of photosynthetic pigments using paper Chromatography.
5. Evolution of Oxygen during photosynthesis
6. Calculation of stomatal index and stomatal frequency.

**III. Biochemical tests:**

Qualitative biochemical tests for Carbohydrates, fats and protein.

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**Suggested Readings**

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

**II B.Sc., IV Semester DSC-IV  
Plant Physiology and Metabolism  
Scheme of theory question paper**

**Time: 3.00 Hours**

**Max. Marks: 70**

**Blue print:**

Units	Hours Allotted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)=40	
<b>Unit 1: Plant-water relations</b>	20	2X3=6	5X2=10	10X2=20	<b>36</b>
<b>Unit 2: Enzymes</b>	4	2X1=2	5X1=5	-	<b>7</b>
<b>Unit 3: Bioenergetics</b>	18	2X2=4	5X1=5	10X2=20	<b>29</b>
<b>Unit 4: Nitrogen metabolism</b>	6		5X1=5	10X1=10	<b>15</b>
<b>Unit 5: Plant Growth and Movements:</b>	12	2X2=4	5X1=5	10X1=10	<b>19</b>
<b>Total</b>	<b>60</b>	<b>8X2=16</b>	<b>5X6=30</b>	<b>10X6=60</b>	<b>106</b>

Time: 4 Hours

Max. Marks: 35 (25+05+05)

**I. Perform the major experiment 'A' write the principle, Requirements, Procedure and record the result with inference and leave the setup for evaluation** **9x1 = 9 marks**

(Determination of osmotic potential of plant cell sap by plasmolytic method. Study of plasmolysis and deplasmolysis on Rhoec leaf)

**OR**

Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophytes

**OR**

Experiment to demonstrate the Relationship between Absorption and Transpiration.

**OR**

Separation of photosynthetic pigments by paper chromatography

**OR**

Evolution of Oxygen during photosynthesis

**OR**

Experiment to demonstrate the Suction force due to transpiration

Principle	-2 marks	Procedure	-3 marks
Requirements	-1 mark	Result and inference	-1 marks
Setting	-2 marks		

**II. Comment on 'B' & 'C' (Minor experiments)** **4x2 =8 marks**

(Root pressure experiment/ Ganong's Potometer experiment / Ganong's light screen experiment/ Mohl's half leaf experiment/ Kuhne's experiment / Phototropism/ Arc Auxanometer experiment/ Bolting/ Effect of auxins on rooting)

Identification	-1 marks
Critical notes	-2 marks
Labeled sketch	-1 marks

**III. Perform the biochemical test of the given sample 'D' & 'E'**

Procedure -3marks	Result-1 marks	<b>4x2=8 marks</b>
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**IV. Practical record** **05 marks**

**V. Viva-Voce** **05 marks**

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**DMD23108/DMD23107**

**II B.Sc., IV Semester DSC-IV  
Plant Physiology and Metabolism  
Practical Question Paper**

**Time: 4 Hours**

**Max. Marks: 35 (25+05+05)**

**I. Perform the major experiment 'A' write the principle, Requirements, Procedure and record the result with inference and leave the setup for evaluation** **9x1 =9 marks**

**II. Comment on 'B' & 'C' (Minor experiments)** **4x2=8 marks**

**II. Perform the biochemical test of the given sample 'D' & 'E'** **4x2=8 marks**

**IV. Practical record** **05 marks**

**V. Viva-Voce** **05 marks**

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**Course outcome:**

After completion of the course the student is able to:

- CO1 Understand in depth microscopy
- CO2 Learn the details of cell
- CO3 Specify the details of DNA
- CO4 Learn the details of gene regulation

**Unit 1- Microscopy: (5 Lectures)**

Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM).

**Unit 2- Cell: (4 Lectures)**

Cell Theory; Ultra structure of Prokaryotic and eukaryotic cells;

**Unit 3- Cell Wall and Cell Membrane: (4 Lectures)**

Cell wall- Structure; Cell Membrane- Fluid mosaic model and functions

**Unit 4- Cell Organelles: (13 Lectures)**

Ultrastructure and functions of Nucleus, Mitochondrion, Chloroplast, Endoplasmic reticulum, Golgi bodies, Lysosomes, Ribosomes, Peroxisomes and Glyoxisomes

Morphology of chromosomes in general, Ultrastructure of Chromosome (Nucleosome concept), Karyotype and Ideogram

**Unit 5-Cell Division: (6 Lectures)**

Cell cycle, Mitosis and Meiosis and their significance

**Unit 6- Nucleic acids: (12 Lectures)**

**A. DNA:** Chemistry, Structure and Replication in Eukaryotes (semi- conservative method) DNA as a genetic material Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment.

**B.RNA:** Chemistry, Structure, Types (mRNA, tRNA, rRNA) and structure. Frankel Conrat's experiment

**Unit 7-Gene concept: (12 Lectures)**

A. Cistron, Recon, Muton- Prokaryotic and Eukaryotic gene structure, Split gene concept.

B. Genetic code- features, Wobble concept. Protein synthesis: Transcription, Splicing and Translation. Central dogma of molecular Biology.

**Unit 8-Regulation of gene expression: (4 Lectures)**

Lac operon and Tryp operon concepts.

1. Preparation of fixatives and stains: FAA, Carnoy's fixative, safranin, acetocarmine and acetoorcein.
2. Study of viruses, prokaryotic cell (bacteria) and eukaryotic cell with the help of light and electron micrographs.
3. Study of cell organelles through photographs.
4. Study of structure of plant cell through temporary mounts- Onion peeling and tomato pulp
5. Study of Mitosis (temporary mounts and permanent slides).
6. Study of Meiosis (temporary mounts and permanent slides).
7. Study the structure of nuclear pore complex by photograph (from Gerald Karp)
8. Structure of DNA and RNA (mRNA, rRNA, tRNA).
9. Study DNA packaging through photographs- solenoid model.
10. Lac operon and Tryp operon concepts.

### **Suggested Readings**

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

**III B.Sc., V Semester DSE-V**  
**Cell and Molecular Biology**  
**Scheme of theory question paper**

**Time: 3.00 Hours**

**Max. Marks: 70**

**Blue print:**

Units	Hours Alloted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)=40	
<b>Unit 1: Microscopy</b>	5	-	-	10X1=10	<b>10</b>
<b>Unit 2: Cell</b>	4	2X1=2	5X1=5	-	<b>07</b>
<b>Unit 3: Cell Membrane and Cell Wall</b>	4	2X1=2	5X1=5	-	<b>07</b>
<b>Unit 4: Cell Organelles</b>	13	2X1=2	-	10X2=20	<b>22</b>
<b>Unit 5: Cell Division</b>	06	2X1=2	-	10X1=10	<b>12</b>
<b>Unit 6: Nucleic acid</b>	12	2X1=2	5X2=10	10X1=10	<b>22</b>
<b>Unit 7: Gene concept</b>	12	2X2=4	5X1=5	10X1=10	<b>19</b>
<b>Unit 8: Regulation of gene expression</b>	04	2X1=2	5X1=5	-	<b>07</b>
<b>Total</b>	<b>60</b>	<b>8X2=16</b>	<b>5X6=30</b>	<b>10X6=60</b>	<b>106</b>

**Time: 4 Hours****Max. Marks: 35 (25+05+05)**

**I. Prepare a temporary squash of given material 'A'. Sketch, label and identify with reasons. Leave the preparation for evaluation. 07 marks**

(Onion root tip/ flower bud)

Preparation - 4marks

Identification - 1mark

Sketch and label - 1mark

Reasons - 1mark

**II. Identify the cytological slide/Photograph 'B' with labeled diagram and reasons. 04 marks**

(Mitosis/ Meiosis)

Identification - 1mark

Sketch and label - 1mark

Reasons - 2marks

**III. Comment on 'C' and 'D' (charts/photographs) 3 X 2= 06marks**

C- Cell organelle (Identification - 1mark, labeled Sketch and Reason - 2marks)

D- Fixative/ stain (Identification - 1mark, labeled Sketch and Reason - 2marks,)

**IV. Prepare a temporary mount of a plant cell 'E' 04 marks**

(Onion peeling/ tomato pulp)

Preparation - 2 marks

Sketch and label - 2 marks

**V. Write critical notes on 'F and 'G' 2 X 2 = 04 marks**

F-DNA/ DNA packaging/RNA types

G- Nuclear pore complex/ Lac operon/ Tryp operon

Identification - 1 mark

Reasons - 1 marks

**VI. Practical record 05marks**

**VII. Viva-voce 05marks**

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**Time: 4 Hours**

**Max. Marks: 35 (25+05+05)**

- I. Prepare a temporary squash of given material 'A'. Sketch, label and identify with reasons. Leave the preparation for evaluation. 07 marks**
- II. Identify the cytological slide/photograph 'B' with labeled diagram and reasons. 04 marks**
- III. Comment on 'C' and 'D' (charts/photographs) 3 X 2= 06 marks**
- IV. Prepare a temporary mount of a plant cell 'E' 04 marks**
- V. Write critical notes on F and G 2 X 2 = 04 marks**
- VI. Practical record 05 marks**
- VII. Viva-voce 05marks**

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**Course outcome:**

After completion of the course the student is able to:

- CO1 Understand in details with application, if applicable, economic botany
- CO2 Specify the details of plant tissue culture
- CO3 Understand in details with examples recombinant DNA technology

**Unit 1: Cereals and Millets (4 Lectures)**

Rice, Wheat, Maize, Ragi (Botanical name, family, part used, morphology and uses)

**Unit 2: Legumes (6 Lectures)**

General account with special reference to Pigeon pea, Green gram, Black gram, Bengal gram (Botanical name, family, part used, morphology and uses)

**Unit 3: Spices and condiments (8 Lectures)**

General account with special reference to clove, black pepper, cinnamom, cardamom, garlic, onion, chilli and coriander (Botanical name, family, part used, morphology and uses)

**Unit 4: Beverages (4 Lectures)**

Tea and coffee (Botanical name, family, part used, morphology and uses)

**Unit 5: Oils and Fats (4 Lectures)**

General description with special reference to groundnut, sunflower, mustard (Botanical name, family, part used, morphology and uses)

**Unit 6: Fibre Yielding Plants (4 Lectures)**

General description with special reference to Cotton, Jute, kapok and sunn hemp (Botanical name, family, part used, morphology and uses)

**Unit 7: Introduction to biotechnology (2 lecture)****Unit 8: Plant tissue culture (10 Lectures)**

Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

**Unit 9: Recombinant DNA Techniques (18 Lectures)**

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection.

**DME23308/DME23307**

**III B.Sc., V Semester DSE-II  
Economic Botany and Biotechnology  
Practical (2 credits)**

**Lectures: 60 Hours  
(4 hours/week)**

1. Study of Cereals and Millets
2. Study of Legumes
3. Study of Spices and condiments
4. Study of Beverages
5. Study of Oils and Fats
6. Study of Fibre Yielding Plants
7. Familiarization with basic equipments in tissue culture.
8. Study through photographs: Anther culture, somatic embryogenesis,
9. Study through photographs: endosperm and embryo culture; micropropagation.
10. Study of molecular techniques: PCR, Blotting techniques and PAGE.

**Suggested Readings**

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

**III B.Sc., V Semester DSE-II**  
**Economic Botany and Biotechnology**  
**Scheme of Theory Question Paper**

**Time: 3.00 Hours**

**Max. Marks: 70**

**Blue print:**

Units	Hours allotted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)=40	
<b>Unit 1: Cereals and Millets</b>	4		5X1=5	-	<b>07</b>
<b>Unit 2: Legumes</b>	6	2X1=2	-	10X1=10	<b>12</b>
<b>Unit 3: Spices and condiments</b>	8	-	5X1=5	10X1=10	<b>15</b>
<b>Unit 4: Beverages</b>	4	-	5X1=5	-	<b>05</b>
<b>Unit 5: Oils and Fats</b>	4	2X1=2	5X1=5	-	<b>07</b>
<b>Unit 6: Fibre Yielding Plants</b>	4	2X1=2	-	10X1=10	<b>12</b>
<b>Unit 7: Introduction to biotechnology</b>	2	2X1=2	-	-	<b>02</b>
<b>Unit 8: Plant tissue culture</b>	10	2X1=2	5X1=5	10X1=10	<b>17</b>
<b>Unit 9: Recombinant DNA Techniques</b>	18	2X2=4	5X1=5	10X2=20	<b>29</b>
<b>Total</b>		<b>8X2=16</b>	<b>5X6=30</b>	<b>10X6=60</b>	<b>106</b>



**Floriculture**

Theory (2 credits)

Lectures: 30 Hours  
(2 hours/week)**Course outcome:**

After completion of the course the student is able to:

- CO1 Specify the classification and characteristics of gardening
- CO2 Understand in depth nursery management
- CO3 Identify in details with examples ornamental plants

**Unit 1- Establishment and management of Nurseries: (7 Lectures)**

Definition, importance of nurseries, classification of nurseries, and management of nurseries

1. **Basic requirements for Nurseries:** Agro-climatic conditions, Topography, Selection of site Selection of soil, Seed bed preparation, Water supply and irrigation.

Parts of nursery- a) Building structures, b) Propagating structures- raising of seedlings

2. **Management of nursery:** Irrigation, Nutrition, Weed control, Plant protection, Uprooting, packing and transplantation

**Unit 2-Gardening and Landscaping (8 Lectures)****A. Features of a garden:**

1. Introduction, living elements, hedges, edges, trees, flower beds, lawn, Shrubbery, climbers and creepers, paths, Steps, arches, pergola, rockery, Water garden, sunken garden, carpet beds, topiary, trophy, ,non living elements.
2. Gardening: Introduction, Formal style, Informal style, planning a garden, creating a garden, establishment of the garden.
3. Some Famous gardens of India

**B. Landscaping:**

1. Home garden, Public garden. Educational institution, commercial complexes and companies.
2. Importance, Scope of floriculture and landscape gardening.

**Unit 3-Garden Plants:****(5 Lectures)**

Introduction, Annuals, Biennials, Perennials, Shrubs, Trees, Climbers(Divine Vines) Succulents, Cacti,Ferns, Gymnosperms, Palms, Orchids, Bulbous Ornamentals.

**Unit 4- Commercial Floriculture:****(8 Lectures)**

Introduction, Importance of Floriculture from social, Economic, Health and Aesthetic point of view. Marketing and floristry in Indian scenario. Future and scope of Floriculture in India- Employment opportunities. Packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Rose, Chrysanthemum, Gerbera, Gladiolous, Marigold, Orchids).

**Unit 5- Diseases and pests of ornamental plants:****(2 Lectures)**

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**References**

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India Allied Publishers

**Floriculture****Scheme of Theory Question Paper****Blue print:****Max. Marks: 50**

Units	Hours allotted	No. of questions from each category			Total Marks 50
		2 marks (5/8)=10	5marks (4/6)=20	10marks (2/4)=20	
<b>Unit 1: Establishment and management of Nurseries.</b>	7	2X2=4	5X1=5	10X1=10	<b>19</b>
<b>Unit 2: Gardening and Landscaping:</b>	8	2X2=4	5X2=10	10X1=10	<b>24</b>
<b>Unit 3: Garden Plants:</b>	5	2X2=4	5X2=10	-	<b>14</b>
<b>Unit 4: Commercial Floriculture</b>	8	2X1=2	-	10X2=20	<b>22</b>
<b>Unit 5: Diseases and Pests of Ornamental Plants.</b>	2	2X1=2	5X1=5	-	<b>07</b>
<b>Total</b>	<b>30</b>	<b>8X2=16</b>	<b>5X6=30</b>	<b>10X4=40</b>	<b>86</b>

**Ethnobotany**  
**Theory (Credits 2)****Lectures: 30 Hours**  
**(2 hours/week)****Course outcome**

After completion of the course the student is able to:

**CO1.** Understand the details of Ethnobotany

**CO2.** Learn the characteristics of traditional medicinal plants

**Unit 1- Ethnobotany: (6 Lectures)**

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science

The relevance of ethnobotany in the present context; Major and minor ethnic groups or

Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

**Unit 2- Methodology of Ethnobotanical studies: (6 Lectures)**

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places.

**Unit 3- Role of Ethnobotany in modern Medicine: (10 Lectures)**

Medico-ethnobotanical sources in India; Significance of the following plants in ethnobotanical practices (along with their habitat and morphology) a) *Azadirachta indica* b) *Ocimum sanctum*

c) *Vitex negundo* d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata*

g) *Cassia auriculata* h) *Indigofera tinctoria*

Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*.

Role of ethnic groups in conservation of plant genetic resources Endangered taxa and forest management (participatory forest management).

**Unit 4- Ethnobotany and legal aspects: (8 Lectures)**

Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with

few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

## References

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
- 3) Lone et al,. Palaeoethnobotany
- 4) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
- 5) S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
- 6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
- 7) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-19969)

DME23408 /DME23407

III B.Sc., V Semester SEC-II  
**Ethnobotany**  
Scheme of Theory Question Paper

Blue print:

Max. Marks: 50

Units	Hours allotted	No. of questions from each category			Total Marks 50
		2 marks (5/8)=10	5marks (4/6)=20	10marks (2/4)=20	
Unit 1: Ethnobotany	6	2X2=4	5X1=5	10X1=10	19
Unit 2: methodology of Ethanobotanical studies	6	2X3=6	5X2=10	-	16
Unit 3: role of ethonobotany in modern medicine	10	2X2=4	5X1=5	10X2=20	29
Unit 4: Ethnobotany and legal aspects	8	2X1=2	5X2=10	10X1=10	22
<b>Total</b>	<b>30</b>	<b>8X2=16</b>	<b>5X6=30</b>	<b>10X4=40</b>	<b>86</b>

**Course outcome:**

After completion of the course the student is able to:

- CO1 Specify the details of heredity
- CO3 Write down the classification and characteristics of mutations
- CO4 Learn the details of plant breeding
- CO2 Identify in details with examples linkage

**Unit 1- Heredity:****(24 Lectures)**

1. Brief life history of Mendel
2. Terminologies
3. Laws of Inheritance
4. Modified Mendelian Ratios: incomplete dominance; complementary factors; supplementary factors, Duplicate factors, Epistasis.
6. Pedigree Analysis
7. Cytoplasmic Inheritance: leaf variegation in *Mirabilis jalapa*, Male sterility.
8. Chromosome theory of Inheritance.
9. Quantitative inheritance-Concept, mechanism, examples. Monogenic vs polygenic Inheritance.

**Unit 2- Sex-determination and Sex-linked Inheritance:****(6 Lectures)**

Sex – determination in *Melandrium album* by XX-XY method, Bridges Genic balance theory, Sex-linked Inheritance

**Unit 3- Linkage and Crossing over:****(8 Lectures)**

Linkage: complete & incomplete linkage, coupling & repulsion, recombination frequency, linkage in Maize, two point test cross, linkage maps, Coincidence and interference. Crossing over: concept and significance.

**Unit 4-Mutations and Chromosomal Aberrations:****(6 Lectures)**

Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy; Structural chromosomal changes: Deletions, Duplications, Inversions & Translocations.

**Unit 5- Plant breeding and Methods of crop improvement:**

**(12 lectures)**

Introduction, objectives and Methods: Plant introduction, selection, Hybridization- Emasculation and bagging. Mutation breeding, polyploidy breeding, genetic or molecular plant breeding. Methods of propagation– Procedure, advantages and limitations

**Unit 6- Inbreeding depression and heterosis:**

**(4 lectures)**

Inbreeding depression and Heterosis; Applications. Germplasm maintenance, Pollen banks and Quarantine measures.



1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.
3. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs.
6. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
7. Hybridization techniques - Emasculation, Bagging (For demonstration only).
8. Induction of polyploidy conditions in plants (For demonstration only).

#### Suggested Readings

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. WileyIndia.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

**III B.Sc., VI Semester DSE-III  
Genetics and Plant Breeding  
Scheme of Practical Question Paper**

**Time: 4 Hours**

**Max. Marks: 35 (25+05+05)**

- I. Perform the experiment 'A'. 6 marks**  
(Emasculation and bagging)  
Preparation -2 marks  
Sketch and label - 2marks  
Reasons - 2marks
- II. Conduct experiment 'B'. 4 marks**  
(Induction of polyploidy)  
Principle -1 marks  
Requirements -1 marks  
Procedure -1 marks  
Result and inference -1 marks
- III. Problems on Chromosome mapping using point test cross data 'C'. 4 marks**
- IV. Comment on the given specimen 'D' 3 marks**  
(Pedigree analysis)  
Identification - 1mark  
Reasons - 2marks
- V. Problems on gene interaction 'E' 4 marks**
- VI. Identify the given photographs 'F' & 'G' 2x2=4 marks**  
(F- Aneuploidy & G- Translocation)  
Identification - 1mark  
Reasons - 1marks
- VI. Practical record 5 marks**
- VII. Viva-Voce 5 marks**

**III B.Sc., VI Semester DSE-III  
Genetics and Plant Breeding  
Scheme of Theory Question Paper**

**Time: 3.00 Hours**

**Max. Marks: 70**

**Blue print:**

Units	Hours Allotted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)40	
<b>Unit 1: Heredity</b>	24	2X3=6	5X1=5	10X3=30	<b>41</b>
<b>Unit 2: Sex-determination and Sex-linked Inheritance</b>	4	2X1=2	5X1=5	-	<b>7</b>
<b>Unit 3: Linkage and Crossing over</b>	8	2X1=2	-	10X1=10	<b>12</b>
<b>Unit 4: Mutations and Chromosomal Aberrations</b>	4	2X1=2	5X1=5	-	<b>7</b>
<b>Unit 5: Plant Breeding</b>	4	2X1=2	5X1=5	-	<b>07</b>
<b>Unit 6: Methods of crop improvement</b>	8	-	5X1=5	10X1=10	<b>15</b>
<b>Unit 7: Inbreeding depression and heterosis</b>	4	2X1=2	5X1=5	-	<b>02</b>
<b>Unit 8: Crop improvement and breeding</b>	4	-	-	10X1=10	<b>10</b>
<b>Total</b>	<b>60</b>	<b>8X2=16</b>	<b>5X6=30</b>	<b>10X6=60</b>	<b>106</b>

**Course outcome:**

After completion of the course the student is able to:

- CO2 Learn the details of Spectrophotometry
- CO3 Write down the details of chromatography
- CO1 Specify the details of cell fractioning
- CO4 Identify in details with application, if applicable, biostatistics

**Unit 1: Imaging and related techniques (15 Lectures)**

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

**Unit 2: Cell fractionation (8 Lectures)**

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl<sub>2</sub> gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

**Unit 3: Radioisotopes (4 Lectures)**

Use in biological research, auto-radiography, pulse chase experiment.

**Unit 4: Spectrophotometry (4 Lectures)**

Principle and its application in biological research.

**Unit 5: Chromatography (8 Lectures)**

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ionexchange chromatography; Molecular sieve chromatography; Affinity chromatography.

**Unit 6: Characterization of proteins and nucleic acids (6 Lectures)**

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

**Unit 7: Biostatistics (15 Lectures)**

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

**DMF23308/ DMF23307**

**III B.Sc., VI Semester DSE-IV  
Analytical Techniques in Plant Science  
Practicals (2 credits)**

**Lectures: 60 Hours  
(4 hours/week)**

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

**Suggested Readings**

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGrawHill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition

**III B.Sc., VI Semester DSE-IV**  
**Genetics and Plant Breeding**  
**Scheme of Theory Question Paper**

**Time: 3.00 Hours**

**Max. Marks: 70**

**Blue print:**

Units	Hours Allotted	No. of questions from each category			Total Marks 70
		2 marks (5/8)=10	5marks (4/6)=20	10marks (4/6)40	
<b>Unit 1: Imaging and related techniques</b>	15	2X2=4	5X2=10	10X1=10	<b>24</b>
<b>Unit 2: Cell fractionation</b>	8	2X1=2	5X1=5	10X1=10	<b>17</b>
<b>Unit 3: Radioisotopes</b>	4	2X2=4	-	-	<b>4</b>
<b>Unit 4: Spectrophotometry</b>	4	2X1=2	-	10X1=10	<b>12</b>
<b>Unit 5: Chromatography</b>	8	-	5X1=5	10X1=10	<b>15</b>
<b>Unit 6: Characterization of proteins and nucleic acids</b>	6	2X1=2	5X1=5	-	<b>7</b>
<b>Unit 7: Biostatistics</b>	15	2X1=2	5X1=5	10X2=20	<b>27</b>
<b>Total</b>	<b>60</b>	<b>8X2=16</b>	<b>5X6=30</b>	<b>10X6=60</b>	<b>106</b>

**Botany Pattern of theory question paper (CBCS)**  
**DSC I-DSC IV**  
**(I semester to IV)**

**Time: 3 Hours**

**Max. Marks: 70**

**Instructions to the candidates:**

Draw neat labelled diagrams where ever necessary.

**I. Explain / define any FIVE of the following.**

**2x5=10**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Write short notes on any FOUR of the following.**

**5x4=20**

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.

**III. Give comprehensive and detailed account of any FOUR of the following.**

**10x4=40**

- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

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**Botany Pattern of theory question paper (CBCS)**

**DSE**

**(V semester to VI)**

**Time: 3 Hours**

**Max. Marks: 70**

**Instructions to the candidates:**

Draw neat labelled diagrams where ever necessary.

**II. Explain / define any FIVE of the following.**

**2x5=10**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Write short notes on any FOUR of the following.**

**5x4=20**

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.

**III. Give comprehensive and detailed account of any FOUR of the following.**

**10x4=40**

- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

**\*\*\***



**Botany Pattern of theory question paper (CBCS)**

**SEC**

**(V semester)**

**Time: 2 Hours**

**Max. Marks: 50**

**Instructions to the candidates:**

Draw neat labelled diagrams where ever necessary.

**III. Explain / define any FIVE of the following.**

**2x5=10**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Write short notes on any FOUR of the following.**

**5x4=20**

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.

**III. Give comprehensive and detailed account of any TWO of the following.**

**10x2=20**

- 15.
- 16.
- 17.
- 18.

**\*\*\***

**Suggested Readings:**

<b>Author</b>	<b>Title of the Book</b>	<b>Publisher</b>
<b>VIRUSES AND BACTERIA</b>		
R.C.Dubey and D.K. Maheshwari	A textbook of Microbiology	S. Chand & company, Ramnagar N.Delhi-110005.
P.D. Sharma	Microbiology	Rastogi Publications; Shivaji road Meerat; 250002; India
P. D. Sharma	Microbiology and Plant pathology	Rastogi Publications; Shivaji road Meerat; 250002; India
H. C. Dube	Text book of fungi, Bacteria & Virus	Vani Educational books , Vikas house 20/4, Industrial area, Sahidabad, 201010, Ghaziabad, UP.
Power & Dagainawala		Himalaya Publishing house, Bombay
Power & Dagainawala	General Microbiology. Vol. I	Himalaya Publishing house, Bombay
	General Microbiology. Vol. II	
Pelzar Michael.J		
Prescott, Lansing and Others	Text Book of Microbiology	Orient and Longman, New Delhi.
Ananthanarayana .R . Jayaram Panicker	Text Book of Microbiology	Tata Mc graw Hill
a) salle. A. J.	Functional Principles of Bacteriology	Himalaya Publishing house, Bombay
Vinita Kale and Kishore Bhusari	Applied Microbiology.	
Frazier William. C.	Food Microbiology	ELBS Publisher , New Delhi
Cruckishank	Text book of Medical Microbiology	Prentice Hall of India N.Delhi
Rangaswamy.G.	Diseases of crop plants in India.	Vardaman Publishers , Bangalore. Vol. III & Vol. IV.
Sundar Rajan	College Microbiology	Tata McGraw Hill Publishing company.
William. C. Frazier and Dennis C. West hoff. 3 <sup>rd</sup> Edn	Food Microbiology	R. Chand & company, Publishers, N.Delhi.
<b>ALGAE</b>		
K.N. Bhatia	A Treatise on Algae	Pradeep Pub., Jalandhar. Mc graw Hill , New york.
Chopra. G.L	A Text book of Algae	Thomas, Nelson and Sons
G. M. Smith	Cryptogamic Botany Vol. I	Rastogi Publications
Prescott, G.W	The Algae to Review	Cambridge University Press
Kumar, M.A and Kashyap.	Recent advances in physiology	

A.K. Fritsch. F. E.  Chapman V.J. & Chapman D.J. Singh, Pande, Jain.  B. P. Pandey  Darley. M. W.	Structure and Reproduction of Algae Vol. I & Vol. II The Algae 2 <sup>nd</sup> Edn. A text book of Botany  Simplified course in Botany  Algal Biology	Mac Milan, Publishing New York. Rastogi Publications; Shivaji road Meerat; 250002; India S. Chand & company, Ltd. Ramnagar N. Delhi-110005. Black well Publishers.  Mc Grawhill, New York. Wiley Eastern Ltd. New Delhi.
<b>FUNGI</b> Smith. G. M. Allexopolos. C. J. and Mims. C. W. Chopra G. L. and Verma. V Mundkur, B. B. Rangaswamy, G. Sharma. P. D. Vashista, R.R.	Cryptogamic Botany Vol. I Introduction to Mycology  Text book of Fungi Fungi & Plant diseases Diseases of India 3 <sup>rd</sup> Edition The fungi Fungi	Pradeep publications, Jalandar Mac Milan & Co Calcutta Prentice Hall of India New Delhi. Rastogi Publications S. Chand and Company, New Delhi.  S. Chand and Company, New Delhi. S. Chand and Company, New Delhi. Central book depot, Allahabad. Mc Grawhill, New York Pradeep Publications, Jalandar.
<b>BRYOPHYTA</b> Pandey. B.P.  Vashista. B. P.  Parihar. N.S. G. M. Smith G. L. Chopra  Chauhan D.K.S	Bryophyta  Bryophyta  Bryophyta Cryptogamic Botany vol. I Class Book and Pteridophytes  Bryophytes and Pteridophytes  Introduction to Plant Anatomy	MC Graw Hill, New York.  Wiley Eastern, New Delhi. S. Chand and Company. Rastogi publications, Meerat.  Rastogi publications, Meerat.
<b>ANATOMY</b> Eames A.J. and Mac Daniels, L. H Katherien Esau Pandey. B. P Singh. V., Pandey, P.C and Jain, D.K. Tayal M. S. Ganguli Das L Datta Venkateshvaralu	Anatomy of seed plants Introduction to Plant Anatomy Anatomy of seed plants  Plant anatomy College Botany Vol. I Cytology and Anatomy	
<b>EMBRYOLOGY OF ANGIOSPERMS &amp; TAXANOMY</b> Bhojwani. S. S. & Bhatnagar, S. P.	The Embryology of Angiosperms  The Embryology of Angiosperms	Vikas publishing HOUSE, New Delhi. Rastogi publications, Shivaji Road, Meerat, 250002. MC Graw Hill publishing

Singh, Pandey, Jain Maheshwari , P Johri, B.M. Eames A. J. Reinert . J and Yeoman M.M Vashishta George H.M. Lawarance. R.N. sutaria A. C. Dutta <b>PTERIDOPHYTA</b> Bold , H.C., Alexopoulos, C.J & Delevoryas, T. Eames, Arthur, J. Parihar, N.S. 1977 Pandey, S.N.& Others Rashid,A.1986 Sporne,K.R.1970 Vashista,P.C. 1987 <b>GYMNOSPERMS</b> Datta, S.C. Pandey, B.P. Ramaswamy, S.N. 1984 Saxena and Sarabhai 1993 Sporne, K.R.1969 Trivedi, B.S.& Singh, D.K Vashista, B.R. Andrews, H.N. 1961 Biswas, C. & Johri, B.M. 1997 <b>PLANT PHYSIOLOGY</b> Conn, E.E. and Stumpf,P.K.1976 Datta, S.C. Delvin, R.M. 1969	The Embryology of Angiosperms  Comparative Embryology of Angiosperms Morphology of Angiosperms Plant cell and Tissue culture.  Plant Anatomy Taxonomy of Vascular plants A Text book of systematic Botany Botany for Degree Students.  Morphology of plants and Fungi  Morphology of vascular plants (lower groups ). The Biology and Morphology of Pteridophytes.  Text book of Botany, Vol. II An introduction to Pteridophyta. The Morphology of Pteridophytes  Pteridophyta  An Introduction to Gymnosperms. Gymnosperms. Anavrutha beeja sasyagalu (Gymnosperms) Text book of Botany Vol. II. The Morphology of Gymnosperms.  An Introduction to Gymnosperms. Gymnosperms. Studies in palaeobotany. The Gymnosperms.  Out line of Biochemistry  Plant physiology	Company, New Delhi. Ind. Sci. Acad. Bull. No.41, New Delhi. MC Graw Hill, New York. Narosa publishing House New Delhi.  Harper C Row, New York.  Mc Graw Hill, New York.  Central book depot. Allahabad.  Vikas publishing House, New Delhi. Vani educational books, New Delhi. Hutchinson university library, London. S. Chand and Co., New Delhi.  Asia publishing house, New Delhi. K. Nath and Co. Prasaranga, University of Mysore, Mysore. Ratna Prakashana Mandir, Agra Hutchinson university library, London. Shashidhar Malaviya Prakashan. S.Chand & Co. New Delhi. Wiley, New York. Narosa, New Delhi.  Wiley-Estern, New Delhi.  Centar book Depot, Allahabad. Affiliated East West, New Delhi. Affiliated East West, New Delhi.
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Delvin, R.M. & Barker, A.V. 1971	Plant physiology	S.Chand & Co. New Delhi.
Jain, V.K. 1990	Photosynthesis	East West Press Pvt. Ltd. New Delhi.
Kumar, H.D. & Singh, H.N. 1975, 1993	Fundamentals of Plant physiology	Atma Ram & Sons, New Delhi.
Krishnamurthy, H.N.	Plant Metabolism I Edn. & II Edn.	Prentice Hall of India Pvt. Ltd.
Lehninger, A.L. 1978	Physiology of plant Growth and Development.	S.Vishwanatha, Pvt. Ltd.
Noggle, G.R. and Fritz George, J. 1977.	Biochemistry	Wiley Eastern, New Delhi.
Rao, K.N. Sudhakar Rao and Bharatan, S. 1987	Introductory Plant physiology	Wiley Eastern, New Delhi.
Rabinowitch, E. & Govindjee. 1970	The function of plant.	First Indian Edn. CBZ Publishers and Distributers, New Delhi.
Salisbury, E.E. & ross, C.W. 1986	Photosynthesis	
	Plant physiology	Ann Arbor Science, Michigan.
<b>ECOLOGY &amp; ENVIRONMENTAL BIOLOGY</b>		
Aarne Vesilid, P & Jeffrey Pierce, J. 1983	Environmental Pollution and Control	McGraw Hill.
BentonAllen.H & Warner, WE		John Wiley and Sons, New York.
Colinvaux paul, A. 1973	Field Biology an Ecology	Tata-McGraw Hill publishing Co. New Delhi.
Dash,M.C.	Introduction to Ecology	S.Chand & Co, New Delhi.
Dara, S.S. 1993	Fundamentals of Ecology	Prentice Hall of india New Delhi.
Kormondy Edward, J. 1986	A Text book of Environmental Chemistry and Pollution Control.	Ratna Prakashan mandir, Agra.
Kochhar, P.L. 1990	Concept of Ecology	Vishal Publications, Jalandar.
Kotpal, R.L. 7 Bali, N.P. 1987	Plant Ecology	Vikas, New Delhi.
Kumar,H.D. 1990	Concept of Ecology	Macmillan Education Ltd. London.
Lloyd, J.R.1980	Concept of Ecology	Longman Inc., newe York.
Mason, C.E.1981	Man and the ecosystem.	Oxford and IBH, New Delhi.
Misra.K.C. 1989	Biology of fresh water Pollution	Saunders, W.B. Philadelphia
Odum,E.P. 1971	Manual of plant Ecology	Wiley, New York.
Odum,E.P. 1983	Fundamentals of Ecology	Divyajyoti prakashan Jodhpur.
Pratap Mowli, P & Venkata Subbaya, N. 1989.	Basic Ecology	Rastogi Publications, Meerut
Sharma, P.D.	Air Pollution and Control	I Edn. Rastogi Publications,Meerut.
Sharma, P.D.	Ecology and Environment	Anmol Publications, New Delhi.
Trivedi, R.N. 1993	Environmental Biology	Vishal Publications jalandhar.

Vashista, P.C. 1989	Text book of Environmental Sciences	S.Chand & Co., New Delhi.
Verma, P.S. and Agarwal, V.K. 1992	Plant Ecology	Macmillan, new York.
Whittaker, R.H. 1975	Principles of Ecology	
<b>CYTOLOGY, GENETICS AND EVOLUTION</b>		
Ahluwalia Kavita, B. 1985.	Communities and Ecosystems II Edn.	Wiley Eastern Ltd.
Booker, R.J 1999	Genetics	Addison Wesley Longman, California.
Archana Sharma, 1990	Genetics-Analysis and Principles	Oxford and IBH, New Delhi Benjamin Cummings.
Ayala, F.J. and Klug, Jr. 1984	The Chromosomes	Tata mcGrawHill, New Delhi
Cherayil, J.D 1974	Modern Genetics II Edn.	W.B.Saunders and Co. Philadelphia
De Robertis, E.D.P. Solez, F.A & Nowinski, W.W. 1966	Gene and Genetics	Surjeet publications, New Delhi
Dobzhansky, T., Ayala, J., Stebbins	Cell Biology	
Dobzhansky, T. 1951	Evolution	Oxford and IBH publishing Co., New Delhi
Dowben Robert, M 1971	Genetics and Origin of species	Harper and Row publishers, John Wiley and Sons,
Gardner, E.J	Cell biology	
& Snustad, D.P. 1984 & 1990	Principles of Genetics	Rastogi publications, Meerut.
Gupta, P.K 1987	Genetics	Prentice Hall of India. New York.
Hexter, W and Yost Henry, T. 1977	The Science of Genetics	Macmillan, India, New Delhi
Jha, A.P. 1993.	Genes and Evolution	George Allen & Unwin, London.
Huxley, J. 1974	Evolution	15 <sup>th</sup> Edn. Rattan prakashan Mandir, Agar.
Kochhar, P.L. 1994	Genetics and Evolution	Amerind Publishing co. New Delhi
Loewy Ariel, G. & Philip Siekevitz. 1974	Cell structure and function	Holt, Rinehart and Winston, New York.
Marril David, J. 1962	Evolution and Genetics	Konark Publishers pvt.Ltd. A. 149, Main Vikar Marg, New Delhi
Nair, P.G.K. Prabhakar Achar, K.	A Text book of Genetics & Evolution	Brooks-Cole, California.
Fairbanks, D.J. and Anderson, W.R. 1999	Genetics – the community of life	
Pawar, C.B. 1983	Essentials of Cytology	Himalayan publishing house, Bombay.
Savage, J.M. 1969	Evolution	Oxford and IBH, New Delhi
Stansfields, W.D. 1977	The Science of Evolution	Calif polytechnic state university and Macmillan, New York.
Sinnot, E.W., Dunn, L.C.,	Principles of Genetics	

& Dobzhansky, T 1958	Principles of Genetics	McGraw Hill, New York
Snustad, D.P., Simmons, M.J. & Jenkins, J.R. 1997		John Wiley, New York.
Swanson Carl, P. 1963	Cytology and Cytogenetics	
Swanson Carl, P & Webster Peter, L.	The Cell	Macmillan & Co., Ltd. London.
Strickberger Monroe, W. 1968	Genetics	Prentice Hall of India Pvt. Ltd., New Delhi
Strickberger Monroe, W. 1996	Evolution	Macmillan Company, New York.
Winchester, A.M. 1966	Genetics	John & Bartlett Sandburry.
<b>PLANT BREEDING, ECONOMIC BOTANY AND TAXONOMY</b>		Oxford & IBH, New Delhi
Allard, R.W. 1960	Principles of Plant Breeding	
Bailey, L.H. 1966	Manual of cultivated plants	John Wiley, New York
Chandrasekharn, S.N., Parthasarathy, S.V. 1973	Cytogenetics and Plant Breeding	Macmillan & Co., New York.
Chaudhari, H.K. 1980	Elementary principles of Plant Breeding	Varadachary and Co., Madras.
Hartman, h.T. & Kester, D.E. 1976	Plant Breeding	Oxford and IBH publishing Co., New Delhi.
Hill, Albert, F. 1983	Economic Botany	Principles and practices, Prentice Hall of India Pvt. Ltd., New Delhi.
Jain S.C.	Medicinal plants	Delhi.
Hutchison, J. 1973	The families of Flowering plants	.Tata-McGraw Hill publishing Co. New Delhi.
Lawrence, George, H.M. 1964.	Taxonomy of Vascular plants	Oxford University Press, London.
Naik, V.N. 1984	Taxonomy of Angiosperms	Oxford and IBH publishing Co., New Delhi
Johri, B.M. & Bhatnagar, S.P.	Taxonomy of Angiosperms	Tata-McGraw Hill publishing Co. New Delhi.
Pullaiah, T. 1998	Taxonomy of Angiosperms	Narosa publishing House New Delhi.
Radford, A.E., Dickison, W.C., Massey, Jr & Bell, C.R 1974	Vascular Plant Systematics	Regency Publications, New Delhi.
Poehlman, J.M. & Dhirendranath, B. Ramaswamy, S.N., Radhakrishna Rao, M & Govindappa, D.A. 2001	Breeding Asian Field Crops	Harper & Row, New York.
Ramaswamy, S.V. & Razi, B.A. 1973	Flora of Shimoga District	Oxford and IBH publishing Co., New Delhi
Rendle, A.B. 1979	Flora of Bangalore District.	Prasaranga, University of Mysore, Mysore.
	Classification of Flowering Monocotyledons Vol.I. (Indian Reprint Edition)	Prasaranga, University of Mysore, Mysore.
	Classification of Flowering plants-Dicotyledons Vol. II.	Vikas Publishing house, New Delhi.

Rendle, A.B. 1979	(Indian Reprint Edition) A text book of Economic Botany.	Vikas Publishing house, New Delhi.
Samba Murthy, A.V.S.S. & Subramanyam. N.S. 1973	Flora of Karnataka, Vol. I & Vol. II	Tata-McGraw Hill publishing Co. New Delhi.
Saldhana, Cecil, J. 1984	Flora of Hassan district (Karnataka, India)	Oxford and IBH publishing Co., New Delhi
Saldhana, Cecil, J., & Nicolson Dan, H. 1976	Text book of Botany, Vol. III.	Amerind Publishing Co. Pvt. Ltd., New Delhi.
Saxena and Sarabhai. 1993	Plant Taxonomy	Ratan Prakashan Mandir. Agra.
O.P. Sharma	Flora of India series 2: Flora of Karnataka.	Tata-McGraw Hill publishing Co. Ltd. 4/12, Asif ali road, New Delhi.
Sharma, B.D., Singh, N.P., Raghavan, R.S. & Miss. Deshpande, U.R. 1984	Taxonomy of Angiosperms	Botanical Survey of India & Dept. of Environment, New Delhi.
Singh, V.	Introduction to Principles of plant taxonomy	
Sivarajan, V.V. 1984	Dictionary of Economic plants in India	
Umarao Singh, Wadhvani, A.M. & Johri, B.M. 1983	Taxonomy of Angiosperms	
Vashishta, P.C. 1976	A Text book of Practical Botany Vol. I & II	Rastogi Publications. Kalyani Publications, New Delhi.
<b>GENERAL</b>	Practical Botany Vol. I & II	ICAR, New Delhi.
Ashok Bendre and Ashok Kumar	College Botany Vol. I, II, III & IV	R. Chand & Co., New Delhi
Dr. H.M. Srivastava	Medicinal Plants Vol. 1- 5	Rastogi Publications, Shivaji road, Meerut.
Sundararajan, S.	Global Biodiversity Assessment	Pradeep publications opp. Sitta Mandhir, Jalandhar.
Kottakkal Arya Vaidya sala's	Biodiversity and Ecosystem functions	Subha's Publications, Bangalore.
<b>BOOKS ON BIODIVERSITY</b>	Biodiversity and Ecosystem function, Scope.	Cambridge University press, U.K.
Heywood, H & Watson, R.J. 1995	Biodiversity: Implications for global food security	Springer-verlag, Berlin.
Schulze, E.D. & Mooney, H (eds.) 1992	Endemic plants of the Indian region Vol. I.	John Wiley, Chichester.
Mooney, H.A. et al. (eds). 1996	Threatened Plants of India- A State-of-the-Art report	Macmillan India Ltd. Madras.
Swamynathan, M.S. & Jana, S. 1992	Indian plant red data book Vol. I	BSI Calcutta
Ahmedullah, M. & Nayar, M.P. 1987	Biodiversity Database projects in India.	BSI Calcutta
Jain, S.K. & Sastry, A.R.K. 1980		BSI Calcutta
Puri, S.K.		Indira Gandhi Conservation Monitory Centre, New Delhi.



## LIST OF APPROVED PANEL OF EXAMINERS:

Sl. No	Name	Designation and DOB	Joining Date	Phone number
<b>Internal Examiners</b>				
1.	Dr.Prathibha S JSS College, Ooty Road, Mysore	Asso. Prof. 28/04/1964	28/08/1986	9243707241
2.	Gayathri Devi N Jss College, Ooty Road, Mysore	Asst. Prof.	01-01-2005	8050684736
3.	Kiran B L JSS College, Ooty Road, Mysore	Asst. Prof.	23-09-2015	9638219347
<b>External Examiners</b>				
5.	Dr. Ravikumar B S AVK College For Women, Hassan	Asso. Prof. 13/07/1962	16/07/1987	8861716456
6.	Mallikarjunamiah M N Maharani`s Science college For Women, Mysore	Asso. Prof. 05/11/1963	14/08/1992	9880006223
7.	Dr. Hemavathi C Govt. First grade college, Vijayanagar, Mysuru	Asso. Prof. 05/04/1966	17/08/1992	9980748813
8.	Dr. Vijay C R Maharani`s Science College For Women, Mysore	Asso. Prof. 01/10/1962	29/12/1992	9448028585
9.	Dr. Shivalingaiah Maharani`s Science College for Women, Mysore	Asst. Prof. 01/06/1968	08/01/1996	9036766869
10.	Dr. Purushotham S P Maharani`s Science College for Women, Mysore	Asst. Prof. 15/05/1967	02/08/1996	9448115524
11.	Dr. Lingaraju D P AVK College for Women, Hassan	Asst. Prof. 26/02/1965	23/10/2002	9108585024
12.	Dr. Basavaraju G L Govt College for Women, Mandya	Asst. Prof. 21/07/1976	30/01/2004	
13.	Dr. Devika M Saradavilas College, Mysore	Asst. Prof. 14/03/1970	14/12/2005	9880024483
14.	Dr. Pruthviraj Sri Mahadeshwara Govt. First grade college	Asso. Prof.		9448925262
15.	Dr. Nataraju Maharani`s Science College for Women, Mysore	Asso. Prof.		9448033901
16.	Dr. Suresh N S Maharani`s Science College for Women, Mysore	Asst. Prof. 25/02/1975	02/05/2006	9242243601
17.	Dr. Jayalakshmi B Maharani`s Science College for Women, Mysore	Asst. Prof. 18/11/1974	14/07/2006	9482640645
18.	Sowmya H K Govt Science College,Hassan	Asst. Prof. 18/06/1970	22/12/2007	7338466887
19.	Dr. Thoyajaksha Govt Science College, Hassan	Asst. Prof. 20/07/1970	24/12/2007	9743779983
20.	Sandhya Rani D Maharani`s Science College for Women, Mysore	Asst. Prof. 24/08/1972	24/12/2007	9448602597
21.	Dr. Pushpalatha H G Maharani`s Science College for Women, Mysore	Asst. Prof. 23/12/1979	26/12/2007	9480442844
22.	Dr. Ashok N Pyati Maharani`s Science College for Women, Mysore	Asst. Prof. 22/04/1970	28/12/2007	7204661365
23.	Dr. Deepa Hebbar Maharani`s Science College for Women, Mysore	Asso. Prof.		9632869690

24.	Indushree PES College, Mandya	Asst. Prof.		8151917465
25.	Dr. Lalitha V Maharani`s Science College for Women, Mysore	Asst. Prof.		8105004148
26.	Revanamaba B Maharani`s Science College for Women, Mysore	Asst. Prof.		9448528471
27.	Dr. Sharvani, K.A Yuvarajas college, Mysore.	Asst. Prof.		9845885896
28.	Dr. Krishna Yuvarajas college, Mysore.	Asst. Prof.		
29.	Dr. Krishnamurthy Yuvarajas college, Mysore.	Asst. Prof.		
30.	Kalpashree Yuvarajas college, Mysore	Asst. Prof.		8088413446
31.	Dr. Anil Kumar Yuvaraja College, Mysuru	Asst. Prof.		8970945497
32.	Dr. Girijamba Maharani`s Science College for Women, Mysore	Asst. Prof.		9945616792
33.	Dr. Netra Maharani`s Science College for Women, Mysore	Asst. Prof.		9620782198
34.	Dr. Poornima Yuvaraja College, Mysuru	Asst. Prof.		8217642534
35.	Nayana, K. N. Yuvaraja College, Mysuru	Asst. Prof.		9964041544
36.	Dr. Shamala Maharani`s Science College for Women, Mysore	Asst. Prof.		7019453250

## **Aims of Bachelor's degree programme in Botany**

The broad aims of the bachelor's degree programme in Botany are:

1. To provide an environment that ensures the cognitive development of students in a holistic manner. A dialogue about plants and their significance is fostered in this framework, rather than didactic monologues on mere theoretical aspects
2. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
3. To mould a responsible citizen who is aware of the most basic domain-independent knowledge, including critical thinking and communication.
4. To enable the graduate to prepare for national as well as international competitive examinations, especially UGC-CSIR NET, and UPSC Civil Services Examination.

### **Program Learning Outcomes**

The students graduating with the Degree B.Sc. Three years and B. Sc. (Honors) Botany should be able to acquire.

**Core competency:** Students will acquire core competency in the subject Botany, and allied subject areas.

1. The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms) plants.
2. Students will be able to use the evidence-based comparative botany approach to explain the evolution of organisms and understand the genetic diversity on the earth. The students will be able to explain various plant processes and functions, metabolism, concepts of gene, genome, and how organism's function is influenced at the cell, tissue, and organ level.
3. Students will be able to understand the adaptation, development, and behavior of different forms of life.
4. The understanding of networked life on earth and tracing the energy pyramids

through nutrient flow is expected from the students.

5. Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Botany.

**Analytical ability:**

The students will be able to demonstrate the knowledge in understanding research and addressing practical problems.

1. Application of various scientific methods to address different questions by formulating the hypothesis, data collection, and critically analyze the data to decipher the degree to which their scientific work supports their hypothesis.

**Critical Thinking and problem-solving ability:**

An increased understanding of fundamental concepts and their applications of scientific principles is expected at the end of this course. Students will become critical thinkers and acquire problem-solving capabilities.

**Digitally equipped:**

Students will acquire digital skills and integrate the fundamental concepts with modern tools. **Ethical and Psychological strengthening:** Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.

**Team Player:** Students will learn team workmanship in order to serve efficiently institutions, industry, and society

**Independent Learner:**

Apart from the subject-specific skills, generic skills, especially in botany, the program outcome would lead to gain knowledge and skills for further higher studies, competitive examinations, and employment. Learning outcomes-based curriculum would ensure equal academic standards across the country and a broader picture of their competencies. The Bachelor's program in Botany and Botany honors may be mono-disciplinary or multidisciplinary with following broad objectives.

1. Critically evaluation of ideas and arguments by collecting relevant information about the plants, to recognize the position of the plant in the broad classification and Phylogenetic level.
2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.
3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of the plant in taxonomy.

4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.
5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists.
6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.
7. Students will be able to apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biological situations.
8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, and fungi that differentiate them from each other and other forms of life.
9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.
10. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems
11. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

## **B. Sc. Botany Programme outcomes as per NEP 2020**

**Name of the Degree Program: B.Sc.**

**Discipline Core: Botany**

**Total Credits for the Program: 176**

**Starting year of implementation: 2021-22**

### **Program Outcomes:**

#### **By the end of the program the students will be able to:**

(Refer to literature on outcome based education (OBE) for details on Program Outcomes)

**PO1:** Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.

**PO2:** Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.

**PO3:** Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

**PO4:** Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.

**PO5:** Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.

**PO6:** Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.

**PO7:** Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research in all branches of Botany..

**PO8:** Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

**PO 9:** To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC etc.

**PO10:** To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.

**PO 11:** The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies etc at the right opportunity.

**PO 12:** The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in the professional career

## **B. Sc. Botany Programme specific outcomes as per NEP 2020**

**PSO1:** The framework of curriculum for the Bachelor's program in Botany aims to transform the course content and pedagogy to provide a multidisciplinary, student-centric, and outcome-based, holistic education to the next generation of students.

**PSO2:** Aside from structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels; keeping in mind the job prospects; the emphasis has been to maintain academic coherence and continuum throughout the program of study and help build a strong footing in the subject, thereby ensuring a seamless transition into their careers.

**PSO3:** Special attention is given to eliminate redundancy, discourage rote learning, and espouse a problem-solving, critical thinking, and inquisitive mindset among learners.

The curriculum embraces the philosophy that science is best learned through experiential learning, not limited to the confines of a classroom but rather through hands-on training, projects, field studies, industrial visits, and internships.

**PSO4:** This updated syllabus, with modern technology, helps students stay informed on the leading- edge developments in plant sciences and promotes curiosity, innovation, and a passion for research, that will serve them well in their journey into scientific adventure and discovery beyond graduation.

**PSO5:** The goal is to equip students with holistic knowledge, competencies, professional skills, and a strong positive mindset that they can leverage while navigating the current stiff challenges of the job market.



## SUGGESTED METHODOLOGY FOR TEACHING, LEARNING AND EVALUATION

### TEACHING-LEARNING

The whole programme is an Outcome Based Education. Different methods are to be used for teaching learning evaluation; in order to attain the fixed outcomes.

#### **Theory:**

*Student:* Review of Literature, Assignment, Presentation, e-learning, Discussion and Debate with peer group, teachers and experts.

*Teacher:* Lecture, Demonstration, Presentation, Discussion and Debate.

#### **Practical:**

*Student:* Identification, Comparison, Differentiation and Categorization of different plants and their parts by observing Permanent Slides, Hand sectioning etc., Demonstration, Experimentation, Field visit, Report Writing and Keeping records

*Teacher:* Demonstration, Experimentation, Field visit, Certification

**Project:** The finalization of the topic should be done at the beginning of the fourth semester and the list should be kept with the HOD for the perusal of the University Examination authorities. There should be at least three projects from a department. The selection of the topic and group should be student centered as far as possible. A project log book/register is to be maintained by each student and submitted along with the project report during the final submission.

*Student:* Suggestion of Topic, Discussion with the Project guide and Peer group, Review of Literature, Project planning and Designing, Experimentation, Data Analysis and Project Report Preparation and Presentation.

*Teacher:* Confirmation of Topic, Demonstration, Planning of Experimentation, Guidance and Correction and Certification.

### **Experiential Learning (Internships etc.):**

Student should choose one of the topics for self-study from the beginning of the seventh semester. A report should be submitted by the end of Eighth Semester.

Suggested topics include: Studies on mangroves / Sacred groves / Campus flora; Cultivation of RET / Fruit / Vegetable / Medicinal plants / Mushroom; Topics related to Social responsibility- River restoration, PBR (People Biodiversity Register) preparation, Herbarium arrangement, VFC (Village Forest Committee), VNRC (Village Natural Resource Committee) formation, Landscaping and Green Auditing.

### **Field Study / Study Tour:**

The plant diversity studies should be carried out with the support of Field Study / Study Tour. During each year there should be a field study of 1-5 days duration, with a minimum of 5 days for the completion of the programme.

## **EVALUATION**

### **External Evaluation:**

External assessment by the University level examinations on specified times announced by the University for all the courses, theory, practical and Project/Viva Voce. Each student should go through the evaluation process according to the University Regulations 2021-2022

### **End Semester Evaluation-Theory:**

The components of external evaluation and their unit wise and each theory and practical course and the time of examination will be in accordance with the calendar prepared by

the University for each academic year. At the end of each semester, there will be an examination for theory courses. The duration of examinations for all theory and practical courses in Botany will be three hours, except for the Generic Elective Course papers.

### **External –Practical:**

Practical Courses have external examination for all semester. There will be an external practical examiner and an internal examiner / skilled assistant for every practical examination of three hour duration. The external evaluation should be carried out by the team of examiners.

### **EXTERNAL – PROJECT / FIELD STUDY / VIVA VOCE**

The Project/Field Study/General Viva Voce will be conducted in I/II/III/IV/V/VI/VII/VIII Semester Practical Examination.

#### **Viva should be based on:**

##### **Project work**

##### **Experiential Learning (Internships**

##### **etc) Field Study**

#### **General Learning Activity of four years:**

For the external evaluation the components and weightage of Project/Field Study/ Viva Voce can be discussed and determined finally by the Board of Examiners; the suggested components and their weightage is given below. The project viva should be based on the Project and importance should be given to the Scientific method undertaken in that project. The general viva should be on based the changes in the outlook of the student after the learning activity of the 4 year programme, field study and Experiential Learning (Internships etc.). Time taken for each practical batch should be 3 hrs, by giving nearly 10-15 minutes for each student. The project/field study/viva voce evaluation should be conducted by external examiners and internal examiner.

## **ELIGIBILITY TO APPEAR FOR PRACTICAL EXAMINATION**

1. 80% Attendance (All Sem.)
2. Certified Bona-fide Record (All Sem.)
3. Herbarium and Field Book (Respective Sem.)
4. Field Study Reports (Respective Sem.)
5. Certified Bona-fide Project Report (Eighth Sem.)
6. Report on Experiential Learning (Internships etc.) (EighthSem.)

## **CONTINUOUS INTERNAL EVALUATION**

Internal evaluation is a continuous evaluation in all types of courses- theory/ practical / Project / Field study. The teacher has flexibility in deciding the components and their weightage in accordance with the University Regulations, 2021-22. Internal evaluation should be verytransparent to the students and the components and relative weightage should be announced at the beginning of each learning activity by the concerned teacher. Internal evaluation should be published in the notice board, one week before the closure of each semester.

### **INTERNAL –THEORY**

The percentile system can be adopted for calculating the internal component, test paper.

<b>Sl. No.</b>	<b>COMPONENTS</b>	<b>WEIGHTAGE</b>
<b>1</b>	<b>Attendance</b>	<b>10</b>
	<b>Test Papers</b>	<b>40</b>
<b>2</b>	<b>Assignment</b>	<b>20</b>
	<b>Seminar</b>	<b>20</b>
	<b>Viva</b>	<b>10</b>

### **INTERNAL – PRACTICAL**

The internal evaluation may be regular internal assessment on hourly basis or unit wise, whichever is communicated with the student.

<b>Sl. No.</b>	<b>COMPONENTS</b>	<b>WEIGHTAGE</b>
<b>1</b>	<b>Regularity</b>	<b>25</b>
<b>2</b>	<b>Practical Skill-</b> (Sectioning, Drawing, Labeling, Record Keeping Etc)	<b>50</b>
<b>3</b>	<b>Regular Viva/Model Examination</b>	<b>25</b>

### **INTERNAL - PROJECT/FIELD STUDY/VIVA VOCE**

Internal evaluation of the project should start with the beginning of the project and can be finalized by the project viva.

<b>Sl. No.</b>	<b>COMPONENTS</b>	<b>WEIGHTAGE</b>
<b>1</b>	<b>Participation</b>	<b>50</b>
<b>2</b>	<b>Viva</b>	<b>25</b>
<b>3</b>	<b>Field Study and other Assignment Reports</b>	<b>25</b>

## Curriculum Structure for the Undergraduate Degree

### Program B.Sc. BOTANY

**Total Credits for the Program: 176**

**Starting year of implementation:**

**2021-22 Name of the Degree Program: B.Sc.**

**Discipline/Subject: BOTANY**

#### Program Articulation Matrix:

This matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory, project, internships etc. Elective courses may be listed separately.

<b>Semester</b>	<b>Title / Name Of the course</b>	<b>Program outcomes that the course addresses (not more than 3 per course)</b>	<b>Pre-requisite course(s)</b>	<b>Pedagogy</b>	<b>Assessments</b>
1	BOT A1 Microbial Diversity and Technology	PO1	---	Ex. MOOC	Quiz
2	BOT A2 Diversity of Non flowering Plants	PO2, PO3	BOT A1	Desk Work	Debate
3	BOT A3 Plant Anatomy and	PO4, PO5	BOT A1 and A2	Problem solving,	

	Developmental Biology			Book Chapter	Class work  Class work Seminar Project writing Articles writing, Interpretation of results
4	BOT A4 Ecology and Conservation Biology	PO4, PO5	BOT A1 A2 A3	Seminar,	
5.	BOT A5 Plant Taxonomy and Resource Botany	PO6, PO7	BOT A1 A2 A3	Project based learning,	
	BOT A6 Cell Biology and Genetics	PO6, PO7	BOT A6 A1 A2 A3 A4 A5	Term paper	
6.	BOT A7 Plant Physiology and Biochemistry	PO6, PO7, PO9	BOT A5	Assignment,	
	BOT A8 Plant Biotechnology	PO8. PO9	BOT A5	Group Discussion	
7.	BOT A9 Molecular Biology	PO8, PO9	BOT A6 A8	Research Project	
	BOT A10 Seed Biology and Seed Technology	PO9, PO10	BOT A5 A8 A9	Instrumentation	
	BOT A11 Plant Health Technology	PO9, PO10	BOT A5 A4 A8		

8.	BOT A12 Medicinal Plants and Phytochemistry	PO9, PO10	BOT A4 A5 A7 A8		
	BOT A13 Bioinformatics and Computational Biology	PO9, PO10	BOT A5 A8 A9		
	BOT A14 Research Methodology	PO9, PO10	BOT A13		

- Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project based learning/ case studies/self-study like seminar, term paper or MOOC
- Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning).



**IIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka Bachelor of Science (Basic/ Hons.) (Botany as Major)**

Sem.	Discipline Core (DSC) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE)	Ability Enhancement Compulsory Courses (AECC), Languages (L+T+P)		Skill Enhancement Courses (SEC)		Total Credits
					Skill based (L+T+P)	Value based (L+T+P)	
I	Discipline A 1(6) <b>Microbial Diversity and Technology</b> Discipline B 1(5)	OE-1 (3)	L1-1 (3), L2-1(3) (3+1+0 each)		SEC-1: Digital Fluency (2) (1+0+2)	Health and Wellness/ Social & Emotional Learning (2) (1+0+2)	24
II	Discipline A 2(5) <b>Diversity of non flowering plants</b> Discipline B 2(6)	OE-2 (3)	L1-2(3), L2-2 (3) (3+1+0 each)	Environmental Studies (2)		Sports/NCC/NSS etc. (2) (1+0+2)	24
<b>Exit option with Certificate (48 credits)</b>							
III	Discipline A 3(6) <b>Plant Anatomy and Developmental Biology</b> Discipline B 3(5)	OE-3 (3)	L1-3 (3), L2-3(3) (3+1+0 each)	Constitution of India (2)	SEC-2: Artificial Intelligence (2)(1+0+2)		24
IV	Discipline A 4(5) <b>Ecology and conservation biology</b> Discipline B 4(6)	OE-4 (3)	L1-4 (3), L2-4(3) (3+1+0 each)		SEC-3: Cyber Security (2) (1+0+2)	Sports/NCC/NSS etc. (2) (1+0+2)	24
<b>Exit option with Diploma (96 credits)</b>							
Choose any one Discipline as Major, the other as the Minor							
V	Discipline A 5(5) <b>Plant Taxonomy and resource botany</b> Discipline A 6(5) <b>Cell biology and Genetics</b> Discipline B 5(5)	DSE A-1 (3) <b>Algal and Fungal Biotechnology</b>			SEC-3: (2) (2+0+2)	Ethics & Self Aware- ness (2) (1+0+2)	20
VI	Discipline A 7(5) <b>Plant Physiology and biochemistry</b> Discipline A 8(5) <b>Plant Biotechnology</b> Discipline B 6(5)	DSE A-2 (3) <b>Herbal Technology</b>			SEC-4: Professional/ Societal Communication (2)		20
<b>Exit option with Bachelor of Science, B. Sc. Basic Degree (136 credits)</b>							
VII	Discipline A-9(5) <b>Molecular Biology</b> Discipline A-10(5) <b>Seed biology and seed Technology</b> Discipline A-11(4) <b>Plant Health Technology.</b>	DSE A-3 (3) <b>Plant Propagation and Tissue Culture (3)</b>					20
VIII	Discipline A-12(4) <b>Medicinal Plants and Phytochemistry</b> Discipline A-13(4) <b>Bioinformatics and Computational Biology</b> Discipline A-14(3) <b>Research Methodology</b>	DSE A-4 (3) <b>Landscaping, Gardening and Green House Technology</b>					20
<b>Award of Bachelor of Bachelor of Science Honours, B.Sc. (Hons) degree in a discipline etc. (176 credits)</b>							

### DISCIPLINE CORE PAPERS (DSC)

Sl. No.	Semester Details	Subject	Paper No
1	Semester I	Microbial Diversity and Technology	<b>A-1</b>
2	Semester II	Diversity of Non Flowering Plants	<b>A-2</b>
3	Semester III	Plant Anatomy and Development Biology	<b>A-3</b>
4	Semester IV	Ecology and Conservation Biology	<b>A-4</b>
5	Semester V	Plant taxonomy and Resource Botany	<b>A-5</b>
		Genetics and Cell Biology	<b>A-6</b>
6	Semester VI	Plant Physiology and Biochemistry	<b>A-7</b>
		Plant Biotechnology	<b>A-8</b>
7	Semester VII	Molecular Biology	<b>A-9</b>
		Seed Biology and Seed Technology	<b>A-10</b>
		Plant Health Technology	<b>A-11</b>
8	Semester VIII	Medicinal Plants and Phytochemistry	<b>A-12</b>
		Bioinformatics and Computational Biology	<b>A-13</b>
		Research Methodology	<b>A-14</b>

### CORESPECIFIC ELECTIVE PAPERS (DSE)

SI No.	Semester Details	Subject: Botany	Credits	Paper No
1	Semester V	<b>DSE 1:</b> Algal and Fungal Biotechnology	03	E-1
2	Semester VI	<b>DSE 2:</b> Herbal Technology	03	E-2
3	Semester VII	<b>DSE 3:</b> Plant Propagation and Tissue Culture	03	E-3
4	Semester VIII	<b>DSE 4:</b> Landscaping, Gardening and Green House Technology	03	E-4

## **BOTANY COURSE OUTCOMES (COs):**

At the end of the course the student should be able to:

*(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)*

### **Semester I (A-1): Microbial Diversity and Technology**

1. Understand the fascinating diversity, evolution, and significance of microorganisms.
2. Comprehend the systematic position, structure, physiology and life cycles of microbes and their impact on humans and environment.
3. Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

### **Semester II (A-2): Diversity of Non- Flowering Plants**

1. Understand the diversity and affinities among Algae, Bryophytes, Pteridophytes and Gymnosperms.
2. Understand the morphology, anatomy, reproduction and life cycle across Algae, Bryophytes, Pteridophytes and Gymnosperms, and their ecological and evolutionary significance.
3. Obtain laboratory skills/explore non-flowering plants for their commercial applications.

### **Semester III (A-3): Plant Anatomy and Developmental Biology**

1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
3. Understanding the basic concepts in plant morphogenesis, embryology and organ development.

#### **Semester IV (A-4): Ecology & Conservation Biology**

1. Understanding the fundamental concepts in ecology, environmental science and phyto geography.
2. Concept development in conservation, global ecological crisis, Sustainable development and pros and cons of human intervention.
3. Enable the student to appreciate bio diversity and the importance of various conservation strategies, laws and regulatory authorities and global issues related to climate change and sustainable development.

#### **Semester V (A-5): Plant Taxonomy & Resource Botany**

1. Ability to identify, classify and describe the plants in scientific terms. Identification of plants using dichotomous keys.
2. Recognition, processing and utilization of economically important plants.
3. Skill development in processing of biomass and plant products as source of food, healthcare, energy and natural products.

#### **Semester V (A-6): Cell Biology & Genetics**

1. Identify the basic principles and current trends in classical genetics and Cell biology.
2. Recognize the historical process of the evolution of molecular genetics from classical genetics.
3. Develop theoretical background on molecular genetics to provide a strong support for the student for future research and employability.

#### **Semester VI (A-7): Plant Physiology & Biochemistry**

1. Preliminary understanding of the basic functions and intermediary metabolism in a plant body.
2. Awareness on the interdisciplinary nature of botany, chemistry and physics by studying the principles of plant life, growth and reproduction.
3. Recognizing the wonderful mechanism of transport and the Interrelationships existing between metabolic pathways thereby gaining and idea about the importance of plants in the dynamicity of nature.

**Semester VI (A-8): Plant Biotechnology**

1. Learning of knowledge & skill in plant tissue culture, plant molecular biology and transgenic.
2. Application of plant biotechnology in plant genomics, phylogenetic studies and metabolic engineering.
3. Understanding of new molecular techniques in cell and metabolic manipulations.

**Semester VII (A-9): Molecular Biology**

1. Understanding the mechanism and concepts of life process at molecular level through central dogma concept.
2. Skill acquiring in the basic molecular biology techniques & characterization of micro- molecules.
3. Acquiring the emerging technology skills in plant genetic engineering & proteomics.

**Semester VII (A-10): Seed Biology & Seed Technology**

1. Understanding the seed structure and related functions, seed health and productivity.
2. Technology for assessing the seed pathology, purity, and preservation.
3. Learning the field and laboratory protocols of seed production, certification and quality.

**Semester VII (A-11): Plant Health Technology**

1. Understanding & learning common diseases & control measures of plant diseases.
2. Acquiring skills in plant disease diagnosis, control & management through IPM.
3. Learning of new skills in health clinic through biological methods.

**Semester VIII (A-13): Medicinal Plants & Phytochemistry**

1. Knowledge of Indian system of medicine with regard to medicinal plants.
2. Acquiring skills in identification, cultivation and preservation of medicinal plants.
3. Isolation, identification, characteristics of active principles in medicinal plants & drug formulations.

### **Semester VIII (A-14): Bioinformatics & Computational Biology**

1. Learning of basic principles of application, ICT Technology in biological studies & research.
2. Acquiring skill to utilize the computational apps, active data basis and tools in analysis in genetics & proteomics.
3. Learning skills and software used for biological research & process understanding.

### **Semester VIII (A-15): Research Methodology**

1. Understanding the working of science for further application in free, independent, individual needs and in designing scientific experimentation.
2. Acquire knowledge on the principles, components and applications of various scientific equipment in biology.
3. Foundation knowledge in the basic concepts, components and functions of informatics and the importance of statistical principles in biological research.

## Job opportunities in Botany

Exit after ONE Year: Certificate Course

I Sem. - A1: Microbial Diversity and Technology

II Sem. – A2: Diversity and Conservation of Non- Flowering plants

### Job opportunities in Botany

- *Preparation of algal, fungal microbial, bryophyte, pteridophyte, and gymnosperm slides for educational institutions and other line departments (Entrepreneurship).*
- Providing algal, fungal microbial, bryophyte, pteridophyte, and gymnosperm materials for educational institutions and other line departments (Entrepreneurship).
- Developing Nursery (Entrepreneurship).
- Nursery supervisor/manager
- Mushroom cultivation (Entrepreneurship).
- Cyanobacterial, algal and microbial culture (Entrepreneurship).
- Fermentation industries. Dairy farming industries. Dairy products industries. Spice Industries (Lichens)
- Quarantine dept., Quality control/analyst, packaging, Lab. assistant

## **Job opportunities in Botany**

Exit After **TWO** Year: **Diploma Course**

**I Semester-A3: Plant Anatomy and Developmental Biology**

**IV Semester-A4: Ecology and Conservation Biology**

### **Job opportunities in Botany**

#### **In Addition to one year certificate**

- Preparation of Anatomy embryology and Ecological slides for educational institutions and other line departments (Entrepreneurship).
- Providing Anatomy embryology and Ecological materials for educational institutions and other line departments (Entrepreneurship).
- Lab technician
- Garden / nursery supervisor
- Developing his/her own nursery (Entrepreneurship).
- Forest guard, Wild life watch guard.
- Forest nursery (Entrepreneurship).



## **Job opportunities in Botany**

Exit After **THREE** Year: **Degree Course**

**V Semester-A5: Plant Taxonomy and Resource Botany**

**V Semester-A6: Genetics and Cell Biology**

**VISemester-A7: Plant Physiology and Biochemistry**

**VI Semester-A8: Plant Biotechnology**

<b>Job opportunities in Botany</b>
<p><b>In Addition to two year diploma</b></p> <ul style="list-style-type: none"><li>• Supplying the angiosperm plants and cytological slides to the educational institutions and other line departments (Entrepreneurship).</li><li>• Advisor for Health department</li><li>• Marketing NTFPs species (Entrepreneurship).</li><li>• RFO/ forest officers</li><li>• Biochemical Laboratory (Soil, Water, Air testing etc). (Entrepreneurship).</li><li>• Adviser to grow advanced crop (Biotech crop).</li><li>• Farmer friendly liaison officer.</li><li>• Advisor for crop improvement programme.</li></ul>

## **Job opportunities in Botany**

**Exit After FOUR Year: Degree Course (Honors)**

**VII Semester-A9: Molecular Biology**

**VII Semester-A10: Seed Biology and Seed Technology**

**VII Semester-A11: Plant Health Technology**

**VIII Semester-A12: Medicinal Plants and Phytochemistry**

**VIII Semester-A13: Bioinformatics & Computational Biology**

**VIII Semester-A14: Research Methodology**

<b>Jobs opportunities in Botany</b>
<b>In Addition to three year degree</b>
<ul style="list-style-type: none"><li>• Assisting for Ayurvedic doctors.</li><li>• Medicinal plants Marketing (Entrepreneurship).</li><li>• R &amp; D Botany, Biotechnology, Ayurvedic and Pharmaceutical Lab.</li><li>• Laboratory on checking food adulteration (Entrepreneurship).</li><li>• Soil and water assessment laboratory (Entrepreneurship).</li><li>• Biological material analysis Laboratory(Entrepreneurship).</li><li>• Teacher in primary and High Schools.</li><li>• Prepare for joining Research institution for Ph.D. programmes.</li><li>• Wild life photographer</li><li>• Separation and Analyzing phytochemical compounds.</li><li>• Seed technician.</li><li>• Plant health manager</li></ul>

**SUGGESTED DISCIPLINE SPECIFIC ELECTIVE PAPERS (DSE): UG - BOTANY**

<b>Srl No</b>	<b>Subject</b>
1.	Aquatic Botany
2.	Bio-analytical techniques.
3.	Stress Biology
4.	Introduction to plant breeding
5.	Biostatistics
6.	Biofuels & Technology
7.	Horticulture post-harvest practices
8.	Reproductive biology of Angiosperms.
9.	Agroforestry
10.	Food Science
11.	Plant Microbe interaction
12.	IPR
13.	Good laboratory practices
14.	Forensic Botany
15.	Botanical garden, landscaping & Greenhouse technology
16.	Herbal Technology
17.	Plant tissue culture
18.	Genetic Engineering in plants and biosafety
19.	Fermentation Technology
20.	Palynology
21.	Organic Farming
22.	Plant Genomics and proteomics
23.	Mushroom Cultivation
24.	Global Climate Change
25.	Dendrology and Arboriculture

## I B.Sc., I- Semester DSC-1

### Microbial Diversity and Technology

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
4	56	2	56
<b>Content of Theory Course 1</b>			<b>56 Hrs</b>
<b>Unit –1</b>			15
<p><b>Chapter No. 1: Microbial diversity</b>-Introduction to microbial diversity; Methods of estimation; Hierarchical organization and positions of microbes in the living world. Whittaker’s five-kingdom system and Carl Richard Woese’s three-domain system. Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature</p>			5
<p><b>Chapter No. 2 History and developments of microbiology</b>-Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky and M W Beijerinck and Paul Ehrlich)</p>			5
<p><b>Chapter No. 3 Microscopy</b>-Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic and special) and Principles of staining. Simple, Gram’s and differential staining.</p>			5

<b>Unit – 2</b>	15
<b>Chapter No. 4. Culture media for Microbes-</b> Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storage media.	5
<b>Chapter No. 5. Sterilization methods</b> -Principle of disinfection, antiseptic, tyndallisation and Pasteurization, <b>Sterilization</b> -Sterilization by dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods of sterilization- phenolic compounds, anionic and cationic detergents.	5
<b>Chapter No. 6. Microbial Growth</b> -Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.	5
<b>Unit – 3</b>	11
<b>Chapter No. 7 Microbial cultures and preservation</b> -Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.	5
<b>Chapter No. 8. Viruses-</b> General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types.	4
<b>Chapter No. 9. Viroids-</b> general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases. Economic importance of viruses.	2

<b>Unit – 4</b>	15
<p><b>Chapter No. 10. Bacteria-</b> General characteristics and classification. Archaeobacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of <i>Rhizobium</i> and its applications. A brief account of Actinomycetes and Cyanobacteria. Mycoplasmas and Phytoplasmas- General characteristics and diseases. Economic importance of Bacteria.</p>	5
<p><b>Chapter No. 11. Fungi-</b>General characteristics and classification. Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study of <i>Phytophthora</i>, <i>Rhizopus</i>, <i>Neurospora</i>, <i>Puccinia</i>, <i>Penicillium</i> and <i>Trichoderma</i>. Economic importance of Fungi.</p>	6
<p><b>Chapter No. 12. Lichens</b> – Structure and reproduction. <b>VAM Fungi</b> and their significance. <b>Plant diseases-</b>Late Blight of Potato, Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus Canker, Root Knot Disease of Mulberry.</p>	4

#### **Text Books**

1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman Ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, New Delhi.
3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi.

## References

1. Alexopoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., NewDelhi.
2. Allas RM. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
3. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4<sup>th</sup> ed. Eaglewood Cliffts. N.J.Prentice- Hall. New Delhi.
4. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge UniversityPress. Cambridge.
5. Jayaraman J. 1985. Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
6. Ketchum PA. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
7. Michel J, Pelczar Jr.EC and Krieg CR. 2005. Microbiology, Mc.Graw-Hill, NewDelhi.
8. Powar CB and Daginawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishing house,Bombay.
9. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.
10. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.
11. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London, 587pp.
12. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World 5<sup>th</sup> edition. Prentice-Hall India, Pvt. Ltd. New Delhi.
13. Sullia SB. and Shantharam S. 2005. General Microbiology, Oxford and IBH, NewDelhi.

**I B.Sc., I- Semester DSC-1**  
**MICROBIAL DIVERSITY AND TECHNOLOGY**

**PRACTICALS**

**Lectures: 56 Hours**  
**(4 Hours/week)**

**Practical 1:** Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, LAF, Colony counter, Haemo cytometer, Micrometer etc.).

**Practical 2:** Enumeration of soil/food /seed microorganisms by serial dilution technique.

**Practical 3:** Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of *E coli* / *B. subtilis*/ Fungi and study of cultural characteristics.

**Practical 4:** Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer.

**Practical 5:** Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.

**Practical 6:** Isolation and study of morphology of *Rhizobium* from root nodules of legumes

**Practical 7:** Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.

**Practical 8:** Study of vegetative structures and reproductive structures - *Albugo*, *Phytophthora*, *Rhizopus*, *Saccharomyces*, *Puccinia*, *Agaricus*, *Lycoperdon*, *Penicillium*, (Depending on local availability)

**Practical 9:** Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.



**Practical 10:** Study of late blight of Potato, Downy mildew of Bajra, Citrus canker, Tobacco mosaic disease, Sandal spike disease.

**Practical 11:** Study of well-known microbiologists and their contributions through charts and photographs (As mentioned in theory).

**Practical-12:** Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

(**Note:** Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)

**SCHEME OF BOTANY THEORY EXAMINATION  
I SEMESTER  
MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**BLUE PRINT OF BOTANY THEORY EXAMINATION**  
**I SEMESTER-BLUE PRINT**  
**MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
I	2X2=4	5X2=10	8X1=08	22
II	2X1=2	5X1=05	8X2=16	23
III	2X2=4	5X1=05	8X1=08	17
IV	2X1=2	5X2=10	8X2=16	28
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

**I SEMESTER: PAPER A-1**  
**SCHEME OF PRACTICAL QUESTION PAPER**  
**MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time:** 3 Hours

**Max Marks-** 25

**I. Write critical notes on A, B & C**

**3X2=6**

**Marks**

A and B- Microbial Instruments (As mentioned in the syllabus)

C- Microbiologists (As mentioned in the Syllabus)

(Identification- 1 mark, Application/Contribution- 1Mark)

**II. Bacterial staining D -Simple / Gram's staining**

**5 Marks**

(Preparation- 3 Marks Flow chart- 2 Marks)

**III. Prepare a temporary stained slide E of the given material and leave the preparation for evaluation.**

**5  
Marks**

*(Rhizobium, Rhizopus, Saccharomyces, Penicillium)*

(Identification- 1 Mark, Mounting- 2 Marks, Diagram with reasons- 2 Marks)

**IV. Identify the Specimens F & G**

**2X3=6**

**Marks**

(F- Albugo, Phytophthora, Agaricus, Lycoperdon)

(G - Plant Diseases (As Mentioned in the Syllabus)

( Identification with Diagram - 2 Marks, Reason – 1Mark)

**V. Identify the Permanent Slide J**

**3 Marks**

(Fungi/Pathology)

(Identification & Diagram- 2 Marks, reasons- 1 Marks)

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**I SEMESTER: PAPER A-1**  
**PRACTICAL QUESTION PAPER**  
**MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time:** 3 Hours

**Max Marks-** 25

- |             |  |                    |
|-------------|--|--------------------|
| <b>I.</b>   | Write critical notes on <b>A, B &amp; C</b>  | <b>6 Marks</b>     |
| <b>II.</b>  | Bacterial staining <b>D</b> -Simple / Gram's staining  | <b>5 Marks</b>     |
| <b>III.</b> | Prepare a temporary stained slide <b>E</b> of the given material and leave the preparation for evaluation. | <b>5 Marks</b>     |
| <b>IV.</b>  | Identify the Specimens <b>F &amp; G</b>  | <b>2X3=6 Marks</b> |
| <b>V.</b>   | Identify the Permanent Slide <b>J</b>  | <b>3 Marks</b>     |

**NOTE:** Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.

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## B.Sc. BOTANY: Open Elective Course (OE-1.1)

### Semester I

#### OE-1.1: PLANTS AND HUMAN WELFARE

##### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with economic importance of diverse plants that offer resources to human life.
2. To make the students known about the plants used as-food, medicinal value and also plant source of different economic value.
3. To generate interest amongst the students on plants importance in day today life, conservation, ecosystem and sustainability.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>Content of Theory Course OE-1.1: PLANTS AND HUMAN WELFARE</b>			39 Hrs
<b>Unit I</b>			13
Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation. <b>Cereals:</b> Wheat and Rice (origin, evolution, morphology, post-harvest processing & uses). Green revolution. Brief account of millets and their nutritional importance. <b>Legumes:</b> General account (including chief pulses grown in Karnataka- red gram, green gram, chick pea, soybean). Importance to man and ecosystem.			
<b>Unit II</b>			13
<b>Cash crops:</b> Morphology, new varieties and processing of sugarcane, products and by-products of sugarcane industry. Natural Rubber –cultivation, tapping and processing. <b>Spices:</b> Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper and cardamom. <b>Fruits:</b> Mango, grapes and Citrus (Origin, morphology, cultivation ,processing and uses) <b>Beverages:</b> Tea, Coffee (morphology, processing&uses)			
<b>Unit III</b>			13
<b>Oils and fats:</b> General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustered (Botanical name, family & uses). Non edible oil yielding trees and importance as biofuel. Neem oil and applications.			

<p><b>Essential Oils:</b> General account. Extraction methods of sandal wood oil, rosa oil and eucalyptus oil. Economic importance as medicine, perfumes and insect repellents.</p> <p><b>Drug-yielding plants:</b> Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Aloe vera and Cannabis.</p> <p><b>Fibers:</b> Classification based on the origin of fibers; Cotton and jute (origin morphology, processing and uses).</p>	
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### **Text Books and References**

1. Kochhar, S.L. (2012). Economic Botany in Tropics. MacMillan & Co. New Delhi.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers. Netherland.
3. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett - Publishers. Lincoln, United Kingdom

### **Pedagogy:**

**Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc**

## B.Sc. BOTANY: Open Elective Course (OE-1.2)

### Semester I

### OE 1.2: BOTANY FOR THE BEGINNERS

#### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with importance of Botany: plants as natural resources.
2. To make the students known about the plants used as-food, medicinal value and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of plants in day today life, ecosystem restoration.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>Content of Theory OE 1.2: BOTANY FOR THE BEGINNERS</b>			<b>39 hrs</b>
<b>UNIT I: Living World</b>			<b>13 hrs.</b>
<p>Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation.</p> <p>Concept of Living and Non Living: Viruses, Bacteria, Fungi, Plants and Animals; Five kingdom Classification- Classification of plants- Eichler's system – general characters of groups- An introduction to the Life cycle of plants. Cell Structure-Prokaryote and eukaryote</p>			
<b>UNIT II: Morphology of Angiosperms, Origin and Evolution of Life</b>			<b>13 hrs</b>
<p>Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure - essential and non essential whorls.</p> <p>Definition, Ancient Concepts and Modern Concepts. Origin of Life – Geological Time scale – Variation in Hydrosphere, Lithosphere, Atmosphere and Biosphere from Pre Cambrian to Coenozoic era. Darwin's Natural Selection theory and Modern evidences at molecular and organismic level in support of Darwin's theory</p>			
<b>UNIT III: Interaction between plants and animals</b>			<b>13 hrs</b>
<p>General concept on Interaction between plants, microbes and animals. Ecological Significance of Plants – Solar energy fixing Producers, Nitrogen fixation, biofertilisers, biopesticides,</p> <p>Symbiotic relationships-Mutualism, Commensalism, Proto-operation, Parasitism.</p>			



Plants and Animals for pollination and seed/fruit dispersal- Pollination- Entomophily, Chiropterophily, Myrmecophily Seed Dispersal: Zoochory, Specific case studies on examples for co evolution- Dodo and Calvaria, Butterflies and plants; Wasps and Ficus, mimicking for pollinators. Medicinal uses of plants – traditional knowledge and scientific knowledge – a brief account	
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### **Text Books and References**

1. Agarwal, S. K. (2009), Foundation Course in Biology, Ane Books Pvt. Ltd., New Delhi.
2. Datta, A C Class Book of Botany. New Delhi.
3. Mamatha Rao, Microbes and Non flowering plants-impacts and applications, Ane Books, Pvt Ltd, New Delhi.
4. Pandey, B. P. 2001.College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
5. Prithipal Singh (2007), An introduction to Biodiversity. Ane Books India, New Delhi
6. Raven, P.H; Johnson, G.B; Losos, J.B; Singer, S.R (2005), Biology, seventh edition, Tata McGraw Hill, New Delhi
7. Robert A Wallace. Biology: The world of life. Harper Collins Publishers

### **Pedagogy:**

**Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc**

## B.Sc. BOTANY: Open Elective Course (OE-1.3)

### Semester I

#### OE 1.3: MUSHROOM CULTIVATION

##### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with mushroom cultivation for commercial exploitation.
2. To make the students known about the *Agaricus* (mushroom) used as-food, medicine and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of mushroom in day today life.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
<b>3</b>	<b>39</b>	<b>0</b>	<b>00</b>
<b>Content of Theory Course OE 1.3: MUSHROOM CULTIVATION</b>			<b>39 hrs</b>
<b>UNIT-I . Mycology and Mushroom Biology</b>			<b>13 hrs.</b>
<p>Five kingdom classification of organisms. Kingdom fungi. General characters of form, function, reproduction and relationship with other organisms. Importance of fungi in human welfare.</p> <p>Morphology (range of form, macro-morphology, micro-morphology), life cycle of a typical mushroom and biological function. Edible, non-edible and poisonous species. Domestication of mushroom. Importance of mushroom in human nutrition, sustainable livelihood, ecosystem function and quality of the environment.</p>			
<b>UNIT II. Applied Mushroom Biology</b>			<b>13 hrs</b>
<p>Mushroom cultivation and production. Lab scale, pilot plant and large scale cultivation of commercial species. Crop cycle- spawn, substrate, substrate processing, spawning, spawn run, cropping, harvesting, environment requirement, post harvest practices, shelf life, preservation, storage, transport and marketing. Value-added products of mushroom. Constraints and environment management. Economics of mushroom cultivation. Designs of mushroom facility. Economics of mushroom cultivation and marketing.</p>			
<b>UNIT IV. Mushroom Biotechnology.</b>			<b>13 hrs</b>
<p>Concept. Preparation of flavours, appetizers, nutraceuticals, dietary supplements and cosmetics. Mushroom bioremediation. Cleaning of polluted sites. Utilization of mushroom mycelium or enzymes in recycling biological materials. Mycofiltration and applications of the process. Mycorrhiza applications. Biopulping, biobleaching and biotransformations. Biodetergents.</p>			

**References.**

1. Harandar Singh 1991. Mushrooms: the art of Cultivation. Sterling Publishers.
2. Kaul, T.N.2001. Biology and conservation of Mushrooms. Oxford and IBH Publishing Company. New Delhi.
3. Tripathi, M. Mushroom Cultivation. Oxford and IBH Publishing Company. New Delhi.
4. Suman B.C. and Sharma V P.2007. Mushroom Cultivation in India. Eastern Book Corporation. New Delhi.
5. Singh R. and U.C.Singh 2005. Modern Mushroom Cultivation. Agrobios. New Delhi.

**Pedagogy:**

**Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc**

**OPEN ELECTIVE**  
**SCHEME OF BOTANY THEORY EXAMINATION I SEMESTER**  
**MODEL QUESTION PAPER**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**OPEN ELECTIVE  
BLUE PRINT OF BOTANY THEORY EXAMINATION I SEMESTER**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
<b>I</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>II</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>III</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

**I B.Sc., II- Semester DSC-2**  
**Diversity of Non- Flowering Plants**

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
<b>4</b>	<b>56</b>	<b>2</b>	<b>56</b>
<b>Content of Theory Course 2</b>			<b>56Hrs</b>
<b>Unit –1</b>			<b>15</b>
<p><b>Chapter No. 1</b> Algae –Introduction and historical development in algology. General characteristics and classification of algae, Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. Distribution of Algae.</p>			5
<p><b>Chapter No. 2</b> Morphology and reproduction and life-cycles of <i>Nostoc</i>, <i>Oedogonium</i>, <i>Chara</i>, <i>Sargassum</i> and <i>Batrachospermum</i>. Diatoms and their importance. Blue-green algae-A general account. Algal blooms and toxins.</p>			5
<p><b>Chapter No. 3</b> Algal cultivation- Cultivation of microalgae-<i>Spirulina</i> and <i>Dunaliella</i>; Algal cultivation methods in India. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses.</p>			5

<b>Unit – 2</b>	15
<b>Chapter No. 4.</b> Bryophytes – General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes.	5
<b>Chapter No. 5</b> Distribution, morphology, anatomy, reproduction and life-cycles of <i>Riccia</i> , <i>Anthoceros</i> , and <i>Funaria</i> . Ecological and economic importance of Bryophytes. Fossil Bryophytes.	5
<b>Chapter No. 6. . Pteridophytes-</b> General characteristics and classification; Structure of sporophytes and life-cycles. Distribution, morphology, anatomy, reproduction and life-cycles in <i>Selaginella</i> , <i>Equisetum</i> , <i>Pteris</i> and <i>Salvinia</i> .	5
<b>Unit – 3</b>	15
<b>Chapter No. 7</b> A brief account of heterospory and seed habit. Stelar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance.	5
<b>Chapter No. 8. Gymnosperms-</b> General characteristics. Distribution and classification of Gymnosperms. Study of the habitat, distribution, habit, anatomy, reproduction and life-cycles in <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> .	5
<b>Chapter No. 9.</b> Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines.	5

<b>Unit – 4</b>	11
<b>Chapter No. 10. Origin and evolution of Plants:</b> Origin and evolution of plants through Geological Time scale.	2
<b>Chapter No. 11. Paleobotany-</b> Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating.	5
<b>Chapter No. 12.</b> Fossil taxa- <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Lyginopteris</i> and <i>Cycadeoidea</i> . Exploration of fossil fuels. Birbal Sahni Institute of Paleosciences.	4

### **Text Books**

- 1) Chopra, G.L. A text book of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot. Allahabad.
- 2) Johri, Lata and Tyagi, 2012, A Text Book of, Vedam e Books, New Delhi.
- 3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
- 4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
- 5) Sharma, O.P., 2017, Algae Singh-Pande-Jain 2004-05. A Text Book of Botany. Rastogi Publication, Meerut.

### **References**

1. Sambamurty, A.V.S.S.. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
2. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
3. Anderson R.A. 2005, Algal cultural Techniques, Elsevier, London.
4. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.



5. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew- Hill Publishing Co. New Delhi, Freeman & Co., New York.
6. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
7. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge University Press, Cambridge. Gymnosperms.
8. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India.
9. Kakkar, R.K. and B.R.Kakkar ( 1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
10. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi.
11. Lee, R.E., 2008, Phycology, Cambridge University Press, Cambridge. 4th edition. McGraw Hill Publishing Co., New Delhi.
12. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allahabad.
13. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allahabad.
14. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot., Allahabad. Press, Cambridge.
15. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New Delhi.
16. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
17. Smith, G.M. 1971. Cryptogamic Botny. Vol.I Algae & Fungi. Tata McGraw Hill Publishing. New Delhi.
18. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
19. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge University Cambridge.
20. Sundarajan, S. 1997. College Botany Vol. I. S Chand & Co. Ltd., New Delhi.
21. Vanderpoorten, A. and Goffinet, B. 2009, Introduction to Bryophytes, Cambridge University Press, Cambridge.
22. Vashista, B.R. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.

**I B.Sc., II- Semester DSC-2**  
**Diversity of Non- Flowering Plants**

**PRACTICALS**

**Lectures: 56 Hours**  
**(4 Hours/week)**

**Practical-1:** Study of morphology, classification, reproduction and lifecycle of

*Nostoc.*

**Practical-2:** Study of morphology, classification, reproduction and life-cycle of

*Oedogonium & Chara, Sargassum, Batrachospermum/ Polysiphonia.*

**Practical-3:** Study of morphology, classification, reproduction and life-cycle of

*Riccia/Marchantia & Anthoceros.*

**Practical-4:** Study of morphology, classification, anatomy, reproduction and life-cycle of

*Selaginella and Equisetum.*

**Practical -5:** Study of morphology, classification, anatomy, reproduction and life-cycle of

*Pteris, Azolla..*

**Practical -6:** Study of morphology, classification, anatomy and reproduction

in *Cycas.*

**Practical -7:** Study of morphology, classification & anatomy, reproduction in

*Pinus.*

**Practical -8:** Study of morphology, classification & anatomy, reproduction in

*Gnetum.*

**Practical -9:** Study of important blue green algae causing water blooms in

the lakes.

**Practical -10:** Study of different methods of cultivation of ferns in a nursery.

**Practical -11:** Preparation of natural media and cultivation of *Azolla* in artificial ponds.

**Practical -12:** Media preparation and cultivation of *Spirulina*.

**Practical -13:** Study different algal products and fossils impressions and slides/Photographs.

**Practical-14:** Visit to algal cultivation units/lakes with algal blooms/Fern house/  
Nurseries/Geology museum/lab to study plant fossils.

(**Note:** Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)

**SCHEME OF BOTANY THEORY EXAMINATION  
II SEMESTER  
MODEL QUESTION PAPER  
DIVERSITY OF NON FLOWERING PLANTS**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**BLUE PRINT OF BOTANY THEORY EXAMINATION II SEMESTER**  
**DIVERSITY OF NON FLOWERING PLANTS**

**Time:** 2.5 Hours

**Max Marks-** 60

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
I	2X2=4	5X2=10	8X1=08	22
II	2X1=2	5X2=10	8X2=16	28
III	2X1=2	5X1=05	8X2=16	23
IV	2X2=4	5X1=05	8X1=08	17
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

**II SEMESTER**  
**SCHEME OF PRACTICAL QUESTION PAPER**  
**DIVERSITY OF NON- FLOWERING PLANTS**

**Time:** 3 Hours

**Max Marks-** 25

**I. Prepare a temporary stained slide of the given material A and leave the preparation for evaluation** **5 Marks**

Algae (Nostoc, Oedogonium, Chara, Batrachospermum / Polysiphonia )

(Preparation - 2 Mark, Diagram-1 Marks, Identification with Reasons- 2 Marks)

**II. Identify the given specimens B & C** **2X3=6 Marks**

**B-** Bryophytes (Marchantia and Anthoceros)

**C-** Pteridophytes (Selaginella, Equisetum, Pteris , Azolla,)

(Identification- 1 Mark, Diagram with reasons- 2 Marks)

**III. Identify the Permanent Slides D, E, F & G** **4X2=8 Marks**

(One each from Algae, Bryophyte, Pteridophyte and Gymnosperms)

(Identification- 1 Mark, Diagram with Reasons-1 Marks)

**IV. Comment on H & I** **2X3=6 Marks**

H- Gymnosperm

I – Fossils

(Identification- 1 Mark, Diagram with Reasons- 2 Marks)

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**II SEMESTER**  
**PRACTICAL QUESTION PAPER**  
**DIVERSITY OF NON- FLOWERING PLANTS**

**Time:** 3 Hours

**Max Marks-** 25

**I.** Prepare a temporary stained slide of the given material **A** and leave the preparation for evaluation

**5 Marks**

**II.** Identify the given specimens **B & C**

**2X3=6 Marks**

**III.** Identify the Permanent Slides **D, E, F & G**

**4X2=8 Marks**

**IV.** Comment on **H & I**

**2X3=6 Marks**

**NOTE: Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.**

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**Open Elective Course (OE-2.1)**  
**I B.Sc., Semester II**

**PLANT PROPAGATION, NURSERY MANAGEMENT AND GARDENING**

**Paper Outcome:**

On completion of this course, the students will be able to

1. To gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
2. To get knowledge of new and modern techniques of plant propagation.
3. To develop interest in nature and plant life.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
<b>3</b>	<b>39</b>	<b>0</b>	<b>00</b>
<b>Unit I :Nursery and Vegetative propagation</b>			13
<p>Definition, objectives and scope and general practices and building up of infrastructure for nursery, planning and seasonal activities. Planting - direct seeding and transplants, Soil free/soilless/ synthetic growth mediums for pots and nursery.</p> <p>Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. Hardening of plants .Green house, mist chamber, shed root, shade house and glass house.</p>			
<b>Unit II :Gardening</b>			13
<p>Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design. Computer applications in landscaping, Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.</p>			
<b>Unit III: Seed, Sowing/raising of seeds and seedlings</b>			13
<p>Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification.</p> <p>Transplanting of seedlings - Study of cultivation of different vegetables and flowering plants: cabbage, brinjal, lady's finger, tomatoes, carrots, bougainvillea, roses, geranium, ferns, petunia, orchids etc. Storage and marketing procedures. Developing and maintenance of different types of lawns. Bonsai technique.</p>			



### **Text Books and References**

1. Agrawal, P.K. (1993). Hand Book of Seed Technology. Dept. of Agriculture and Cooperation, National Seed Corporation Ltd. New Delhi.
2. Bose T.K., Mukherjee, D. (1972). Gardening in India. Oxford & IBH Publishing Co. New Delhi.
3. Jules, J. (1979). Horticultural Science, 3rd edition. W.H. Freeman and Co. San Francisco, California.
4. Kumar, N. (1997). Introduction to Horticulture. Rajalakshmi Publications. Nagercoil, Tamil Nadu.
5. Musser E., Andres. (2005). Fundamentals of Horticulture. McGraw Hill Book Co. New Delhi
6. Sandhu, M.K. (1989). Plant Propagation. Walle Eastern Ltd. Bangalore.

### **Pedagogy:**

**Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc**

## Open Elective Course (OE-2.2)

### I B.Sc., Semester II

#### BIO-FUELS

##### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with Bio-fuel plant species cultivation for commercial exploitation.
2. To make the students known about the Bio-fuel used in automobile industries and solving fuel problems in feature.
3. To generate interest amongst the students to know the importance of Bio-fuel in day today life and economic wellbeing.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>UNIT-I</b>			<b>10 hrs.</b>
Introduction, definition, scope and Importance of Bio-fuel with respect to climate change and environmental issues. Public awareness. Biofuels scenario in India and world. History of Biofuels. Advantages and disadvantages of biofuels. Developmental generation of biofuels: first, second, third and fourth generation of biofuels and present status.			
<b>UNIT II</b>			<b>16 hrs</b>
Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the residential, institutional and industrial waste and its importance.(Biomass-plant, animal and microbial based waste). Algal biofuel.  Biodiesel species: <i>Pongamia pinnata</i> , <i>Simarouba gluca</i> , <i>Jatropha curcas</i> , <i>Azardirachta india</i> , <i>Madhuca indica</i> and <i>Callophyllum innophyllum</i> . Seed harvesting, processing, oil extraction, and characterization.			
<b>UNIT III</b>			<b>13 hrs</b>
Introduction to biodiesel, bioethanol, biogas and bio hydrogen. Production technology of biofuels (Biodiesel, ehanol and biogas). Quality analysis of biodiesel, bioethanol and biogas and its comparison with national and international standards. Biofuel sustainability; Biofuel Policy in Karnataka and India. Biofuel production statistics. Fuel against food security concepts.			

### **Text Books and References**

- 1) The Biodiesel Handbook (2005). Jurgen Krahl, Jon Harlan Van Gerpen. AOCS Press.
- 2) Bioenergy and Biofuels (2017). Ozcan Konur. CRC Press, Taylor & Francis's group.
- 3) <https://mnre.gov.in/biofuels>

### **Pedagogy:**

**Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc**

## Open Elective Course (OE-2.3)

### I B.Sc., Semester II

#### BIOFERTILISERS

##### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with bio-fertilizer plant species cultivation for commercial exploitation.
2. To make the students known about the bio-fertilizer used in agriculture forming and industries and solving problems erupted by synthetic fertilizer.
3. To generate interest amongst the students to know the importance of bio-fertilizer in day today agricultural practices and economic wellbeing.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>Content of Theory Course 2.3: BIOFERTILISERS</b>			<b>39 hrs</b>
<b>UNIT-I. General account, isolation and mass multiplication</b>			<b>13 hrs.</b>
General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. <i>Azospirillum</i> : isolation and mass multiplication – carrier based inoculants, associative effect of different microorganisms. <i>Azotobacter</i> : classification, characteristics – crop response to <i>Azotobacter</i> inoculum, maintenance and mass multiplication			
<b>UNIT II. Association of Cyanobacteria and Fungi</b>			<b>13hrs</b>
Cyanobacteria (blue green algae), <i>Azolla</i> and <i>Anabaena Azollae</i> association, nitrogen fixation, factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation  Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM –its influence on growth and yield of crop plants			
<b>UNIT III. Applications of Cyanobacteria and Fungi</b>			<b>13 hrs</b>
Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – bio-compost making methods, types and method of vermin-composting – field Application.			

## **Suggested Readings**

1. Dubey, R.C., 2005 A Text book of Biotechnology S. Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya Publishers. New Delhi.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

## **PEDAGOGY:**

**Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc**

**OPEN ELECTIVE  
SCHEME OF BOTANY THEORY EXAMINATION II SEMESTER  
MODEL QUESTION PAPER**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**OPEN ELECTIVE  
BLUE PRINT OF BOTANY THEORY EXAMINATION II  
SEMESTER**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
<b>I</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>II</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>III</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

## II B.Sc. III-Semester- DSCC

### PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
<b>04</b>	<b>56 hours</b>	<b>02</b>	<b>52 hours</b>
Unit	PLANT ANATOMY		Teaching hours
<b>I</b>	<b>ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES</b>		<b>14</b>
	<p>Introduction, objective and scope of Plant Anatomy, Plant cell structure- nature of plant cell wall.</p> <p><i>Tissue and tissue systems</i> - meristematic tissue, permanent tissue and secretory cells.</p> <p><b>Classification of meristem:</b> (apical, intercalary and lateral), primary and secondary meristem.</p> <p><i>Apical meristem:</i> Theories on organization of meristem (apical cell theory, Tunica-Corpus theory, Histogen theory and Korper-Kappe theory).</p> <p>Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves.</p>		
<b>II</b>	<b>ANGIOSPERM ANATOMY</b>		<b>14</b>
	<p><b>Structure of Dicot root:</b> primary structure and secondary growth (Sunflower), Structure of monocot root (Maize).</p> <p><b>Structure of Dicot stem:</b> Primary structure and secondary growth (Helianthus annuus), Structure of Monocot stem (Zea mays).</p> <p><b>Structure of Dicot leaf:</b> Primary structure (Helianthus annuus), primary structure of Monocot leaf (Zea mays), Stomatal types.</p> <p><b>Anomalous secondary growth:</b> Boerhaavia (dicot stem) Dracaena (monocot stem) Applications in Systematics, and Pharmacognosy. Forensicbotany.</p>		



<b>III</b>	<b>DEVELOPMENTAL BIOLOGY</b> <b>MORPHOGENESIS AND DIFFERENTIATION</b>	<b>14</b>
	<p><b>Morphogenesis in plants -</b> Differentiation and cell polarity in acellular (<i>Dictyostelium</i>), Unicellular (<i>Acetabularia</i>) and multicellular system (root hair and stomata formation)</p> <p><b>Organogenesis:</b> Differentiation of root, stem, leaf and axillary bud. Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves)</p> <p>Root cap, quiescent centre and origin of lateral roots. Transition from vegetative apex into reproductive</p> <p>Developmental patterns at flowering apex: ABC model specification of floral organs. Modification of gene action by growth hormones and cellular differences between floral organs. Senescence - a general account.</p>	
<b>IV</b>	<b>REPRODUCTIVE BIOLOGY</b>	<b>20</b>
	<p>Introduction, Scope and contributions of Indian embryologists: P. Maheswari, B G L Swamy, B.M Johri, M.S. Swaminathan and K.C. Mehta.</p> <p><b>Microsporangium:</b> Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions and sporogenous tissue.</p> <p><b>Microsporogenesis-</b> Microspore mother cells, microspore tetrads, Pollinia.</p> <p><b>Microgametogenesis-</b> Formation of vegetative and generative cells, structure of male gametophyte. Pollen embry sac (Nemec phenomenon).</p> <p><b>Megasporangium -</b> Structure of typical Angiosperm ovule. Types of ovule (Anatropous, Orthotropous, Amphitropous, Hemianatropous, Campylotropous, Circinotropous).</p> <p><b>Megagametogenesis-</b> Types and development of Female gametophyte/embryosac- monosporic- <i>Polygonum</i> type, bisporic - <i>Allium</i> type, tetrasporic - <i>Fritillaria</i> type. Structure of mature embryosac.</p> <p><b>Pollination and Fertilization:</b> Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes.</p> <p><b>Endosperm -</b> Types and its biological importance. Free nuclear (<i>Cocos nucifera</i>) cellular (<i>Cucumis</i>), helobial types. Ruminant endosperm. Study of non-endospermic plants from Podostemaceae, Orchidaceae, Trapaceae.</p> <p><b>Embryogenesis -</b> Structure and development of Dicot (<i>Capsella bursa pastoris</i>) and Monocot (<i>Najas</i>), embryo. Polyembryony, Apomixis and Parthenocarpy.</p>	

### **Text Books for Reference:**

1. Bhojwani and Bhatnagar & Dantu , The Embryology of Angiosperms, 6 Edition 2022-Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms, Woong-Young Soh, Springer Netherlands,
3. Coulter E. G. , 1969. Plant Anatomy - Part I Cells and Tissues - Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
- 10.Karp G., 1985. Cell Biology; Mc.Graw Hill Company
- 11.Maheshwari,P 1950. An introduction to the embryology of angiosperms.  
New York: McGraw-Hill
- 12.Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
- 14.Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
- 15.Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
- 16.Saxena M. R. - Palynology - A treatise - Oxford & I. B .H., New Delhi.
17. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
- 18.Vashishta .P.C .,1984. Plant Anatomy - Pradeep Publications – Jalandhar

**II B.Sc. III-Semester- DSCC**  
**PLANT ANATOMY AND DEVELOPMENT BIOLOGY**  
**PRACTICALS**

**LIST OF EXPERIMENTS TO BE CONDUCTED**

**Practical No. 1**

- i) Study of meristems (Permanent slides/ Photographs).
- ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex Tissues (xylem and phloem).

**Practical No.2, 3 & 4**

Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root (Cicer), stem (Tridax) and leaf (Datura/Zinnia) and monocot root (Maize), stem (Grass) and leaf (Grass).

**Practical No.5**

Anomalous secondary growth: *Boerhaavia* (dicot stem) *Dracaena* (monocot stem)

**Practical No. 6**

Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials

**Practical No. 7**

Permanent slides of Microsporogenesis and male gametophyte, Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis

**Practical No. 8**

Pollen germination by hanging drop method

**Practical No. 9**

Permanent slides: T.S of Tricarpellary and pentacarpellary ovary, Matured ovule, Placentation types: Axile, Marginal and Parietal types.

**Practical No. 10**

Mounting of embryo: Tridax /Cyamopsis/Crotolaria, Mounting of endosperm: Cucumis

**Practical No. 11 & 12**

**Mini project work in groups of 3-5 students, from the following list**

- a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.
- b) Pollen germination of different pollen grains and calculate percentage of germination.
- c) Calculate the percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.
- d) Study of placentation of different flowers.
- e) Any other relevant study related to Anatomy / Embryology

**SCHEME OF BOTANY PRACTICAL EXAMINATION**  
**PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY**

**Time: 3 Hours**

**Max Marks- 25**

- I. Prepare a temporary stained slide of the given material A. Leave the Preparation for evaluation** **5 Marks**  
(Root, Stem, Leaf)  
(Preparation -2 Marks, Identification -1, Diagram with Reasons- 2Marks)
- II. Identify the given slides B, C & D** **3X3=9 Marks**  
(**B** from Tissues, **C** from Anatomy, **D** from Embryology)  
(Identification-1 Mark, Diagram with reasons - 2 Marks)
- III. Mount the material E** **3 Marks**  
(Pollen grain/Stomata/Trichomes)  
(Mounting - 2 Mark, Diagram with Reasons-1 Marks)
- IV. Pollen germination of F by hanging drop method.** **5 Marks**  
(Preparation - 3 Marks, Procedure-2 Marks)
- V. Mount the material of G** **3 Marks**  
(Endosperm / Embryo)

**SCHEME OF BOTANY THEORY EXAMINATION**  
**III SEMESTER**  
**MODEL QUESTION PAPER**  
**PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY**

**Time: 2 Hours**

**Max Marks- 60**

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**BLUE PRINT OF BOTANY THEORY EXAMINATION**  
**III SEMESTER**  
**PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY**

**Time:** 2.5 Hours

**Max Marks-** 60

<b>UNITS</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks</b>
<b>I</b>	2X1=2	5X2=10	8X1=08	<b>20</b>
<b>II</b>	2X1=2	5X1=5	8X2=16	<b>23</b>
<b>III</b>	2X2=4	5X1=5	8X1=08	<b>17</b>
<b>IV</b>	2X2=4	5X2=10	8X2=16	<b>30</b>
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90</b>

**B.Sc. BOTANY – III Semester**  
**Open Elective Course (OEC - 3)**

**Community Forestry**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-3.1	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

After completion of the course, the students will be able to;

- Understand community forestry and its conservation
- Examine the use of trees and community forestry
- Interpret the role of indigenous / tribal people in conservation of forest
- Examine the role of various community forestry conservation programs
- Measure the different properties of trees such as wood volume, age, height, volume etc.

**Keywords:**

Community forestry, Commercial forestry, Conservation Land uses, Timber harvesting

**Unit I**

**14 lectures**

Defining community forestry and conservation, Indigenous community-based forestry systems and their changes, Case studies of indigenous forest management systems: India., History of commercial forestry in India, Diseases of commercial forestry, maintenance of forests, Protection from fire, illicit felling, Measurement of Trees- Height, girth, wood density, wood quality, clear and selective felling.

**Unit II**

**14 lectures**

Role of community forestry in Environmental conservation, Water shed management, soil management and poverty reduction, Trees as a forest management tool managing vegetation to modify climate, soil conditions & ecological processes, Social considerations on land-uses.

### **Unit III**

**14 lectures**

State-sponsored community forestry and conservation programs, Changing paradigms in forestry and environmental conservation, Community-managed commercial timber harvesting. Community based forestry and collaborative conservation in India, factors contributing to the rise of community forestry, Role of tribes in Forest and management.

### **Suggested Reading**

1. Agrawal, A and C.C. Gibson. (2001). Introduction: The Role of Community in Natural Resource Conservation. In: Agrawal, A and C. C. Gibson (eds).Communities and the Environment. NJ: Rutgers University Press
2. Mosse, D.(2001). 'People's knowledge', participation and patronage: operations and representations in rural development. In: Cook, B & Kothari, U (eds), Participation the newtyranny? Zed Press
3. Ong, C.K. & Huxley, P.K. (1996). Tree Crop Interactions–A Physiological Approach. ICRAF.
4. Robinson, D. (2018). The Economic Theory of Community Forestry (Routledge Explorations in Environmental Economics) Routledge.
5. Sagreiya, K.P. (1979). Forests and Forestry. National Book Trust, India, New Delhi, P1-307.



**B.Sc. BOTANY – III Semester**

**Open Elective Course (OEC - 3)**

**Algal Cultivation and Applications**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-3.2	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

**On completion of this course, the students will be able to;**

- Understand core concepts and fundamentals of various levels of algal growth
- Translate various algal technologies for benefit of ecosystem
- Demonstrate algal growth in different types of natural water.
- Analyze emerging areas of Algal Biotechnology for identifying commercial potentials of algal products & their uses.

**Keywords:**

Culture techniques, Algal growth, Algal blooms, Eutrophication, Algal immobilization, Biofertilizers, Pollution indicators

**Unit I**

**14 lectures**

A brief account of culture techniques and media for algal research. Measurement of algal growth: lag phase, log phase, stationary phase and death phase using biomass, chlorophyll content. Limits to algal growth in natural waters. Dynamics and consequences of marine & freshwater algal blooms;

**Unit II**

**14 lectures**

Causative factors for eutrophication and its impact on algal blooms. Algal immobilization: methods and applications, Algal technologies for the restoration/maintenance of soil fertility; reclamation of usar soils. Restoration of degraded aquatic systems through algae; High rate algal ponds for the treatment of wastewaters for the production of useful biomass & fuels.

### **Unit III**

**14 lectures**

Emerging areas of Algal Biotechnology: Single cell proteins, bio-fertilizers, Algae as food, medicine, feed, Biofuel, industrial products such as phyco-colloid (Agar-agar, Algin, Carrageenan, Diatomite); A brief account of commercial potentials of algal products & their uses. Algae as indicators of pollution. Biofouling, Sewage disposal. Waste-land reclamation. Use of Algae in experimental studies. Algae in space. Algal toxins.

### **Suggested Readings**

1. Hoek, C. and Van D. (2009) *Algae: An Introduction to Phycology*. Cambridge University Press
2. Bast, F. (2014). An Illustrated Review on Cultivation and Life History of Agronomically Important Seaplants. In *Seaweed: Mineral Composition, Nutritional and Antioxidant Benefits and Agricultural Uses*, Eds. Vitor Hugo Pomin, 39-70. Nova Publishers, New York ISBN:978-1-63117-571-8
3. Kumar, H.D.(1999). *Introductory Phycology*. Affiliated East-West Press, Delhi
4. Sahoo, D. (2000). *Farming the ocean: seaweeds cultivation and utilization*. Aravali International, New Delhi.
5. Bast, F. (2014). Seaweeds: Ancestors of land plants with rich diversity. *Resonance*, 19 (2)1032-1043/ISSN:0971-8044

**B.Sc. BOTANY – III Semester**  
**Open Elective Course (OEC - 3)**  
**Landscaping and Gardening**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-3.3	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

**After the completion of this course the learner will be able to:**

- Apply the basic principles and components of gardening
- Conceptualize flower arrangement and bio-aesthetic planning
- Design various types of gardens according to the culture and art of bonsai
- Distinguish between formal, informal and free style gardens
- Establish and maintain special types of gardens for outdoor and indoor land scaping

**Keywords:**

Gardening, Landscaping, Flower arrangement, Vertical gardens, Roof gardens, Computer aided designing

**Unit I**

**14 lectures**

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Green house. Special types of gardens, trees, their design, values in land scaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents.

**Unit II**

**14 lectures**

Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.

### **Unit III**

**14 lectures**

Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Land scape designs, Styles of garden, formal, informal and freestyle gardens, types of gardens, Urban land scaping, Land scaping for specific situations, institutions, industries, residents, hospitals, road sides, traffic islands, dam sites, IT parks, corporate. Establishment and maintenance, special types of gardens, Bio-aesthetic planning, eco-tourism, indoor gardening, therapeutic gardening, non-plant components, water-scaping, xeri-scaping, hardscaping; Computer Aided Designing (CAD) for outdoor and indoor scaping Exposure to CAD (Computer Aided Designing)

### **Suggested Readings**

1. Berry, F. and Kress, J. (1991). *Heliconia: An Identification Guide*. Smithsonian Books
2. Butts, E. and Stensson, K. (2012). *Sheridan Nurseries: One hundred years of People, Plans, and Plants*. Dundurn Group Ltd.
3. Russell, T.(2012). *Nature Guide: Trees: The world in your hands* (Nature Guides).

**II B.Sc. IV SEMESTER**  
**Ecology and Conservation Biology**

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
<b>04</b>	<b>56</b>	<b>02</b>	<b>56</b>

<b>Contents of Theory Course</b>		
<b>Unit</b>	<b>Topics</b>	<b>Teaching Hours</b>
<b>I</b>	<p><b>Introduction to Ecology and Conservation Biology:</b> Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation.</p> <p><b>Ecological factors:</b> Climatic factors: light, temperature, precipitation and humidity.</p> <p><b>Edaphic factors:</b> Soil and its types, soil texture, soil profile, soil formation; physico-chemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms.</p> <p>Topographic Factors: Altitude</p> <p><b>Ecological groups of plants and their adaptations:</b> Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.</p>	15 hrs
<b>II</b>	<p><b>Ecosystem Ecology:</b> Introduction, types of ecosystems with examples -terrestrial and aquatic, natural and artificial.</p> <p>Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.</p> <p>Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem.</p> <p>Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle- Phosphorus.</p> <p>Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere.</p> <p><b>Community Ecology:</b> Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes.</p> <p>Intra-specific and Inter-specific interactions with examples.</p> <p><b>Ecological methods and techniques:</b> Methods of sampling plant communities – transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping.</p> <p><b>Population Ecology:</b> Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal.</p>	15 hrs

<p><b>III</b></p>	<p><b>Phytogeography and Environmental issues:</b></p> <p>Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov’s concept, types. Phytogeographical regions – concept, phytogeographical regions of India. Vegetation types of Karnataka – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shoal forests and grasslands. An account of the vegetation of the Western Ghats.</p> <p>Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment). Water pollution disasters – National mission on clean Ganga ,Minimata, Pacific gyre garbage patch, Exxon valdez oil spill.</p> <p>Air pollution: Causes, effect, air quality standards, acid rain, control.</p> <p>Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.</p>	<p>11hrs</p>
<p><b>IV</b></p>	<p><b>Biodiversity and its conservation:</b></p> <p>Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG’s in biodiversity conservation.</p> <p>Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity.</p> <p>Concept of Biodiversity Hotspots, Biodiversity hot spots of India.</p> <p>Concept of endemism and endemic species.</p> <p>ICUN plant categories with special reference to Karnataka/ Western Ghats.</p> <p>Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002).</p> <p>Conservation methods – <i>In-situ</i> and <i>ex-situ</i> methods</p> <p><i>In-situ</i> methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves.</p> <p><i>Ex-situ</i> methods-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.</p>	<p>15 hrs</p>

**SUGGESTED REFERENCE BOOKS:**

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.
10. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.

**II B.Sc. IV-Semester**  
**Ecology and Conservation Biology**  
**PRACTICALS**

**LIST OF EXPERIMENTS TO BE CONDUCTED**

Practical No.	Experiments
1	Determination of pH of different types of Soils, Estimation of salinity of soil/water samples.
2	Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc
3	Hydrophytes: Morphological adaptations in <i>Pistia</i> , <i>Eichhornia</i> , <i>Hydrilla</i> , <i>Nymphaea</i> . Anatomical adaptations in <i>Hydrilla</i> (stem) and <i>Nymphaea</i> (petiole).
4	Xerophytes: Morphological adaptations in <i>Asparagus</i> , <i>Casuarina</i> , <i>Acacia</i> , <i>Aloe vera</i> , <i>Euphorbiatirucalli</i> . Anatomical adaptations in phylloclade of <i>Casuarina</i> .
5	Epiphytes: Morphological adaptations in <i>Acampe</i> , <i>Bulbophyllum</i> , <i>Drynaria</i> . Anatomical adaptations in epiphytic root of <i>Acampe</i> / <i>Vanda</i> . Halophytes: study of Viviparyin mangroves, Morphology and anatomy of Pneumatophores.
6	Study of a pond/forest ecosystem and recording the different biotic and abiotic components
7	Demonstration of different types of vegetation sampling methods – transects and quadrats. Determination of Density and frequency.
8	Application of remote sensing to vegetation analysis using satellite imageries
9	Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book.
10	Determination of water holding capacity of soil samples
11	Determination of Biological oxygen demand (BOD)
12	Determination of Chemical oxygen demand (COD)
13	Determination of soil texture of different soil samples.

**SCHEME OF BOTANY PRACTICAL EXAMINATION**  
**IV-Semester**  
**ECOLOGY AND CONSERVATION BIOLOGY**

**Time: 3 Hours**

**Max Marks- 25**

**I. Conduct the experiment A.**

**6 Marks**

(COD/Water holding capacity of soil/Salinity of soil/Water sample)  
(Requirements - 1Mark, Procedure -3 marks, Result - 2Marks)

**II. Write the ecological adaptations of B & C**

**2X3=6 Marks**

(Hydrophytes, Xerophytes, Epiphyte, Halophyte, Parasite)  
(Identification-1 Mark, Diagram with reasons - 2 Marks)

**III. Prepare a temporary stained slide of the given material D. Leave the preparation for evaluation.**

**5 Marks**

(Hydrilla/Nymphaea/Casuarina/Orchid root)  
(Mounting -2 Mark, Identification-1,Diagram with Reasons-2 Marks)

**IV. Comment on E (Ecological instruments)**

**3 Marks**

(Instruments studied in Practicals)

**V. Identify the slides/Chart F & G**

**2 X 2.5=5 Marks**

(One from adaptations, One from Quadrants/Remote sensing of Satellite image)



**BLUE PRINT OF BOTANY THEORY**  
**EXAMINATION IV SEMESTER-BLUE PRINT**  
**ECOLOGY AND CONSERVATION BIOLOGY**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks.</b>
<b>I</b>	2X1=2	5X1=05	8X2=16	23
<b>II</b>	2X2=4	5X2=10	8X1=08	22
<b>III</b>	2X2=4	5X2=10	8X1=08	22
<b>IV</b>	2X1=2	5X1=05	8X2=16	23
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

**SCHEME OF BOTANY THEORY EXAMINATION  
IV- SEMESTER  
ECOLOGY AND CONSERVATION BIOLOGY**

**Time: 2 Hours**

**Max Marks- 60**

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**B.Sc. BOTANY – IV Semester**  
**Open Elective Course**  
**Plant Diversity and Human Welfare**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC - 4.1	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

After the completion of this course, the learner will be able to:

- Develop understanding of the concept and scope of plant biodiversity
- Identify the causes and implications of loss of biodiversity
- Apply skills to manage plant biodiversity
- Utilize various strategies for the conservation of biodiversity
- Conceptualize the role of plants in human welfare with special reference to India

**Keywords:**

Biodiversity, Biodiversity loss, Hotspots, Biodiversity management, Conservation strategies, Biodiversity awareness programmes

**Unit I: Plant Diversity and its Scope**

**14 lectures**

Levels of biodiversity: Genetic, Species and Ecosystem; Agro-biodiversity and cultivated plant taxa and related wild taxa. Values and uses of Biodiversity, Methodologies for valuation, Ethical and aesthetic values, Uses of plants; Ecosystem services.

**Unit II: Loss of Biodiversity and Management of Plant Biodiversity**

**14 lectures**

Loss of biodiversity-causes and implications, Hotspots of biodiversity, extinction of species, projected scenario for biodiversity loss. Organizations associated with biodiversity management, IUCN, UNEP, WWF, UNESCO, NBPGR; Methodology for execution; Biodiversity legislation; Information management and communication.

### **Unit III: Conservation of Biodiversity, Role of Plants in Relation to Human Welfare**

**14 lectures**

Conservation of genetic, species and ecosystem diversity, *In situ* and *ex situ* conservation strategies, India's biodiversity and its conservation Social approaches to conservation, Biodiversity awareness programmes, Sustainable development. Importance of forestry their utilization and commercial aspects; Avenue trees; Ornamental plants of India; Alcoholic beverages; Fruits and nuts; Wood and its uses; their commercial importal,

#### **Suggested Readings**

1. Krishnamurthy, K.V. (2004).An Advanced Text Book of Biodiversity-Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S.(2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Reddy, K.V. and Veeraiah, S. (2010). Biodiversity and Plant Resources. Aavishkar publication, New Delhi.
4. Heywood, V.H. and Watson, R.T.(1995). Global biodiversity and Assessment. Cambridge University Press.

**B.Sc. BOTANY – IV Semester**  
**Open Elective Course**  
**Medicinal Plants in Health Care**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-4.2	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

On completion of this course, the students will be able to:

- Recognize the basic medicinal plants
- Apply techniques of conservation and propagation of medicinal plants.
- Setup process of harvesting, drying and storage of medicinal herbs
- Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India

**Keywords:**

Medicinal plants, Traditional systems, endangered medicinal plants, Ethnobotany, Folk medicines, Ethnic communities

**Unit I: History and Traditional System of Medicine** **14 lectures**

History, Scope and Importance of Medicinal Plants; Traditional systems of medicine; Definition and Scope.

**Ayurveda:** History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments,

**Siddha:** Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.

**Unani:** History, concept: Umoor-e-tabiya, tumors treatments / therapy, polyherbal formulations.

**Unit II: Conservation, Augmentation and Ethnobotany and Folk Medicine** **14 lectures**

Conservation of Eendemic and endangered medicinal plants, Red list criteria; *In situ* conservation: Biosphere reserves, sacred groves, National Parks; *Ex situ* conservation: Botanic Gardens, Ethnomedicinal plant Gardens.

**Propagation of Medicinal Plants:** Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of greenhouse for nursery production, propagation through cuttings, layering, grafting and budding.

Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethno-botany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India.

### Unit III Medicinal Plants

14 lectures

Brief description of selected plants and derived drugs, namely Guggul (*Commiphora*) for hypercholesterolemia, *Boswellia* for inflammatory disorders, Arjuna (*Terminalia arjuna*) for cardioprotection, turmeric (*Curcuma longa*) for wound healing, antioxidant and anticancer properties, Kutaki (*Picrorhiza kurroa*) for hepatoprotection, Opium Poppy for analgesic and antitussive, Salix for analgesic, Cincona and Artemisia for Malaria, Rauwolfia as tranquilizer, Belladonna as anticholinergic, Digitalis as cardiotoxic, Podophyllum as antitumor.

#### Suggested Readings:

1. Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press.
2. AYUSH ([www.indianmedicine.nic.in](http://www.indianmedicine.nic.in)). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
3. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). *Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation*.
4. Dev, S. (1997). Ethno-therapeutics and modern drug development: The potential of Ayurveda. *Current Science* 73:909–928.
5. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16<sup>th</sup>edn. Philadelphia, PA: Elsevier Saunders Ltd.
6. Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
7. Kapoor, L.D. (2001). Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.
8. Saroya, A.S. (2017). Ethnobotany. ICAR publication.
9. Sharma, R.(2003). Medicinal Plants of India-An Encyclopaedia. Delhi: Daya Publishing House.
10. Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi.
11. Thakur, R.S., H.S. Puri, and Husain, A.(1989). Major medicinal plants of India. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.

**B.Sc. BOTANY – IV Semester**  
**Open Elective Course (OEC - 4)**  
**Floriculture**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC - 4.3	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

After completing this course the learner will be able to;

- Develop conceptual understanding of gardening from historical perspective
- Analyze various nursery management practices with routine garden operations.
- Distinguish among the various Ornamental Plants and their cultivation
- Evaluate garden designs of different countries
- Appraise the landscaping of public and commercial places for floriculture.
- Diagnoses the various diseases and uses of pests for ornamental plants.

**Keywords:**

Gardening, Transplanting, Mulching, Plant growth regulators, Ornamental plants, Commercial floriculture

**Unit I**

**14 lectures**

Introduction: Importance and scope of floriculture and landscape gardening. Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

**Unit II**

**14 lectures**

Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and fern allies; Cultivation of plants in pots; Indoor gardening; Bonsai. Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flowerbeds, Shrubbery, Borders, Water-garden. Some Famous gardens of India.

Floriculture and green house technology. Commercial aspects and exporting of flowers and ornamental plants. Quarantine and testing requirements.

### **Unit III**

**14 lectures**

Landscaping Places of Public Importance: Landscaping highways And Educational institutions. Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Liliun, Orchids). Diseases and Pests of Ornamental Plants.

### **Suggested Readings**

1. Randhawa, G.S. and Mukhopadhyay, A. (1986).Floriculture in India. Allied Publishers.
2. Adams, C., M. Early and J. Brrok (2011). Principles of Horticulture. Routledge, U.K





# **JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**

(An Autonomous College of University of Mysore)  
Re-accredited by NAAC with 'A' grade  
OOTY ROAD, MYSORE-570 025, KARNATAKA



ESTD-1964

## **REVISED SYLLABUS**

**B. Voc. (Food Processing & Engineering)**

**2022 - 2023**

**DEPARTMENT OF FOOD  
PROCESSING & ENGINEERING**

Scheme of Instruction For B. Voc. (Food Processing & Engineering)								
General Education Component (NEP)								
(L-Lecture; T-Tutorial; P-Practical/Practice) (1 Credit = 15 Hrs)								
Semesters	Paper No.	Title	L:T:P	Theory Hours	Tutorial Hours	Practical Hours	Total Hours	Total Credit
Sem I	FPA010A	Udyoga Siri -1	03:00:00	45	0	0	45	3
	FPA020A	Reverberations-1	03:00:00	45	0	0	45	3
	FPA050A	Environment Studies	03:00:00	45	0	0	45	3
	FPA060A	Business Organization	03:00:00	45	0	0	45	3
	FPA070A	Biomolecule	02:00:01	30	0	0	15	3
	FPA0130A	Health, Wellness & Yoga	00:00:02	0	0	0	30	2
	FPA080A	Process Machineries for Pulp Processing	01:00:02	15	0	30	45	3
	FPA090A	Introduction to the Food Processing Industry	01:00:02	15	0	30	45	3
	FPA100A	Production of Fruit Pulp	01:00:02	15	0	30	45	3
	FPA110A	Food Safety Hygiene & Sanitation	01:00:02	15	0	30	45	3
								<b>12</b>
Sem II	FPB010A	Vignana siri-II	03:00:00	45	0	0	45	3
	FPB020A	Reverberations-II	03:00:00	45	0	0	45	3



# 1<sup>st</sup> Semester NEP Syllabus for B.Voc 2022-23 Batch

Sl no.	PROCESS MACHINERIES FOR PULP PROCESSING (PRACTICAL)	Hrs
<b>UNIT 1: INTRODUCTION TO PULP PROCESSING</b>		
1.	Safety measures and personal protective equipment (PPE) in the work area Familiarization with the process machineries and their components Setting up and preparing the work area for pulp processing Cleaning and maintenance of process machineries Troubleshooting common issues in pulp processing equipment	8
<b>UNIT 2: FRUIT AND VEGETABLE PREPARATION FOR PULP PROCESSING</b>		
2.	Sorting and grading fruits and vegetables Washing and sanitizing raw materials Pre-processing techniques such as peeling, slicing, and removing seeds or pits Proper storage and handling of prepared fruits and vegetables	6
<b>UNIT 3: PULP EXTRACTION AND REFINING</b>		
3.	Operating pulp extraction equipment Adjusting and monitoring extraction parameters Refining pulp using appropriate techniques Quality control tests to assess pulp consistency and quality Unit 4: Packaging and Storage of Fruit Pulp	8
<b>UNIT 4: PACKAGING AND STORAGE OF FRUIT PULP</b>		
4.	Packaging fruit pulp using suitable materials and techniques Sealing and labeling of packaged fruit pulp Storage and preservation techniques for maintaining product quality Quality control checks for packaged fruit pulp	8
	<b>Total Practical</b>	<b>30</b>
SL.no.	(THEORY)	Hrs
1.	Overview of pulp processing Importance of fruit and vegetable processing in the food industry Types of fruits and vegetables used for pulp processing Basic principles of pulp production Introduction to process machineries used in pulp processing	4
2.	Selection and procurement of fruits and vegetables Sorting and grading of raw materials	3

	Washing and sanitization techniques Pre-processing methods for different types of fruits and vegetables	
3.	Extraction methods for pulp production Equipment used for pulp extraction Refining techniques for achieving desired pulp consistency and texture Quality control measures during the extraction and refining process	4
4	Packaging materials and considerations for fruit pulp Packaging techniques to ensure product safety and shelf life Storage conditions and requirements for fruit pulp Quality control measures during packaging and storage	4
	<b>Total Theory</b>	<b>15</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 15 hours L:T:P = 1:0:2</b>		

#### Reference Books

"Fruit and Vegetable Processing: Improving Quality" by S. J. Gould

"Food Process Engineering Operations" by George D. Saravacos and Athanasios E. Kostaropoulos

"Food Processing Technology: Principles and Practice" by P.J. Fellows

**JSS MAHAVIDYAPEETHA**  
**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**  
**(Autonomous)Ooty Road, Mysore-25.**  
**B.Voc in Food Processing and Engineering.**  
**1<sup>st</sup> Semester:**  
**PROCESS MACHINERIES FOR PULP PROCESSING**

**QP: 15118**

**Section A:**

( 5X1 Marks)

Multiple Choice Questions

Choose the most appropriate answer for each question.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section B**

(5X3=15 Marks)

Answer any three questions from this section.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section C**

(10X1=10 marks)

Answer any one question from this section.

- 1.
- 2.
- 3

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# 1<sup>st</sup> Semester NEP Syllabus for B.Voc 2022-23 Batch

Sl no.	INTRODUCTION TO FOOD PROCESSING INDUSTRY (PRACTICAL)	Hrs
<b>UNIT 1: Principles of Food Processing Industry</b>		
1.	Safety and hygiene practices in food processing (2 hours) Introduction to equipment and machinery used in food processing (2 hours) Demonstration of proper cleaning and maintenance procedures (2 hours) Hands-on experience in handling and storing fruits and vegetables (2 hours) Understanding and implementing basic quality control measures (2 hours)	8
<b>UNIT 2: FRUIT AND VEGETABLE PROCESSING</b>		
2.	Hands-on experience in fruit and vegetable harvesting techniques (2 hours) Practical demonstration of sorting, grading, and washing techniques (2 hours) Cutting, peeling, and slicing fruits and vegetables (2 hours) Canning process: Preparing fruits or vegetables, filling jars, and sealing (3 hours) Thermal processing: Pasteurization or sterilization techniques (2 hours) Freezing fruits and vegetables using appropriate techniques (2 hours) Drying fruits and vegetables through dehydration methods (2 hours) Introduction to fermentation: Making fermented products from fruits and vegetables (2 hours)	10
<b>UNIT 3: UNIT 3: ASEPTIC PACKAGING</b>		
3.	Sterilization methods for aseptic packaging (2 hours) Hands-on experience in operating aseptic packaging equipment (2 hours) Packaging line operations and quality control (2 hours)	8
<b>UNIT 4: FOOD PROCESSING INDUSTRY REGULATIONS AND MANAGEMENT</b>		
4.	Food processing industry regulations and standards (1 hour) Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Points (HACCP) (1 hour) Quality assurance and quality control in food processing (1 hour)	4



	<b>Total Practical</b>	<b>30</b>
<b>SL.no.</b>	<b>(THEORY)</b>	<b>Hrs</b>
1.	Overview of the food processing industry (1 hour) Importance of fruit and vegetable processing (1 hour) Major processes involved in food processing (1 hour) Introduction to aseptic packaging (1 hour)	4
2.	Harvesting and post-harvest handling of fruits and vegetables (1 hour) Sorting, grading, and washing techniques (1 hour) Cutting, peeling, and slicing methods (1 hour) Preservation methods: Canning (chemical preservation), thermal processing, and freezing (1 hour) Preservation methods: Drying and fermentation (1 hour)	5
3.	Principles and advantages of aseptic packaging (1 hour) Aseptic processing techniques (1 hour) Aseptic packaging materials and equipment (1 hour)	3
4	Food processing industry regulations and standards (1 hour) Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Points (HACCP) (1 hour) Quality assurance and quality control in food processing (1 hour)	3
	<b>Total Theory</b>	<b>15</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 15 hours L:T:P = 1:0:2</b>		

#### Reference Books

"Food Processing Technology: Principles and Practice" by P.J. Fellows

"Food Processing Handbook" by James G. Brennan

"Food Processing: Principles and Applications" by Stephanie Clark and Stephanie Jung

"Food Processing Technology: Principles and Practice" by Geoffrey Campbell-Platt

"Food Processing: From Field to Fork" by Sarah E. Kemp and Nikolaos Tzortzoglou

"Postharvest Technology and Food Process Engineering" by Amalendu Chakraverty

"Food Processing Operations Modeling: Design and Analysis" by L. Grierson

"Food Process Engineering and Technology" by Zeki Berk

"Food Process Engineering and Quality Assurance" by Gaurav Tewari and Vijay Kothari

"Handbook of Food Processing: Food Preservation" by Stephanie Clark, Malcolm C. Bourne, and Robert J. Loewe

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**1<sup>st</sup> Semester: Introduction to Food Processing Industry**

**QP: 15119**

**Section A:**

( 5X1 Marks)

Multiple Choice Questions

Choose the most appropriate answer for each question.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section B**

(5X3=15 Marks)

Answer any three questions from this section.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section C**

(10X1=10 marks)

Answer any one question from this section.

- 1.
- 2.
- 3

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## 1<sup>st</sup> Semester NEP Syllabus for B.Voc 2022-23 Batch

Sl no.	<b>PRODUCTION OF FRUIT PULP (PRACTICAL)</b>	Hrs
	<b>UNIT 1: INTRODUCTION TO FRUIT PULP PRODUCTION</b>	
1.	Hands-on activities related to fruit pulp production Introduction to fruit pulp production equipment and tools Safety guidelines for handling fruits and equipment	2
	<b>UNIT 2: FRUIT SELECTION AND PREPARATION</b>	
2.	Sorting, cleaning, and washing of fruits Removal of seeds, skins, and undesirable parts Techniques for peeling and slicing fruits Proper handling and storage of prepared fruits	8
	<b>UNIT 3: EXTRACTION AND PROCESSING METHODS</b>	
3.	Demonstrations of different extraction methods Hands-on exercises for pulp extraction techniques Enzyme treatments and their application in fruit pulp processing	8
	<b>UNIT 4: FRUIT PULP PRESERVATION AND PACKAGING</b>	
4.	Techniques for pulp preservation Hands-on exercises for different preservation methods Packaging and labelling procedures for fruit pulp	9
	<b>UNIT 5: PRODUCT DEVELOPMENT AND MARKETING</b>	
5.	Market analysis and target consumer identification Packaging and branding strategies Marketing channels and distribution networks	3
	<b>Total Practical</b>	<b>30</b>
SL.no.	<b>(THEORY)</b>	Hrs
1.	Overview of fruit pulp production Importance of fruit pulp in the food industry Types of fruits used for pulp production Nutritional value and health benefits of fruit pulp Market trends and demand for fruit pulp	4
2.	Selection criteria for fruits used in pulp production Proper handling and storage of fruits for pulp production	2
3.	Different methods of fruit pulp extraction (e.g., pressing, milling, blending) Factors influencing the choice of extraction method	4

	Enzyme treatments and their effects on pulp quality	
4	Techniques for pulp preservation (e.g., freezing, canning, aseptic packaging) Packaging materials and their suitability for fruit pulp	3
5	Value-added products using fruit pulp (e.g., juices, smoothies, jams) Product development and innovation in the fruit pulp industry	2
	<b>Total Theory</b>	<b>15</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 15 hours L:T:P = 1:0:2</b>		

#### Reference

1. "Fruit Processing: Nutrition, Products, and Quality Management" by Rakesh K. Singh
2. "Postharvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation, and Waste Management" by Amalendu Chakraverty
3. "Fruit and Vegetable Processing: Principles and Applications" by S. R. Prabha and T. K. Goswami
4. "Fruit Processing and Packaging: Technologies, Equipment, and Applications" by Shantanu Bhattacharya

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**(Autonomous)Ooty Road, Mysore-25.**  
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**1<sup>st</sup> Semester: Production of Fruit Pulp**

QP: 15120

**Section A:**

( 5X1 Marks)

Multiple Choice Questions

Choose the most appropriate answer for each question.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section B**

(5X3=15 Marks)

Answer any three questions from this section.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section C**

(10X1=10 marks)

Answer any one question from this section.

- 1.
- 2.
- 3

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# 1<sup>st</sup> Semester NEP Syllabus for B.Voc 2022-23 Batch

Sl no.	FOOD SAFETY AND, HYGIENE AND SANITATION (PRACTICAL)	Hrs
	<b>UNIT 1: INTRODUCTION TO FOOD SAFETY AND SANITATION</b>	
1.	Hands-on training in cleaning and sanitizing procedures (2 hours) Demonstrations of personal hygiene and protective measures (1 hour) Introduction to HACCP principles through case studies (3 hours)	6
	<b>UNIT 2: FOOD SAFETY PRACTICES IN PROCESSING FOOD PRODUCTS</b>	
2.	Simulated scenarios for temperature control and monitoring (2 hours) Identification and control of allergens in a processing unit (2 hours) Equipment and utensil maintenance and sanitation (2 hours) Pest control practices and inspections (2 hours)	8
	<b>UNIT 3: IMPLEMENTING SAFETY AND SANITATION IN THE WORK AREA</b>	
3.	Work Area Design and Layout for Food Safety (2 hours) Good Manufacturing Practices (GMPs) (2 hours) Training and Supervision of Employees (2 hours) Waste Management and Disposal (1 hour) Emergency Preparedness and Response (1 hour)	8
	<b>UNIT 4: MONITORING AND AUDITING FOOD SAFETY AND SANITATION</b>	
4.	Internal Monitoring and Self-Inspection (2 hours) Food Safety Audits and Inspections (2 hours) Corrective Actions and Continuous Improvement (2 hours) Food Safety Culture and Communication (1 hour) Emerging Trends and Technologies in Food Safety (1 hour)	8
	<b>Total Practical</b>	<b>30</b>
SL.no.	(THEORY)	Hrs
1.	Importance of Food Safety and Sanitation in the Food Industry (1 hour) Regulatory Framework and Standards (1 hour) Hazards and Risks in Food Processing (1 hour)	3
2.	Food Handling and Storage Practices (1 hour) Cross-Contamination Prevention (1 hour) Safe Use and Maintenance of Equipment and Utensils (1 hour) Pest Control in Food Processing Areas (1 hour)	4
3.	Standard Operating Procedures (SOPs) (1 hour) Work Area Design and Layout for Food Safety (1 hour) Waste Management and Disposal (1 hour) Emergency Preparedness and Response (1 hour)	4
4	Theory: 4 hours Documentation and Record-Keeping (1 hour)	4

	Corrective Actions and Continuous Improvement (1 hour) Food Safety Culture and Communication (1 hour) Emerging Trends and Technologies in Food Safety (1 hour)	
	<b>Total Theory</b>	<b>15</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 15 hours L:T:P = 1:0:2</b>		

#### Reference Books

- "Principles of Food Sanitation" by Norman G. Marriott and Robert B. Gravani
- "Food Safety: Basic Concepts, Recent Issues, and Future Challenges" edited by Alexandru Mihai Grumezescu
- "Food Hygiene and Sanitation" by S. R. Sangwan
- "Food Safety: Emerging Issues, Technologies, and Systems" edited by Steven C. Ricke
- "Food Safety Management: A Practical Guide for the Food Industry" by Yasmine Motarjemi and Huub Lelieveld

#### Other Sources

- Food and Agriculture Organization (FAO): [www.fao.org/food-safety](http://www.fao.org/food-safety)
- World Health Organization (WHO): [www.who.int/foodsafety/en](http://www.who.int/foodsafety/en)
- Centers for Disease Control and Prevention (CDC): [www.cdc.gov/foodsafety/index.html](http://www.cdc.gov/foodsafety/index.html)
- Food Safety and Inspection Service (FSIS): [www.fsis.usda.gov/food-safety](http://www.fsis.usda.gov/food-safety)
- European Food Safety Authority (EFSA): [www.efsa.europa.eu](http://www.efsa.europa.eu)

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**(Autonomous)Ooty Road, Mysore-25.**  
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**1<sup>st</sup> Semester:**  
**FOOD SAFETY AND, HYGIENE AND SANITATION**

**QP: 15121**

**Section A:**

( 5X1 Marks)

Multiple Choice Questions

Choose the most appropriate answer for each question.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section B**

(5X3=15 Marks)

Answer any three questions from this section.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section C**

(10X1=10 marks)

Answer any one question from this section.

- 1.
- 2.
- 3

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## IInd Semester NEP Syllabus for B.Voc 2022-23 Batch

<b>Sl no.</b>	<b>PLANTATION CROP TECHNOLOGY (THEORY)</b>	<b>Hrs</b>
	<b>Unit 1: Introduction to plantation crops</b>	
1.	Definition of plantation crops Importance and contribution to the economy Major plantation crops and their geographical distribution	4
	<b>Unit 2: Harvesting and Post-Harvest Technology</b>	
2.	Post-harvest handling and processing Value addition and storage techniques	3
	<b>UNIT 3: Processing of plantation crops</b>	
3.	Maturity indices and harvesting techniques Processing of coffee, Tea, areca nut, coconut, cocoa, Cashew, Palm etc Value addition products from plantation crop products	4
	<b>Unit 4: Sustainability and Environmental Issues:</b>	
4.	Sustainable practices in plantation agriculture Biodiversity and conservation Environmental impacts and mitigation measures	4
	<b>Total Theory</b>	<b>15</b>
<b>Sl. no.</b>	<b>(PRACTICAL)</b>	<b>Hrs</b>
1.	value Addition: Practical involve processing plantation crops to create value-added products like tea processing, coffee roasting, or Tea processing and areca nut, cashew	10
2.	Post-Harvest Handling: Students may learn about post-harvest techniques, including grading, sorting, and packaging of harvested crops.	6
3.	Quality assessment and sensory evaluation of value added plantation crops	8
4.	Plantation Establishment: Practical sessions focus on proper planting techniques, spacing, and layout for different plantation crops like tea, coffee, rubber, or oil palm.	6
	<b>Total Practical</b>	<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 15 hours L:T:P = 1:0:2</b>		

## **Reference books**

- "Cereal Processing: Food Cycle Technology Sourcebook" by L. W. Rooney and S. S. Murthy
- "Bakery Food Manufacture and Quality: Water Control and Effects" by S. Cauvain and L. S. Young
- "Confectionery Science and Technology" by R. J. Clarke
- "Fruit and Vegetable Processing: Improving Quality" edited by W. Jongen
- "Food Processing Technology: Principles and Practice" by P. J. Fellows
- "Handbook of Food Processing Equipment" by G. M. Campbell-Platt
- "Principles of Food Processing" by A. Singh and R. Heldman
- "Food Packaging: Principles and Practice" edited by G. L. Robertson
- "Food Quality Assurance: Principles and Practices" by I. M. Mujtaba and C. R. White Jr.
- "Food Process Engineering: Emerging Trends in Research and Their Applications" edited by C. Anandharamakrishnan and A. Nema

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**B.Voc in Food Processing and Engineering.**  
**2<sup>nd</sup> Semester:**  
**PLANTATION CROP TECHONOLOGY**

**QP: 15218**

**Section A:**

**( 5X1=5 Marks)**

Multiple Choice Questions

Choose the most appropriate answer for each question.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section B**

**(5X3=15 Marks)**

Answer any three questions from this section.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section C**

**(10X1=10 marks)**

Answer any one question from this section.

- 1.
- 2.

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## IInd Semester NEP Syllabus for B.Voc 2022-23 Batch

Sl no.	<b>Food Engineering Processing: Principles and Applications (THEORY)</b>	<b>Hrs</b>
<b>Unit 1: Introduction to Food Engineering</b>		
1.	Food engineering minimizes waste and optimizes resources in food processing. Food engineers promote sustainability and efficiency in the food industry through innovative practices. Food engineering contributes to food security by improving production efficiency and ensuring the availability of safe and nutritious food.	3
<b>Unit 2: Overview of Unit Operations and Unit Processes in Food Engineering</b>		
2.	Introduction to unit operations and unit processes Examples of unit operations in food engineering Examples of unit processes in food engineering	3
<b>UNIT 3: Principles of heat transfer: conduction, convection, and radiation</b>		
3.	Heat exchangers and their applications in food processing Heat transfer during processing operations: Pasteurization Sterilization Baking	6
<b>UNIT 4: Mass Transfer in Food Processing (3 hours)</b>		
4.	Mass Transfer in Food Processing (3 hours) Principles of mass transfer: diffusion, evaporation, and adsorption Mass transfer in drying and dehydration processes Mass transfer in concentration and extraction processes	3
<b>Total Theory</b>		<b>15</b>
Sl. no.	<b>(PRACTICAL)</b>	<b>Hrs</b>
1.	Heat Transfer Practical Hands-on experiments on heat transfer principles Measurement of heat transfer coefficients Operation and maintenance of heat exchangers	10
2.	Mass Transfer Practical Hands-on experiments on mass transfer principles Measurement of diffusion coefficients Drying and dehydration experiments	10
3.	Food Processing Operations Practical Practical demonstrations of food processing operations involving heat and mass transfer Pasteurization techniques and equipment	10

	Sterilization techniques and equipment Baking processes and equipment	
	<b>Total Practical</b>	<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 15 hours L:T:P = 1:0:2</b>		

## Reference Books

### 1. "Food Process Engineering and Technology" by Zeki Berk

This book provides an overview of food process engineering principles and their applications. It covers topics such as heat and mass transfer, food preservation, food quality, and processing operations.

Available for free download in PDF format:

[http://www.hesperianpress.com/pdf/Food\\_Process\\_Engineering\\_and\\_Technology.pdf](http://www.hesperianpress.com/pdf/Food_Process_Engineering_and_Technology.pdf)

### 2 "Food Engineering: Integrated Approaches" by Gustavo Barbosa-Canovas et al.

This book offers a comprehensive overview of food engineering principles and their integration in food processing. It covers topics such as food preservation, thermal processing, separation techniques, and packaging. Available for free download in PDF format: <https://www.intechopen.com/books/food-engineering-integrated-approaches>

### 3 "Fundamentals of Food Process Engineering" by Romeo T. Toledo

This book provides an introduction to the fundamental principles of food process engineering. It covers topics such as heat and mass transfer, food preservation, dehydration, and thermal processing. Available for free download in PDF format:

[http://www.hesperianpress.com/pdf/Fundamentals\\_of\\_Food\\_Process\\_Engineering.pdf](http://www.hesperianpress.com/pdf/Fundamentals_of_Food_Process_Engineering.pdf)

### "4 Unit Operations in Food Processing" by R.L. Earle

This book focuses on the unit operations involved in food processing. It covers topics such as fluid flow, heat transfer, size reduction, mixing, and separation processes. Available for free online reading:

<https://www.nzifst.org.nz/unitoperations/>

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**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**  
(Autonomous)Ooty Road, Mysore-25.  
**B.Voc in Food Processing and Engineering.**  
**Food Engineering Processing: Principles and Applications**

**2<sup>nd</sup> Semester:**

**Section A:**

**( 5X1=5 Marks)**

Multiple Choice Questions

Choose the most appropriate answer for each question.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section B**

**(5X3=15 Marks)**

Answer any three questions from this section.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section C**

**(10X1=10 marks)**

Answer any one question from this section.

- 1.
- 2.

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## IInd Semester NEP Syllabus for B.Voc 2022-23 Batch

Sl no.	PRINCIPLES AND TECHNIQUES IN FOOD MANUFACTURING (THEORY)	Hrs
<b>Unit 1: Fruit and Vegetable Processing and Preservation</b>		
1.	Importance of fruit and vegetable selection for processing Pre-processing techniques: sorting, cleaning, washing, and grading Juice extraction methods and clarification techniques Canning of fruit and vegetables products	4
<b>Unit 2: Cereal Processing</b>		
2.	Theory (Total Hours: 3) Overview of cereal processing industry Common cereal grains and their characteristics Principles of cereal milling Flour production process and quality considerations	3
<b>UNIT 3: Bakery Confectionery Production</b>		
3.	Bakery product formulation and ingredient selection Mixing techniques and equipment in bakery production Dough fermentation and proofing principles Baking principles and oven technologies	4
<b>Unit 5: Packaging and Quality Assurance</b>		
4.	Packaging materials and techniques for food processing Quality assurance and shelf-life extension techniques	4
<b>Total Theory</b>		<b>15</b>
Sl. no.	(PRACTICAL)	Hrs
1.	Sorting, cleaning, and grading of fruits and vegetables Juice extraction experiments and quality analysis Hands-on experience in fruit and vegetable drying techniques Packaging and storage of processed fruits and vegetables	10
2.	Sorting, cleaning, and grading of fruits and vegetables Juice extraction experiments and quality analysis Hands-on experience in fruit and vegetable drying techniques Packaging and storage of processed fruits and vegetables	6
3.	Formulation and preparation of bakery product recipes Hands-on mixing and dough preparation Fermentation and proofing experiments Baking and quality assessment of bakery products	8
4.	Hands-on packaging of food products Quality assessment and sensory evaluation techniques	6
<b>Total Practical</b>		<b>30</b>
<b>Total Practical Hours: 30 hours Total Theory Hours: 15 hours L:T:P = 1:0:2</b>		

### Reference books

- "Cereal Processing: Food Cycle Technology Sourcebook" by L. W. Rooney and S. S. Murthy
- "Bakery Food Manufacture and Quality: Water Control and Effects" by S. Cauvain and L. S. Young
- "Confectionery Science and Technology" by R. J. Clarke
- "Fruit and Vegetable Processing: Improving Quality" edited by W. Jongen

"Food Processing Technology: Principles and Practice" by P. J. Fellows

"Handbook of Food Processing Equipment" by G. M. Campbell-Platt

"Principles of Food Processing" by A. Singh and R. Heldman

"Food Packaging: Principles and Practice" edited by G. L. Robertson

"Food Quality Assurance: Principles and Practices" by I. M. Mujtaba and C. R. White Jr.

"Food Process Engineering: Emerging Trends in Research and Their Applications" edited by C. Anandharamakrishnan and A. Nema



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**B.Voc in Food Processing and Engineering.**  
**PRINCIPLES AND TECHNIQUES IN FOOD MANUFACTURING**

**2<sup>nd</sup> Semester:**

**Section A:**

**( 5X1=5 Marks)**

Multiple Choice Questions

Choose the most appropriate answer for each question.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section B**

**(5X3=15 Marks)**

Answer any three questions from this section.

- 1.
- 2.
- 3.
- 4.
- 5.

**Section C**

**(10X1=10 marks)**

Answer any one question from this section.

- 1.
- 2.

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**B.N ROAD, MYSURU – 25**  
**SYLLABUS**  
**B.Voc- II Semester**  
**Communicative English**

No. of Credits : 3

No. of Instruction hrs : 3 / Week(45 hrs)

- AIMS:**
- 1) To familiarize students to basic English
  - 2) To enable them to develop listening & speaking skills

**OBJECTIVES:** Students should be able to \_\_\_\_

- 1) Write English without grammatical errors
- 2) Speak English Language effectively and accurately
- 3) Listen and understand public announcements and news on TV & Radio

**Module – 1 Grammar**

	<b>Marks</b>	<b>Hrs/ Week</b>
1. Subject and Verb Agreement	5	6
2. Voice	5	5
3. Articles	5	3
4. Speech	5	6
5. Question tag	5	5
6. Framing of Questions	5	Q=05

**Module – 2 Writing Skills**

1. Letter Writing Letter of Application/Letter of Grievances/Resume Preparation	10	4
2. Comprehension	10	3
3. Essay Writing	10	3

**Module – 3 Speaking Skills**

1. Greeting		
2. Requesting		
3. Enquiring		
4. Explaining	10	Q=05
5. Reporting		
6. Permission		
7. Thanking		

<b>70</b>	<b>45</b>	
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**B.Voc Semester - III**

<b>Sl. no.</b>	<b>Information Communication Technology</b>	<b>Hrs</b>
1	The humanitarian supply chain – Definition, system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer	5
2	Technology framework – Front-end services, Middleware services and Infrastructure services: Supporting the food assistance supply chain; Mapping technologies; Web portals	5
3	Mobile technologies - Combining hand-held and wireless communications technologies	5
4	Beneficiary identification - Challenges in food assistance to ensure that assistance goes to the right beneficiaries	5
5	ICT in emergencies – Requirement inputs of Food assistance interventions during emergencies	5
6	Linking the humanitarian supply chain - Ways in which WFP uses technology and technological techniques to fulfill its role as the provider of food assistance in development and emergencies	5

<b>Sl. no.</b>	<b>Practical</b>	<b>Hrs</b>
1.	Identification of software related to Food Processing and Engineering	3
2.	Practicing the use of software	6
3.	Requirement development for Food Processing Software	6

**INDIAN CONSTITUTION**  
**COMMON PAPER TO ALL DEGREE CLASSES (FOR B.Voc 45 HOURS 3/WEEK)**

**UNIT I** **08 hrs**

- a) Preamble of the Indian Constitution
- b) Salient features of Indian Constitution

**UNIT II** **10 hrs**

- a) Fundamental Rights
- b) Fundamental Duties
- c) Directive principles of State Policy

**UNIT III** **14 hrs**

- a) President – Election Method, Powers and Functions
- b) The Role of the Prime Minister
- c) The Parliament – Structure, Power and Functions(Lok Sabha and Rajya Sabha)
- d) Supreme Court – Organization and Jurisdiction

**UNIT IV** **13 hrs**

- a) The Role of Governor in the Administration of State
- b) Powers and Functions of the Chief Minister
- c) Composition , Powers and Functions of both the Houses of State Legislature
- d) High Court – Organization and Jurisdiction

**TEXT BOOKS**

- An introduction to the Constitution of India by M V Pylee
- Introduction to the Constitution of India by D D Basu
- Understanding the Constitution of India by Dr. H M Rajashekar
- Indian Constitution by Sommanna, Brahamananda, H B Mallikarjuna swamy,
- Indian Constitution by H T Ramakrishana, Rajiv

**B.Voc Semester - IV**

<b>Sl. no.</b>	<b>Biostatistics</b>	<b>Hrs</b>
1.	Statistical concepts: Data structure, sampling methods, collection, classification and tabulation of data, graphical and diagrammatic representation, histogram, frequency polygon, frequency curve, bar graph, pie chart etc.	4
2.	Measure of Central Frequency: Mean, median, mode.	2
3.	Measure of dispersion of data: Range, semi-interquartile range, mean deviation, standard deviation, standard error, coefficient of variation, confidence limits.	5
4.	Types of distribution of data: Normal, Binomial, Poisson.	7
5.	Z-test, t-test, ANOVA, multiple comparisons, LSD and DMRT, Chi-square test.	4
6.	Regression estimate, correlation coefficient.	4
7.	Experimental designs, data transformation.	4

<b>Sl. no.</b>	<b>Practical</b>	<b>Hrs</b>
1.	Analytical Problems / calculations	15

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**B.N ROAD, MYSORE.**

**DEPARTMENT OF ENVIRONMENTAL STUDIES**

**(3 Hrs Theory / week)**

**3 Credits (45 Hrs)**

**Environmental Studies (One-Semester Compulsory Core Module for B.Voc Programmes)**

**Unit 1: Environment and natural systems**

**4 hrs**

- Introduction to Environment and Environmental Studies
- Definition and Components of Environment, Relationship between the different components of Environment
- Man and Environment relationship
- Impact of technology on Environment, Environmental Degradation
- Multidisciplinary nature of the Environment studies
- Its scope and importance in the present day Education System

**UNIT 2: Ecology and Ecosystems:**

**7 hrs**

- Introduction: Ecology- Objectives and Classification
- Concept of an ecosystem- structure and functions of ecosystem
- Components of ecosystem- Producers, Consumers, Decomposers
- Bio-Geo- Chemical Cycles- Hydrologic Cycle, Carbon cycle, Energy Flow in Ecosystem, Food Chains, Food webs ,Ecological Pyramids
- Major Ecosystems: Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem, Estuarine Ecosystem.

**Unit 3: Natural Resources**

**7 hrs**

Renewable and Nonrenewable resources, exploitation and conservation,

- Water resources: Surface and Ground water sources, Indian and Global scenario.  
Land as a resource, land use change and land degradation
- Forest resources: Definition and Classification of Forests  
Ecological and Economic importance and benefits of forest, Indian scenario,  
Deforestation: causes and effects, case studies remedial measures
- Food resources: Sources of food, Global and Indian food demand scenario,  
Limits of food production, Environmental effects of Agriculture
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies
- Mineral resources: Definition and Classification of minerals, mining issues Case studies.
- Role of individual in conservation of natural resources.

**Unit 4 : Biodiversity and its Conservation**

**6 hrs**

- Biodiversity : Definition, Levels of biological diversity : genetic, species and ecosystem diversity
- Biogeographic zones of India
- Hot spots of biodiversity
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- Biodiversity patterns
- India as a mega-biodiversity nation
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

#### **UNIT 5: Environmental pollution:**

**9 hrs**

- Types of Environmental Pollution:
- Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution: Industrial Agricultural, Municipal; Classification of water pollutants, Effects of water pollutants, Eutrophication.
- b) Marine pollution: Causes, effects and control.
- c) Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO<sub>2</sub>, NO<sub>x</sub>, Natural & Anthropogenic Sources, Effects of common air pollutants
- d) Soil Pollution: causes, effects and control.
- e) Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects
- f) Thermal Pollution: Causes, effects and control.
- g) Nuclear hazards and human health risks.
- Solid waste management: Control measures of urban and industrial waste.
- Role of individual in the prevention of pollution, Pollution case studies.

#### **UNIT 6: Sustainable development and Environmental issues and Policies.**

**7 hrs**

- Sustainable development: Meaning, changes in resource utilization, urbanization.
- Water conservation: watershed management and Rain water harvesting.
- Environmental issues: Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management: floods, drought, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act: Air, Water, Wildlife (Prevention and Control of Pollution)
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

#### **Unit 7 : Human Population and the Environment**

**5 hrs**

- Population growth, Explosion, demographic variation among nations.

- Family welfare Program.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- HIV/AIDS
- Women and Child welfare.
- Role of information technology in Environment and human health

### **Unit 8: Field visit**

**5 hrs**

- Field work Visit to an area to document environmental assets :river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Visit to the solid waste treatment plant and water treatment plant.
- Video: The one degree • (Equal to 5 lectures)

### **REFERENCE BOOKS:**

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha Second edition, 2013 Publisher: Universities Press (India) Private Ltd, Hyderabad.
2. Basics of Environmental Studies by Prof Dr N S Varandani, 2013 Publisher: LAP -Lambert Academic Publishing, Germany
3. Environmental Studies by Anindita Basak, 2009 Publisher: Drling Kindersley(India)Pvt. Ltd Pearson
4. Textbook of Environmental Studies by Deeksha Dave & S S Kateva , Cengage Publishers.
5. Environmental Sciences by Daniel B Botkin & Edward A Keller Publisher: John Wiley & Sons.
6. Environmental Studies by R. Rajagopalan, Oxford University Press
7. Environmental Studies by Benny Joseph, TMH publishers
8. Environmental Studies by Dr. Suresh K Dhameja, 2007 Published by : S K Kataria & Sons New Delhi
9. Basics of Environmental Studies by U K Khare, 2011 Published by Tata McGraw Hill.
10. Environmental Studies by N.Arumugam & V.Kumaresan, saras publication.



**TITLE: FUNDAMENTALS OF MICROBIOLOGY****UNIT-I****10Hrs**

- History: Contributions of - Antony van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Dmitry Iwanowski, Alexander Fleming (in brief).  
Development and scope of Microbiology. Branches of Microbiology.
- Microscopy: Types of Microscope, Construction and working principle of bright field microscope. Dark field, fluorescence and phase contrast microscopy(application). Electron microscopy- Types, applications and their limitations.
- Staining technique: Types of stains, Principle of Simple, negative and differential staining techniques (gram's staining).

**UNIT-II****06hrs**

Sterilization technique: Definition – Sterilization, disinfection, antiseptic, antibiotics, Fungicide, Bactericide.

**A. Physical methods:**

- Heat –
  - Dry heat – Hot air
  - Moist heat method – Autoclave and Pressure cooker
- Filtration–Types of filters: Membrane filter, Hepa filter (e.g., Laminar air flow)
- Radiation methods – UV rays, Gamma rays and Cathode rays

**B. Chemical method:** Use and mode of action of- Alcohols, Aldehydes, Halogens and Phenols.

**UNIT-III****06hrs**

Media – Types, Pure culture and Cultural characteristics: Serial dilution, pure culture by isolation – Pour plate, Spread plate, Streak plate and Micromanipulator techniques . Colony characteristics – plate cultures/solid media and broth cultures/liquid media. Maintenance and Preservation of pure cultures – Sub culturing, overlaying with mineral oil, Refrigeration (4°C) Lyophilization and cryopreservation.

**UNIT-IV****08hrs**

Comparative account of Prokaryotic and eukaryotic cell. Systems of classification: Haeckel's three-kingdom, Whittaker's five-kingdom and Cavalier-Smith's eight kingdom classification.

- General characteristics of bacteria, fungi, actinomycete, virus, protozoa and algae. Organization of cell wall, cell membrane, flagella capsules and formation of spores in bacteria.
- Bacteriophages : Morphology and multiplication( T-4 phage)

**PRACTICALS****15 Hrs -1 Credit**

- Staining and mounting of algae and fungi **3Hrs x1**
- Simple, Negative and Gram's staining **3Hrs x1**
- Preparation of culture media- Nutrient agar, PDA and NB **3Hrs x1**
- Methods of obtaining pure cultures of microorganism-Spread plate, pour plate and streak plate and subculturing **3Hrs x1**
- Isolation of microorganisms from soil by serial dilution technique (Bacteria and Fungi) **3Hrs x1**

**TITLE: MICROBIAL GROWTH AND METABOLISM****UNIT: I****08Hrs**

1. Major nutritional type of Microorganisms.
2. Nutritional requirements of Microorganisms. Elementary nutrients: Carbon, Nitrogen, Sulphur, Oxygen and Energy sources, Vitamins and Growth factors.
3. Uptake of nutrients: Diffusion- Simple and Facilitated, Active transport (use of Proton motive force, ATP : ABC transporter), Group translocation, Iron uptake.

**UNIT: II****07Hrs**

1. Definition, Growth rate and generation time. The growth curve in batch culture - Phases of growth and their significance.
2. Physical and chemical factors affecting growth-Temperature, pH, Oxygen and saline (water activity) Requirements. Measurement of growth by cell number (Haemocytometer) and cell mass (Turbidometer).

**UNIT:III****05Hrs**

Microbial Enzymes: Definition, Nomenclature, Classification, Properties, Mode and Mechanism of enzyme action, Factors effecting enzyme action. Cofactors and Coenzymes.

**UNIT:IV****10Hrs**

**Aerobic respiration:** Definition, Sugar degradation pathways - EMP, HMP and ED pathways. Ultra structure of Mitochondrion, Formation of acetyl CoA from pyruvate, TCA cycle, Electron transport system and Oxidative phosphorylation

**Anaerobic respiration:** Introduction, Anerobic respiration with special reference to dissimilatory Nitrate reduction. (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction) Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways).

**PRACTICALS****15 hours– 01 Credit**

1. Effect of temperature and pH on growth of bacteria. **3Hrs x1**
2. Acid and gas production from carbohydrates- Demonstration of fermentation of lactose **3Hrs x1**
3. Turbidimetric/spectrophotometric monitoring of growth using liquid cultures **3Hrs x1**
4. Cell counting by Haemocytometer **3Hrs x1**
5. Starch hydrolysis **3Hrs x1**

**TITLE: FOOD MICROBIOLOGY-1****UNIT:I****10Hrs**

- A. Introduction to Food Microbiology: Definition, Concept and Scope. Food as a substrate for microorganisms. Food as a substrate for microorganisms, Factors influencing microbial growth in foods (intrinsic and extrinsic factors).
- B. Contamination, preservation and spoilage in various foods viz. – fruits and vegetables, canned foods, cereals and cereal product (cereal grains, flour, bread, pasta, macroni), sugars & sugars products (Honey, Candy), Meat (Fresh meat, fish), Milk and Milk products (cheese, butter).

**UNIT:II****05Hrs**

- A. Methods of food preservation: Physical method – high temperature, low temperature, canning. Drying – solar drying, drum drying, spray drying. Radiation.
- B. Chemical methods – chemical preservatives – salient features of the chemical preservatives (propionates, benzoate, sorbates, nitrates and nitrites, sulphur dioxide and sulphates, sugar and salt)

**UNIT: III****05Hrs**

- A. Food borne intoxication and infection:  
Bacterial intoxication- Botulism & staphylococcal intoxication  
Bacterial infection- Salmonellosis.  
Mycotoxin – Origin, types and importance of toxins with reference to Aflatoxins.

**UNIT-IV****10 Hrs**

- A. Introduction to Dairy Microbiology: Source of milk contamination. Types of microorganisms in milk.
- B. Methods to detect microbial spoilage by SPC, Reductase test.
- C. Biochemical changes of milk - Souring, Gassy fermentation, Proteolysis, Lipolysis, and Ropiness.
- D. Fermented dairy products (a brief account of characteristic and therapeutic value). Acidophilus milk, Yoghurt, Butter milk, Srikhand. Types of cheese. Probiotics and their benefits.
- E. Preservation of milk and milk products – Pasteurization and Sterilization. Microbiological standard for milk and milk products (in brief).

**PRACTICALS****3hrsX5 practicals**

1. Isolation and enumeration of microorganisms from spoiled fruits and vegetables
2. Isolation and enumeration of Microorganisms present in food Utensils.
3. Detection of number of bacteria in milk by SPC
4. Turbidity test to detect boiled and unboiled milk.
5. Methylene blue reductase test to determine the quality of milk.

**Paper code: FPD520**

**MICROBIOLOGY  
II B.Voc., IV Semester**

**30hours-2 Credits**

**TITLE: FOOD MICROBIOLOGY-II**

**UNIT-I**

**06 Hrs**

**Food fermentations:** Bread, cheese, vinegar, fermented vegetables, Fermented dairy products: Kefir, Kumiss, sour cream, dahi & lassi. Experimental and Industrial production methods. Oriental Fermented foods, their quality standards and control.

**UNIT-II**

**06Hrs**

**Food produced by Microbes:** Microbial cells as food (single cell proteins)- mushroom cultivation. Bioconversions- production of alcohol, fermented beverages- beer and wine & types of wine. Genetically modified foods.

**UNIT-III**

**10Hrs**

**Detection of food-borne microorganisms:** Culture, Microscopic and Sampling methods. Chemical: Thermostable nuclease *Limulus* Lysate for Endotoxins, Nucleic Acid (DNA) probes, DNA Amplification (PCR), Adenosine- Triphosphate Measurement, Radiometry, Fluoro-and Chromogenic substrates. **Immunologic Methods:** Fluorescent Antibody, Enrichment Serology, Salmonella 1-2. Test, Radioimmunoassay, ELISA.

**UNIT-IV**

**08Hrs**

**Microbial indicators of food safety and quality control:** Principles of quality control and microbiological criteria, Indicators of product quality and microbiological safety of foods, Hazard analysis and critical control points (HACCP), Good manufacturing process (GMP) Microbiological standards Codex Alimentarius and Food legislation.

**PRACTICALS**

**3hrsX5=15 practicals**

1. Production of sauerkraut
2. Identification of Bacteria from idli batter and curds
3. Preparation of wine from grapes.
4. Role of yeast in bread making
5. Culturing of *Chlorella* / *Spirulina*.

**Unit –I**

**15hours**

- A. Brief history and developments in industrial microbiology
- B. Microorganisms of industrial importance; Isolation, Screening and Preservation of Industrial important microbes..
- C. Strain improvement of Microorganisms for industrial purposes.
- D. A brief account of production medium, inoculum medium, raw materials-Molasses, corn steep liquor, sulphite waste liquor, yeast extract and whey. Buffers, Precursors, Inhibitors and Antifoam agents.

**Unit-II**

**15 hours**

- A. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation (in brief).
- B. Types of fermenters – laboratory, pilot-scale and production fermenters  
Components of a typical continuously stirred tank bioreactor  
Fermentation process – Surface, Submerged and Solid state fermentation. Types- Batch and Continuous fermentation.

**Unit-III**

**15 hours**

Downstream processing: Steps in recovery and purification of fermented products – Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, chromatography, Drying and crystallization.

**UNIT: IV**

**15 hours**

**Industrial production**

- A. a. Organic acids – Citric acid.  
b. Antibiotics – Penicillin.  
c. Enzymes –Pectinase and amylase.  
d. Alcohol – Ethanol.  
e. Amino acid –Glutamic acid.
- B. Role of microorganisms in the production and recovery of minerals and petroleum.

**Practicals:**

1. Preparation of alcohol using jaggery or molasses.
2. Estimation of percentage alcohol in a given sample by specific gravity method.
3. Production of citric acid using *Aspergillus niger*
4. Cultivation of edible mushroom
5. Isolation of antibiotic/ amino acid/organic acid producing microbes and their preservation.
6. Production of penicillin in the Laboratory
7. Antibiotic sensitivity test by Kirby-Baner method
8. Study of fermenters –Seed tank and Pilot scale
9. Production of any vitamin and its quantification by bioassay.
10. Alcoholic fermentation and determination of total acidity and non-reducing sugars

**III B.Voc., VI Semester**

**TITLE: PATHOGENIC MICROBIOLOGY**

**UNIT-I**

**20 Hrs**

Introduction to important diseases caused by Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, Enterobacteriaceae (Proteus, Shigella, Salmonella), Vibrio, Yersinia, Hemophilus, Mycobacterium, The operative pathogenic mechanisms, laboratory diagnosis, prevention and control of these diseases.

**UNIT-II**

**15 Hrs**

Morphology, pathogenesis, life cycle, laboratory diagnosis, prevention and control of viral diseases viz. Rabies, Polio, Small pox, Herpes, Measles, Influenza and AIDS.

**UNIT-III**

**15 Hrs**

Introduction to Human mycotic infections viz Cryptococcosis, Dermatophytosis, Blastomycosis, Opportunistic Mycosis; Candidiasis and Aspergillosis.

**UNIT-IV**

**10 Hrs**

Life cycle, pathogenic, mechanisms and control of parasitic infections viz. amoebiasis, Kala-azar, toxoplasmosis, ascariasis, filarisis, hook worm infections.

**PRACTICALS**

**3 hrsX10 practicals**

- 1- 4. Identification of both gram positive and gram negative microorganisms on the basis of :
  - (i) Morphology.
  - (ii) Bio-chemical characteristics.
  - (iii) Serological reactions.
6. Stainings – Alberts, ZNCF.
- 6-7. Demonstration of pathogens (Viruses, fungi, parasites) through photographs/ permanent mounted slides.
- 8-9. Demonstration of cysts/ovas of protozoa/Helminths through photographs.
10. Isolation of dermatophytes from human skin.

## REFERENCES

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- Alexopoulos, C.J., Mims, C.W.and Blackwell.M. (1996). **Introductory Mycology**, Fourth edition. Wiley eastern limited, New Delhi.
- Ananthanarayana, C. and Paniker, C.K.J. (1996) **Textbook of Microbiology**, sixth edition. Orient Longman limited, Chennai.
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- Dubey,R.C. and Maheshwari, D.K. (1999). **A text book of Microbiology** .S.Chand and company limited , Ramnagar, New Delhi.
- Frazier,W.C. and Westhoff,C.D. (1995). **Food Microbiology**.Tata McGraw- Hill publishing Company limited, New Delhi.
- Freifelder,D. (1984). **Essentials of Molecular Biology**. Narosa Publishing House, New Delhi.
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Kumar, H.D. and Swathi Kumar (1998). **Modern Concepts of Microbiology**. Vikas publishing House Pvt Ltd, New Delhi.

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Pelczar, Jr, J.M., Chan, E.C.S. and Kreig, N.R. (1993). **Microbiology**. Tata McGraw- Hill publishing Company limited, New Delhi.

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Powar and Daginwala. (1996). **General Microbiology**, Vol II. Himalaya publishing House Bombay.

Prescott, L.M., Harley, J.P. and Klein, D.A. (1999). **Microbiology**, International edition, Fourth edition, WBC Mc Graw Hill.5.

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Rao,A.S. (1997). **Introduction to Microbiology**. Prentice- Hall of India Pvt Ltd. New Delhi

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**PATTERN OF QUESTION PAPER FOR B.VOC**  
**SUBJECT: MICROBIOLOGY**  
**(THEORY:I SEMESTER TO VI SEMESTER)**

Time: 3hours

Max marks: 70

I. Define/Explain any ten in one/two sentences: 3X10=30  
(Twelve questions to be given and ten to be answered)

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

II Answer any FOUR of the following: 4X4=16  
(Six questions to be given and four to be answered)-short answer type

- 13
- 14
- 15
- 16
- 17
- 18

III (Three essay type questions- with all internal choices) 8X3=24

- 19
- 20
- 21

Test+ Assessment (C-1+C-2) = 30 (15+

**Approved list of Paper setters**

<b>Sl No.</b>	<b>Name</b>	<b>College address</b>
1.	Dr..M .Seema	Chairperson, Dept. of Microbiology JSS College, Ooty road, Mysore
2.	Dr..K.Sumana	Assistant prof. Dept. of Microbiology JSS College, Ooty road, Mysore
3	Dr.S.Mahadevamurthy	Associate Prof & HOD Dept. of Microbiology Yuvaraja's college Mysore.
4	Dr.Syeda Kauser Fathima	Associate Prof. of Microbiology Maharani's Science College for women JLB road Mysore.
5	Dr. H.S. Jayanth.	Asso.Prof.of Microbiology Dept. of Microbiology Yuvaraja's college Mysore.
6	Dr.Nagarathnamma	Asso. Prof. of Microbiology Government women college Mandya
7	Dr. Mashooda Begum	Asso.Prof.of Microbiology Maharani's Science College for women JLB road, Mysore.
8	Sri. M. Girish	Assistant prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore
9	Dr. P.K.Maheshwar	Assistant Prof. Dept. of Microbiology Dept. of Microbiology Yuvaraja's college,Mysore.
10	Smt. M.S.Shobha	Assistant Prof, Dept. of Microbiology Maharani's Science College Mysore
11	Sri. Shankaregowda	Asso.Prof.of Microbiology Government Science College Mandya
12	Sri. R.A. Manjunath	Assistant Prof. Dept. of Microbiology Saradavilas College,Mysore
13	Dr.M.P. Ragavendra	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore

14	Dr.K.Girish	Assistant Prof. Dept. of Microbiology Maharani's Science College, Mysore
15	Sri. G.S. Siddegowda	Assistant Prof. Dept. of Microbiology Maharani's Science College Mysore
16	Smt. M.S. Poornima	Assistant Prof. Dept. of Microbiology Yuvaraja's College,Mysore
17	Dr.N.S.Devaki	Assistant Prof. Dept. of Molecular Biology Yuvaraja's College , Mysore
18	Syeda Farahna Parveen	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore

19	Smt. Vanitha	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
20	Smt. Revanamba	Assistant Prof. Dept. of Microbiology Maharani's Science College,Mysore
21	Uzma Bathool	Assistant Prof. Dept. of Microbiology St.Philomina's College, Mysore
22	Mahadeva prasad	Assistant Prof. Dept. of Microbiology JSS College for Women Saraswathipuram,Mysore

## SEMESTER I

### Paper -I BIOMOLECULES

(30 hours -2 Credits)

#### SECTION-I : Amino Acids & Proteins:

09 Hrs

1. Introduction to Bio-chemistry.
2. **Amino Acids:** Definition, biological functions of Amino acids. Classification based on the nature of "R" groups (Polarity). Stereoisomerism and RS system of designating optical isomers (D & L rotation). Protein and non-protein amino acids. Specialized role of amino acids. Physical and Chemical properties of amino acids. Titration curve of amino acids.
3. **Proteins:** Peptide bond formation and structure, classification of proteins based on structure with examples. Secondary structure: -  $\alpha$ -Helix,  $\beta$ -sheet,  $\beta$ -barrel and  $\beta$ -turn. Tertiary structure – Fibrous proteins (collagen) and Globular proteins (Myoglobin). Quaternary Structure– hemoglobin. Denaturation and renaturation of proteins by Anfinsen's experiment. Salting in & salting out of proteins.

#### SECTION-II: Carbohydrates:

08 Hrs

1. Definition, classification and biological functions of carbohydrates.
2. Monosaccharides-Fischer and Haworth structures of monosaccharides. Derivatives of monosaccharides (Sugar acids, deoxysugars, amino sugars and their biological importance). Oligosaccharides (structure of maltose, lactose, sucrose, cellobiose, trehalose) and functions.
3. Homo-and hetero-polysaccharides (structures of starch, glycogen, cellulose, chitin). Polysaccharides of bacterial cell wall.

#### SECTION-III: Lipids

08 Hrs

1. Definition and classification and biological functions of lipids, fatty acids (saturated and unsaturated). Essential fatty acids and its functions. Physical properties of lipids- melting point, boiling point and their relation to molecular size. Fats as source of energy. Waxes.
2. Structures and functions of Lipids: Triacylglycerols, phospholipids: lecithins (PhosphatidylCholines), cephalins (Phosphatidylethanolamines), Phosphatidylserines, phosphatidyl inositol, sphingomyelins, plasmalogens), cerebrosides, gangliosides.
3. Lipoproteins—Composition, classification and biological functions.
4. Prostaglandins, Leukotrienes, Thromboxanes and their importance.

#### SECTION-IV: Nucleic Acid

05 Hrs

1. Nucleic Acids: Structure and properties of purine and pyrimidine bases. Nucleosides and nucleotides. Biologically important nucleotides. Double helical model of DNA. Denaturation of DNA. Physical and chemical properties of nucleic acids.

## **PRACTICALS**

**(15 Hrs -1 Credit)**

1. Calibration of volumetric glassware's (Burette, pipette). **3 Hrs**
2. Qualitative tests for : (a) Carbohydrates. (b) Amino acids and proteins (c) Cholesterol and lipids **3 Hrs X 2**
3. Estimation of amino acid by formal titration **3 Hrs**
4. Estimation of reducing sugars by DNS method **3 Hrs**

**ENZYMOLGY AND BIOENERGETICS****SECTION-I : Enzymology****08 hrs**

**Introduction to enzymes** - General characteristics of enzymes. Prosthetic group. Holoenzymes, apoenzyme and cofactors. Coenzymes and their biochemical functions, assay of enzyme activity, units of enzyme activity. Active sites(s) of enzymes. IUB system of nomenclature and classification of enzymes. Theories of enzymes catalysis: Acidbase catalysis, covalent catalysis.

**SECTION-II: Enzyme Purification :****08 hrs**

Isolation and purification of enzymes- Preliminary fractionation procedures and precipitation techniques. Chromatography methods: Principle, Construction and applications of Gel filtration, adsorption, ion exchange and affinity chromatography. Criteria of enzyme purity.

**SECTION-III : Enzyme Kinetics****09 hrs**

Factors affecting velocity of enzyme catalysed reactions (Enzyme concentration, pH and temperature). Michaelis –Menten equation. Determination of  $K_m$  and its significance. Enzyme inhibition- Reversible inhibition (competitive, uncompetitive, non-competitive). Antibiotics as inhibitors. Allosteric enzymes and enzyme regulation. Isoenzymes and their clinical significance.

**SECTION-IV: Bioenergetics****05 hrs**

Laws of thermodynamics, Entropy, Enthalpy, Gibbs free energy. Types of reactions- Endergonic & Endergonic. Structure and role of ATP & other high energy compounds (Phosphocreatine, phosphoenolpyruvate). Redox reactions, Redox potential and its applications. Commercial importance of enzymes

**PRACTICALS****(15 Hrs – 1 Credit)**

1. Assay of salivary amylase enzyme activity. **3 Hrs**
2. Effect of pH on enzyme activity. **3 Hrs**
3. Effect of temperature on enzyme activity **3 Hrs**
4. Effect of substrate concentration on enzyme activity and determination of  $K_m$  and  $V_{max}$  **3 Hrs**
5. Effect of activators (NaCl) on salivary enzyme activity **3 Hrs**

## Semester III

### Paper – III

(30 hours-2 Credits)

## **METABOLISM**

### **SECTION-I: Carbohydrate Metabolism**

**08 Hrs**

Digestion, Absorption and transport of Carbohydrates, Metabolic Pathways- Glycolysis, TCA cycle, Pentose Phosphate Pathway, Glucuronate pathway, Glycogenolysis & Glycogenesis, Gluconeogenesis. Diseases associated with carbohydrate metabolism.

### **SECTION-II: Lipid Metabolism**

**08 Hrs**

Digestion, absorption & Transport of Lipids,  $\beta$ -Oxidation of fatty acids.  $\alpha$  and  $\omega$  oxidation of fatty acids. Degradation of triglycerides and phospholipids. Formation and utilization of ketone bodies. Biosynthesis of saturated fatty acids, Biosynthesis of Cholesterol. Diseases associated with Lipid metabolism.

### **SECTION-III: Protein Metabolism**

**08 Hrs**

Digestion, absorption & transport of Proteins, General Reactions of Amino Acids : Deamination, transamination and decarboxylation. Urea cycle and its significance. Ketogenic and glucogenic amino acids. Biosynthesis of amino acids (Phenyl alanine and Glutamic acid) and their degradation. Diseases associated with Proteins metabolism.

### **SECTION-IV: Nucleic acid Metabolism**

**06 Hrs**

Degradation of purines and pyrimidines. Biosynthesis of purines, pyrimidine nucleotides. Catabolism of Heme & Formation of Bile pigments. Diseases associated with Nucleic acid metabolism.

## **PRACTICALS**

**(15 Hrs = 1 Credits)**

1. Estimation of protein by Biuret method. **3 Hrs**
2. Estimation of Ca<sup>+</sup> in serum. **3 Hrs**
3. Estimation of iron in drumsticks **3 Hrs**
4. Estimation of creatinine in serum **3 Hrs**
5. Estimation of uric acid in urine **3 Hrs**

## Semester IV

### Paper IV

(30 hours -2 Credits)

## BIOCHEMICAL TECHNIQUES

### SECTION-I: Spectroscopic Techniques 8 Hrs

:  
Beer-Lambert's Law. Light absorption and its transmittance. Determination and application of extinction coefficient. Principle and Applications of following spectroscopic techniques - U.V.- Visible, infra-red, Fluorescent emission and NMR spectroscopy.

### SECTION-II: Electrophoretic & Centrifugation Techniques 8 Hrs

Principles and applications of the following electrophoresis techniques. Paper electrophoresis, PAGE, SDS- PAGE.

Principle of differential and density gradient centrifugation. Ultra centrifuge – construction and applications

### SECTION-III: Chromatographic Techniques 8 Hrs

Principles of Adsorption and Partition chromatography. Techniques of ascending, descending, circular paper chromatography.

**Thin Layer Chromatography**-Technique and advantages over paper chromatography

**Column chromatography** – Principle and applications of Gel Filtration chromatography, ion – exchange chromatography.

### SECTION-IV: Radio Isotopic Techniques 6 Hrs

Properties of radioactive emissions. Units of radioactivity. Isotopes and their applications in biological studies -  $^3\text{H}$ ,  $^{14}\text{C}$ ,  $^{131}\text{I}$ ,  $^{60}\text{CO}$ , and  $^{32}\text{P}$ . Techniques used to measure radioactivity- GM counter. Biological hazards of radiation and safety measures in handling radioisotopes.

### PRACTICAL

(15 Hrs = 1 Credits)

- |  |              |
|--|--------------|
| 1. Identification of amino acids by circular paper chromatography. | <b>3 Hrs</b> |
| 2. Identification of amino acids by ascending Paper chromatography | <b>3 Hrs</b> |
| 3. Separation of phospholipids by thin layer chromatography.       | <b>3 Hrs</b> |
| 4. Separation of leaf pigments by column chromatography            | <b>3 Hrs</b> |
| 5. Separation of proteins by PAGE                                  | <b>3 Hrs</b> |
| 6. Estimation of protein by Lowry/BCA method.                      | <b>3 Hrs</b> |



## Semester V

### Paper V

(60 hours-4 Credits)

#### BIOCHEMISTRY AND NUTRITION-1

##### SECTION-I: Introduction

15 Hrs

Concept of Nutrition, Calorific value of foods and its determination (Bomb calorimeter), different components of energy expenditure, measurement of energy expenditure by direct and indirect calorimetric method (principles only) Energy expenditure at rest and work, respiratory quotient, Basal Metabolic Rate (BMR), determination of BMR by indirect calorimetric method, factors affecting BMR. Specific dynamic action of foods.

##### **Proximate analysis of food samples:**

Moisture, fiber, ash, proteins, carbohydrates, fats and their importance

**Water Metabolism:** Distribution in the body, factors maintaining water balance and factors influencing water balance

##### SECTION-II: Proteins

15 Hrs

Review of functions of proteins in the body, Digestion and absorption. Essential and Nonessential amino acids. Amino Acid Availability Antagonism, Toxicity and Imbalance, Amino acid Supplementation. Effects of deficiency. Food source and Recommended Dietary Allowances for different age group. Amino acid pool. NPU, Biological Value, Nitrogen balance. PEM and Kwashiorkor

##### SECTION-III: Vitamins

15 Hrs

Classification, example with structure, dietary sources, daily requirement, biological roles and deficiency disorders with symptoms– Thiamine, Riboflavin, Niacin, pantothenic acid, Pyridoxine, Biotin, Folic acid and Vitamin C .

Structures, dietary sources, daily requirement, biological roles and deficiency disorders with symptoms- Vitamin A, D, E & K. Hypervitaminosis.

##### SECTION-IV: Minerals

15 Hrs

Dietary sources, physiological functions, deficiency disorders, absorption, balance and excretion of Macro nutrients- Ca, P, Na, K, Cl and Micronutrients – Fe, Zn, Cu, I & Mg.

##### PRACTICAL

(30 Hrs = 2 Credits)

1. Estimation of haemoglobin in blood. 3Hrs
2. Identification of Sugars in fruit juice using paper chromatography. 3Hrs
3. Estimation of vitamin E in serum. 3Hrs
4. Determination of proteins by dye binding assay. 3Hrs
5. Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate 3HrsX3
6. Detection of adulterants in food. 3Hrs
7. Estimation of Calcium in ragi. 3Hrs
8. Estimation of Vitamin – C in lemon or gooseberries by DPPH method 3Hrs

## SEMESTER VI

### Paper -VI

(60 hours -4 Credits)

#### BIOCHEMISTRY AND NUTRITION-2

##### **SECTION-I: Dietary Carbohydrates & Health**

**15 Hrs**

Review functions of carbohydrates. Digestion, absorption, utilization and storage, hormonal regulation of blood glucose. Dietary requirements and source of carbohydrates, Dietary fiber, role of fiber in lipid metabolism, colon function, blood glucose level and GI tract functions.

##### **SECTION-II : Dietary Lipid & Health**

**15 Hrs**

Review of classification, sources, functions, digestion, absorption, utilization and storage. Essential Fatty Acids; Functions of EFA, RDA, – excess and deficiency of EFA. Lipotropic factors, role of saturated fat, cholesterol, lipoprotein and triglycerides. Importance of the following: a) Omega – fatty acids. Omega 3/ omega 6 ratio b) Phospholipids c) Cholesterol in the body d) Mono, Polyunsaturated and Saturated Fatty Acids. Dietary implications of fats and oils, Combination ratios of n6 and n3, MUFA, PUFA and SFA

##### **SECTION-III : Digestion & Antinutritional factors**

**15 Hrs**

Gastrointestinal tract secretions - Composition and functions of Saliva, gastric, bile, pancreatic and intestinal Juices. Appetite, gastrointestinal tract hormones.

Digestion, absorption and transport of Proteins.

**Antinutritional factors:** Sources and harmful effects of anti vitamins (e.g.: avidin, dicumarol), Protease inhibitors, oxalates and fitates. Natural toxicants, (e.g.: Lathyrus sativa). Food adulterants- structure and harmful effects of - Butter yellow, lead chromate and malachite green.

##### **SECTION-IV- Assessment of Nutritional Status, Food & Drug Interactions**

**15 Hrs**

Anthropometric measurements; Z scores, BMI, skinfold, circumference ratios. Biochemical assessment; Basal metabolic panel, Comprehensive metabolic panel, CBC, Urine Analysis, Assessment of Anemia, ROS assessment, GTT and glycosylated Hb, Differential diagnosis of B12 and folate.

Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions, Appetite changes with drug intakes and malnutrition. Food as medicine.

## **PRACTICAL**

**(30 Hrs = 2 Credits)**

1. Estimation of DNA by diphenylamine method. **3Hrs**
2. Determination of saponification value of an oil or fat. **3Hrs**
3. Determination of Iodine value of an oil or fat. **3Hrs**
4. Determination of Acid value of an oil or fat. **3Hrs**
5. Estimation of SGPT in serum **3Hrs**
6. Estimation of SGOT in serum. **3Hrs**
7. Extraction of RNA from yeast and its estimation by Orcinol method. **3Hrs**
8. Determination of total protein and A/G ratio in serum. **3Hrs**
9. Estimation of serum phospholipids. **3Hrs**
10. Immobilization of enzymes/ cells by entrapment in alginate gel **3Hrs**
11. Demonstration of ELISA **3Hrs**

## SEMESTER VII

### Paper VII: Food Chemistry

Theory: 30 Hrs

Sl. No.		Hrs
1.	Introduction to food chemistry, its role in processing and food formulations	1
2.	Moisture in foods: Role and type of water in foods, Functional properties of water, role of water in food spoilage, Water activity and sorption isotherm, Molecular mobility and food stability.	2
3.	Dispersed systems of foods: Physicochemical aspects of food dispersion system: a) Sol b) gel c) foam d) emulsions.	1
4.	Carbohydrates: Functional characteristics of different carbohydrates. Maillard reaction, caramelization, methods to control non enzymatic reactions. Starch and Dietary fibres, Functional properties of polysaccharides, natural vegetable gums, carbohydrate composition of various natural foods.	5
5.	Proteins in foods: Protein content and composition in various foods- cereal grains, legumes and oilseed proteins, proteins of meat, milk, egg and fish. Functional properties of proteins in foods – water and oil binding, foaming, gelation, emulsification. Effect of processing on functional properties of proteins-heat processing alkali treatments, chilling, freezing, dehydration and radiations. Unconventional sources of proteins- SCP fish protein concentrates, leaf proteins	5
6.	Lipids in foods: Role and use of lipids /fat, occurrence, fat group classification, Physicochemical aspects of fatty acids in natural foods, hydrolysis, reversion,. Chemical aspects of lipolysis, auto-oxidation, antioxidants, Technology of fat and oil processing: Refining, Hydrogenations, Inter etherification, Safety use of oils and fats in food formulation.	5
7.	Vitamins and minerals, Dietary sources, requirements, Allowances, Enrichment, Restorations, Fortifications, Losses of vitamins and minerals, Optimization and retention of vitamins and minerals	2
8.	Enzymes in food industry, Carbohydrases (Amylases, cellulases, pectinases,) Proteases, Lipases and oxidases in food processing.	2
8.	Chemistry of food flavour: definitions of flavour, Flavourmatics / flavouring compounds, Sensory assessment of flavour, Technology for flavour retention.	2
9.	Food colours, natural and synthetic, Regulatory aspects –Natural and synthetic permitted food colours.	1
10.	Food toxicants – anti nutritional factors and their occurrence, effects and methods of elimination or inactivation- protease inhibitors, lectins, lathyrogens, phytates and flatulence factors.	2
11.	Food Contaminants, Pesticidal residues – permitted limits. Toxicology and	2

public health.

<b>Sl. No.</b>	<b>Practical</b>	<b>Hrs</b>
1.	Determination of moisture content of foods using different methods	3
2.	Determination of crude proteins by microkjeldahl method	3
3.	Determination of crude fat by soxlet method	3
4.	Sensory acceptability of food products: Physical Attributes (Appearance, color, texture, taste and overall acceptability).	3
5.	Determination of minerals and acid insoluble ash and estimation of Calcium and phosphorus	3
6.	Assay of amylases, papain and lipases	3
7.	Estimation of iron in drumsticks	3
8.	Determination of food colors	3

## REFERENCES

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2. Publication - John Wiley
3. Title - Fundamentals of general organic chemistry and biological chemistry, 4<sup>th</sup> edn, Author-Holum, J.R.(1990), Publication- Wiley International.
4. Modern Inorganic chemistry, Jolly, W.L.(1984), McGraw Hill
5. Concise Inorganic Chemistry, 4<sup>th</sup> edn, Lee, J.D.(1991), Chapman and Hall
6. General Chemistry, 5<sup>th</sup> edn, Petrucci, R.H.(1989), Collier MacMillan
7. Principles Of Inorganic Chemistry, 20<sup>th</sup> edn., Puri, B.R and Sharma, L.R.(1989), S.L.N.Chand and Co.
8. Textbook of Inorganic Chemistry, 19<sup>th</sup> Revd., Soni, P.L.(1989), Sulthan Chand and Sons.
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15. Physical Chemistry Of Biological Systems, Raymond Change
16. Textbook Of Physical Chemistry, 17<sup>th</sup> revd. Edn., Soni, P.L. and Dharmarha, D.P(1990), Sulthan Chand and Sons.
17. Basic Physical Chemistry For The Life Sciences, 2<sup>nd</sup> edn. Williams, V.R. and Williams, H.B.(1973), Freeman.
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30. Genetics of Bacteria and their Viruses - W. Hayes.
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33. Bacterial Plasmids – P. Breda
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35. Genetic Engineering, Vol. 1-7, Setlow and Bolander (Eds.)
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37. Recombinant DNA - Watson *et al.*, 1983
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49. Microbial Transformations and special Processes - Rehm, H. J. and Reed, G. Vol. 6
50. Plant Biotechnology – King, S. D. and Arntzen, C. D., 1989.
51. Somaclonal Variation in Crop Improvement – Bajaj, Y. P. S., (Ed.) 1990.
52. Haploids in Crop Improvement – Bajaj, Y. P. S., (Ed.) 1990.
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54. Fundamentals of Biotechnology – P. Prave, V. Paunt, W. Sitting and D. A. Sukatesn (Ed.) 1987
55. Biochemical Engineering Fundamentals – J. E. Bailey and D. F. Ollis, 1977.



## **B.Voc Degree Examinations according to NEP 2021**

**60 : 40 pattern**

Theory papers: Total marks = 100 marks

C1= 20 marks(IA)C2= 20marks(IA)

C3= 60marks (Main exam.)

Practical papers: Total marks = 50 marks

C1= 10 marks (IA)

C2= 10 marks(IA) +05(Record)

C3= 25 marks (Main Exam.)

IA = Internal assessment (Assignment/seminar/test/viva-voce).

**MODEL QUESTION PAPER**

**BIOCHEMISTRY**

**TIME : 2.30 hrs**

**MAX. MARKS: 60**

**NOTE: ALL SECTIONS ARE COMPULSORY**

**SECTION – A**

1. Answer any FIVE of the following

5 x 2 = 10

- a.
- b.
- c.
- d.
- e.
- f.
- g.

**SECTION – B**

Answer any FOUR of the following

4x 5 =20

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

**SECTION – C**

Answer any THREE of the following

3 x 10 = 30

- 8.
- 9.
- 10.
- 11.
- 12.

**Note: section C may include sub questions a, b**

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B.Voc DEGREE EXAMINATION

MODEL QUESTION PAPER (PRACTICALS)

BIOCHEMISTRY

**Time: 3 h**

**Max. Marks: 25**

1. Write the principle and procedure of \_\_\_\_\_ experiment 05
  2. Major experiment (Conduct and report the results) 15
  3. Viva-voce 05
-

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**OOTY ROAD, MYSORE-570 025, KARNATAKA**



ESTD-1964

## **SYLLABUS**

**B. Voc. (Food Processing & Engineering)**

**2021-22**

**DEPARTMENT OF COMPUTER SCIENCE**

**Revised Scheme of Instruction for B.Voc – Food Processing & Engineering 2016-17****General Education Component – Computer Science**

<b>Semester</b>	<b>Title</b>	<b>L: T: P</b>	<b>Theory Hrs</b>	<b>Tutorial Hrs</b>	<b>Practical Hrs</b>	<b>Total Hrs</b>	<b>Credits</b>
Semester I	COMPUTER FUNDAMENTALS & DOS	2:0:1	30	0	15	45	3
Semester II	C PROGRAMMING	2:0:1	30	0	15	45	3

**SEMESTER I**  
**COMPUTER SCIENCE**  
**PAPER - I**  
**COMPUTER FUNDAMENTALS & DOS**

(2 hrs theory / week)  
Credits

**30 hours - 2**

**SECTION- I**

**15 Hours**

**INTRODUCTION**

Computer, Characteristic of Computer, History of Computer, Generation of Computers, Components of Computer and Applications of Computers.

Key Factors of Computers: Hardware, Software - types of Software (Application and system), forms of software (firmware, shareware, freeware), Translator - Assembler, Compiler and Interpreters. Computer Application – Business, Scientific, Entertainment and educational.

**CLASSIFICATION OF COMPUTERS**

Mode of operations – Analog, Digital and hybrid Computers.

Size and capabilities – Micro, Mini, Main frame and Super computer.

**MEMORY UNITS**

Primary memory - RAM, ROM, PROM, EPROM, EEPROM, Flash memory, cache memory.

Secondary memory – Magnetic disk (Hard disk, Floppy disk, Zip disk, Jaz disk, Super disk), Optical disk (CD, CD – R, CD – RW, DVD).

**COMPUTER PERIPHERALS DEVICES AND INTERFACES**

Input devices – Working principle of Keyboard and mouse, Functional capabilities of Scanner, Digital Camera, OMR, OCR, touch pad, touch screen. Output Devices – Monitor, Printer, Plotter and projector.

**PROGRAMMING LANGUAGES**

Machine, Assembly language and High Level Language.

**INFORMATION SYSTEM**

Data and Information, types of information, what is an information System, Types of Information Systems — System development life cycle.

## **SECTION- II**

**15 Hours**

### **OPERATING SYSTEM AND THE USER INTERFACE**

Operating System– Functions, services, Types-Batch, Single, Multiprogramming, and Multiprocessing.

Operating System – the user interface –running programs –managing hardware –enchaining the operating system with utility software- typical operating systems in use

### **COMPUTERS AND COMMUNICATION**

Single user, multi-user, workstation, and client server systems. Computer networks, Types of Network LAN, WAN, Internet, Internet applications, WWW, Email, FTP, web browsers (Internet explorer, Google Chrome, Mozilla).

### **DISK OPERATING SYSTEM (DOS)**

Introduction, History & version of DOS. DOS basics – physical structures of disk, drive, Name, FAT, File & Directory structure and Naming Rules, Booting Process, DOS System files, role of config.sys file.

### **DOS COMMANDS**

Internal – DIR, MD, CD, RD, COPY, DEL, REN, VOL, DATE, TIME, CLS, PATH, TYPE etc.

External – CHKDSK, XCOPY, PRINT, DISK COPY, DISKCOMP, DOSKEY, TREE, MOVE, LABEL, APPEND, FORMAT, SORT, FDISK, BACKUP, EDIT, MODE, ATTRIB, HELP, SYS, WILD CARD Characters etc.

Executable V/S Non executable Files in DOS.

### **TEXT BOOKS:**

- Peter Norton’s ‘Introduction to Computers’, Second Edition, TMH
- Computer Fundamentals – P K Sinha, BPB

### **REFERENCE BOOKS :**

- Introduction to Computers – N Subramanian, TMH
- Understanding Computers – R Rajagopalan. TMH
- Computers Today – Donald Sanders, MGH

BCA Question Paper Pattern

Time 3 Hours

Max. Marks: 60

Part A

I. Answer any 2 sub questions from each main

3 X 10 = 30

1. A.  
B.  
C.

2 X 5 = 10

2. A.  
B.  
C.

2 X 5 = 10

3. A.  
B.  
C.

2 X 5 = 10

Part B

II. Answer all Questions from the following

3 X 10 = 30

4. A.  
B.

OR

10

10

5. A.  
B.

OR

10

10

6. A.  
B.

OR

10

10

(Note: one Question from each Unit and marks of Questions may have internal split-ups. )



BSc Question Paper Pattern

Time 3 Hours

Max. Marks: 60

Part A

I. Answer all Questions from the following

04 X 05 = 20

1. A.

05

OR

B.

05

2. A.

05

OR

B.

05

3. A.

05

OR

B.

05

4. A.

05

OR

B.

05

Part B

II. Answer all Questions from the following

04 X 10 = 40

5. A.

10

OR

B.

10

6. A.

10

OR

B.

10

7. A.

10

OR

B.

10

8. A.

10

OR

B.

10

(Note: one Question from each Unit and marks of Questions may have internal split-ups.)

BCA / B.Sc. Question Paper Pattern

Time 2 Hours

Max. Marks: 30

Part A

I. Answer any Five sub questions from the following

05 X 02 = 10

1. A.
- B.
- C.
- D.
- E.
- F.

Part B

II. Answer any Four questions from the following

04 X 05 = 20

1. A.
- B.
- C.
- D.
- E.

(Note: one Question from each Unit and marks of Questions may have internal split-ups. )

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ESTD-1964

## **SYLLABUS**

### **B.VOC. (FOOD PROCESSING & ENGINEERING)**

**2021-2022**

### **DEPARTMENT OF FOOD PROCESSING AND ENGINEERING**

## General Component

### Semester - VII

Sl. no.	PRODUCT DEVELOPMENT AND ENTRPREUNERSHIP	Hrs
1	<p>Sensory evaluation of foods - Importance, need and application for product formulation, Basic tastes, threshold tests for basic tastes, Sensory panel, type, selection and training.</p> <p>Types of sensory tests- Subjective and objective sensory evaluation.</p> <p>Instrumental tests for sensory attributes – color, texture and odor.</p>	8
2	<p>Product Development - Designing new product – types and drawing forces, Need for product development.</p> <p>Stages of product development, Consumer research.</p> <p>Role of sensory evaluation in consumer product acceptance.</p>	5
3	<p>Entrepreneurship - Starting and managing an enterprise - Steps in preparing a business plan, Components of management, Developing managerial skills, Managing a food industry.</p> <p>Factors influencing entrepreneurship groups</p> <p>Qualities of an entrepreneur</p>	6
4	<p>Consumer Behaviour &amp; Marketing - Factors influencing food purchases, product acceptance, purchasing trends. Changing food trends.</p>	3
5	<p>Special food processing technologies and novel food ingredients – Membrane technology (reverse osmosis and ultra-filtration), agglomeration, agitation, air classification, extrusion, automation in food industries.</p>	8

<b>Sl. no.</b>	<b>Practical</b>	<b>Hrs</b>
1	Sensory analysis: Different types of sensory tests for basic tastes and sensory attributes of products.	5
2	Project on different sensory techniques and responses utilizing prepared food products, analysis and presentation of sensory data.	3
3	Stepwise development of a new food product, standardization, acceptability studies and submission of project report.	4
4	Survey on types of convenience foods / consumer behaviour / analysis of food labelling.	3

## General Component

### Semester – VIII

Sl. No.	Food Standards, Regulatory Affairs and IPR Issues	Hrs
1.	Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control, Current challenges to food safety	3
2.	Principles of food quality assurance, total quality management (TQM)–good manufacturing/management practices, good hygienic practices, good lab practices, general awareness and role of management practices in quality control	3
3.	Microbial quality control: determination of microorganisms in foods by cultural, microscopic, physical, chemical methods. Statistical quality control in food industry Food adulteration, nature of adulterants, methods of evaluation of food adulterants and toxic constituents	3
4.	Food safety management, applications of HACCP in food safety, concept of food trace ability for food safety, Food safety and Standards Act 2006: salient provision and prospects	3
5.	Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI)	3
6.	Introduction to WTO agreements: SPS and TBT agreements, Codex Alimentarius Commission, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 14000)	5
7.	Food safety in USA, USFDA, Legislation in Europe: Directives of the official journal of the EU, council regulations, food legislation in UK. Regulating methods for food analysis, case studies. Enforcers of Food Laws Approval Process for Food Additives, Nutritional Labeling	5
8.	Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights. Distinction among Various forms of IPR. Patent rights/protection and procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical	5

	indication and Industrial design	
<b>Sl. No.</b>	<b>Practical</b>	<b>Hrs</b>
1.	<p>Study of food regulations in various countries ;</p> <p>study of nutritional labeling of packaged food items by visiting food market, Visit the websites of FSSAI, BIS, AGMARK, ISO, Codex Alimentarius Commission , USFDA</p> <p>Study of patent law in India and the procedure for grant of patent in India</p>	15

<b>B.Voc (Food Processing and Engineering) Syllabus</b>		
<b>Honours degree</b>		
<b>NSQF Level: 8 – Semester I &amp; II</b>		
<b>Sub Sector: Fruits &amp; Vegetables</b>		
<b>Job Role: Head of Production</b>		
<b>UNIT I</b>		
<b>Post Harvest Management of Fruits</b>		
<b>S.No</b>	<b>THEORY</b>	<b>Hrs</b>
1.	General Introduction of fruits-citrus, tropical and subtropical, pome, stone, soft, and berry fruits, melons and watermelons	1
2.	Importance and scope of post harvest management of fruits, Morphology, structure and composition of fruits	2
3.	Maturity Indices and standards for standards for selected fruits, methods of maturity determination	2
4.	Post-harvest physiological and biochemical changes in fruits; ripening of climacteric and non-climacteric fruits	2
5.	Harvesting and handling of important fruits. Harvesting tools; field heat removal/precooling of fruits. Sorting and grading at farm and cluster level; factors affecting post harvest losses	2
6.	Nature of post harvest deterioration; physiological change- physical damage; chemical injury-pathological decay; identification of diseases and disorders in fruit-nutritional disorders, respiratory disorders, temperature disorders and miscellaneous disorders. Classification of diseases and diseases organisms, types of diseases and agents of diseases in fruits.	4
7.	Pre-cooling of fruits and cold storage, zero energy cool chamber	3
8.	Shelf life enhancement- permitted chemicals for ripening, wax coating	3
9.	Storage practices: Refrigerated storage, modified atmospheric storage-novel MAP gases and their role, novel MAP applications, Applying high oxygen MAP; MAP of minimally processed fruits; controlled atmosphere storage/ultra low oxygen storage of fruits, recent advances in CAP and MAP	9
<b>TOTAL</b>		<b>28</b>
<b>S.No</b>	<b>PRACTICALS</b>	<b>Hrs</b>
1.	Familiarization of various fruits available in India and categorization of fruits used for pulping	3
2.	Studies on morphological features of some of the fruits	3
3.	Studies on maturity indices; Studies on harvesting of fruits	3
4.	Studies on permitted chemicals for ripening and enhancing the shelf life of fruits	3
5.	Studies on regulations of ripening of banana and mango	3
6.	Studies on physiological disorders like chilling injury of certain fruits	3
7.	Studies on pre cooling and storage of fruits and vegetables	3
8.	Demonstration on wax coating on apples, citrus and Mango	3
9.	Studies on various storage systems and structures;	3
10.	Studies on pre packaging of whole and cut vegetables	3
11.	MAP of minimally processed fruits & vegetables	3
12.	Visit to commercial packaging houses for mango, banana, pomegranate, grapes	3



13.	Visit to Controlled Atmospheric packaging centres	4
14.	Visit to commercial storage structures for onion and potato	4
15.	Visit to multi chamber cold storages for fruits and vegetables	4
16.	Visit to Fruit Orchards -Observations on Pruning, orchard Hygiene, Irrigation, Manuring, Insect Pests, Pathological Spoilages, Pre-harvest spray schedules to control pathological spoilages and insect infestation	4
17.	Visit to Fruit Orchards - Studies on Causes for pre and post harvest losses. Spoilage factors, post harvest field operations including methods to reduce the post harvest losses	4
<b>TOTAL</b>		<b>56</b>

## UNIT II

### Technology for processing of Fruit Pulp

S.No	THEORY	Hrs
1.	Process of receiving, ripening, checking raw material quality, sorting, washing, cutting/slicing, deseeding/destining, pulping, precooking/pasteurization, sterilizing, aseptic packaging or canning, retort pouching, sampling for quality analysis and storing	2
2.	Machineries and tools used for the fruit pulping process such as fruit washer, peeler, slicer, fruit pulper, steam jacketed kettles, packaging machines etc	2
3.	Quality assessment of packaging materials	2
4.	Enzymes in quality and processing of tropical and sub tropical fruits	3
5.	Non thermal processing methods-ultra violet light, high pressure processing, ultrasound, ozone application, irradiation, pulsed electric field	7
6.	Introduction, canning machineries, various steps involved in canning of fruit pulp, syrup preparation, pretreatment for canning operation	7
7.	Canning of various fruits, process flow diagram for canning, filling, exhausting, sealing and processing operations	5
<b>TOTAL</b>		<b>28</b>

S.No	PRACTICALS	Hrs
1.	Canning of mango pulp	5
2.	Canning of tomato pulp	5
3.	Preservation of tomato pulp by chemical preservation method	5
4.	Preservation of banana pulp by freezing method	5
5.	Canning of mango slices in syrup	5
6.	Canning of pineapple slices in syrup	5
7.	Canning of banana slices in syrup	5
8.	Visit to fruit processing units and collection of data on wastes and by products	5
9.	Visit to Aseptic packing units for fruit pulps & concentrates	8
10.	Visit to the pilot plants of CFTRI & DFRL Mysore	8
<b>TOTAL</b>		<b>56</b>

## UNIT III

### Food Quality and Food Microbiology

S.No	THEORY	Hrs
1.	Introduction – definition, historical development and significance of food microbiology; Microscope; Classification & morphology of microbes; Techniques of pure culture; Bacteriology of air & water; Anti-microbial agents – physical & chemical – mechanism & action	3
2.	Sources of Contamination: Air, Water, Soil, Sewage, Post processing	3

	Contamination. Intrinsic & extrinsic factors influencing the growth of Microorganisms in foods	
3.	Disinfection & disinfectants; Energy metabolism of aerobic & anaerobic microbes; Thermal inactivation of microbes; Concept, determination & importance of TDT, F, Z & D values; Factors affecting heat resistance; Pasteurization and sterilization	4
4.	Microbiology of Fruits and vegetables and their products like jam, jelly, sauce, juice/pulp	3
5.	Food Quality aspects of Fruits & vegetables; Introduction, Quality principles, Quality enhancement model. Application of quality enhancement model	3
6.	Food Waste Treatment : Liquid waste, Solid waste vessel containers & wrapping waste, Hazardous waste .Quality and Safety of Frozen Foods: Fruits, Vegetable	3
7.	Measuring and Controlling Devices: Role of transducers measurements in food processing; Humidity, Turbidity and Color, Food & Process temperature controller and indicators. Statistical Quality Control for food Industry : Food Quality System, Fundamentals, Process control implementing quality control program, six sigma, RSM	4
8.	Food additives – preservatives, antioxidants, sequestrates, surface active agents, stabilizers and thickeners, bleaching and maturing agents, starch modifies, buffers, acids, alkalis, food colors, artificial sweeteners, nutritional additives, flavoring agents.	5
	<b>TOTAL</b>	<b>28</b>
	<b>PRACTICALS</b>	<b>3</b>
1.	Determination of firmness of fruits	3
2.	Determination of moisture content	3
3.	Titrate acidity estimation	3
4.	Estimation of SO <sub>2</sub> in food sample	3
5.	Estimation of sodium benzoate in food sample	3
6.	Estimation of polyphenol and polyphenol oxidase	3
7.	Estimation of Reducing sugar, Non-reducing and total sugars	3
8.	Determination of organic acid content	3
9.	Ascorbic acid estimation	3
10.	Determination of pH in food products	3
11.	Determination of total Ash	3
12.	Determination of total soluble solids	3
13.	Estimation of ash content	3
14.	Estimation of crude fibre	3
15.	Estimation of pectin	3
16.	Flow process chart of food plant Waste utilization processes, various treatment for waste disposal analysis of cleaners & sanitizers, CIP Cleaning	11
	<b>TOTAL</b>	<b>56</b>
<b>UNIT IV</b>		
<b>Food Safety, Hygiene and Sanitation for Processing of Fruit Pulp</b>		
<b>S.No</b>	<b>THEORY</b>	<b>Hrs</b>
1.	Food safety, hygiene and sanitation for processing of fruit pulp: food safety standards and regulations for fruit pulp, definition of hygiene, hygiene practices and its importance at every stage of fruit pulp processing at industrial level; personal hygiene requirements; physical, chemical and biological hazards and methods for prevention of various hazards; CIP and	14

	COP methods and procedures, GHP, GMP and HACCP; waste management-pre and post production.	
2.	Microbiological aspect of Food; types of food microbes, causes of food spoilage, types of food spoilage/deterioration, criteria to check the food spoilage, need for food preservation, different types of food preservation methods, method of assessing the quality of products based on physical parameters	14
	<b>TOTAL</b>	<b>28</b>
<b>S.No</b>	<b>PRACTICALS</b>	<b>Hrs</b>
1.	Clean and maintenance of work area using appropriate sanitizers, ensure the work area safe and hygienic for fruit processing, disposal of waste material as per SOPs and industrial requirement	8
2.	Check the working and performance of machineries and tools for fruit pulp process, clean the machineries and tools used with recommended sanitizer, to place the necessary tools required for the process, to attend minor repair, faults of all machineries if required.	8
3.	Disassembling and assembling of machineries used in fruit pulp industry (Fruit mill, crusher etc)	8
4.	Demonstration of CIP and COP methods of cleaning the machines with approved sanitizers	8
5.	Visit to industry to learn about GHP, GMP, HACCP	12
6.	Visit to industry to learn about waste management pre and post production	12
	<b>TOTAL</b>	<b>56</b>
<b>S.No</b>	<b>UNIT V</b>	<b>Hrs</b>
<b>Plant Design, Plant Economics and Plant Management</b>		
1.	Food Industry management- location of plant land and building requirements, plant capacity, plant and machinery requirement, building and plant layout, utilities, byproducts, waste, energy and safety audit, manpower requirements	5
2.	Introduction to economics: Meaning, scope, and contribution to business decisions. Analysis of Demand: Law of demand, Utility function, Rate of commodity substitution, Maximization of utility, Demand functions, Indifference curve analysis, Substitution and income effects. Market demand and demand elasticities: concept of market demand, price and income elasticities of demand, importance of elasticity. Demand forecasting: causes and techniques of demand forecasting	6
3.	Analysis of supply and market equilibrium: Law of supply, price elasticity of supply, equilibrium of demand and supply. Theory of the Firm: Production function, returns to scale, Optimizing behavior, Input demands, Cost functions, Profit maximization, economics & diseconomies of scale, break even analysis. Market structures perfect competition: Profit maximization and equilibrium of firm and industry, Short run and long run supply curves; Price and output determination, practical applications	6
4.	Plant maintenance program; Role of maintenance staff and plant operators, Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'. Hygiene and sanitation requirement in food processing and fermentation industries; CIP methods, sanitizing & disinfestation, pest control in food processing; storage and service areas	6
5.	Supply chain management for fruits	5

		<b>TOTAL</b>	<b>28</b>
<b>PRACTICALS</b>			
1.	Visit to industry to learn the management system		16
2.	Visit to Fruit & Vegetable Processing Industries. Preparation of a Business Plan for setting up fruit & vegetable processing unit		40
		<b>TOTAL</b>	<b>56</b>

VI	<b>Hands on Training in Fruit Pulp Processing Industry and submission of report</b>		120
		<b>TOTAL</b>	<b>540</b>



# Model Curriculum

## Fruit Pulp Processing Technician

**SECTOR: FOOD PROCESSING**  
**SUB-SECTOR: FRUITS & VEGETABLES**  
**OCCUPATION: PROCESSING**  
**REF ID: FIC/Q0106, V1.0**  
**NSQF LEVEL: 4**





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# Fruit Pulp Processing Technician

## CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Fruit Pulp Processing Technician”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

<b>Program Name</b>	<b>Fruit Pulp Processing Technician</b>		
<b>Qualification Pack Name &amp; Reference ID. ID</b>	FIC/Q0106, v1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	12/01/2016
<b>Pre-requisites to Training</b>	Preferably Class 8 and 2-3 years' experience in a food processing unit		
<b>Training Outcomes</b>	The programme will help in building the following key competencies amongst the learner: Process fruits to produce fruit pulps manually or through machine operation; Plan, organize, prioritize, inspect, and calculate production requirements; Maintain process parameters to achieve the desired quality and quantity; Follow and maintain food safety and hygiene in the work environment		

This course encompasses 5 out of 5 National Occupational Standards (NOS) of “Fruit Pulp Processing Technician” Qualification Pack FIC/Q0106, Version 1.0 issued by Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p><b>Introduction to the training program</b></p> <p><b>Theory Duration</b> (hh:mm) 00:30</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b> Bridge Module</p>	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
2	<p><b>Overview of the “Fruit Pulp processing technician” Role</b></p> <p><b>Theory Duration</b> (hh:mm) 01:00</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b></p>	<p>Understanding the roles and responsibilities of fruit pulp processing technician</p> <p>Awareness of the nature and availability of job opportunities</p>	Laptop/computer white board, marker, projector, chart papers
3	<p><b>Introduction to the Food Processing Industry</b></p> <p><b>Theory Duration</b> (hh:mm) 01:30</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b></p>	<p>Define food processing</p> <p>List the various sub sectors of food processing industry</p>	Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual
4	<p><b>Introduction to Fruit &amp; Vegetable Processing</b></p> <p><b>Theory Duration</b> (hh:mm)</p>	<p>State the need for fruit and vegetable processing</p> <p>State the common methods of fruit and vegetable processing</p>	Laptop, white/black board, marker, chart papers, projector, trainer’s guide, student handbook, pictures/charts of

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	02:00  <b>Practical Duration</b> (hh:mm) 01:00  <b>Corresponding NOS Code</b>		different subsectors in fruit and vegetable processing e.g. pickle, jam and jelly, ketchup, juices, squashes, fruit pulp etc.
5.	<b>Overview of Fruit Pulp Processing</b>  <b>Theory Duration</b> (hh:mm) 03:00  <b>Practical Duration</b> (hh:mm) 01:00  <b>Corresponding NOS Code</b> FIC/N0120 FIC/N0121 FIC/N0122 FIC/N0123	Define fruit pulping List the various fruits used for pulping Describe the pulping process	Laptop/computer white board, marker, projector, chart papers, Trainer's guide , student handbook
6.	<b>Organizational standards and norms</b>  <b>Theory Duration</b> (hh:mm) 05:00  <b>Practical Duration</b> (hh:mm) 01:00  <b>Corresponding NOS Code</b> FIC/N0120 FIC/N0121 FIC/N0122 FIC/N0123 FIC/N9001	State the roles and responsibilities of a jam, jelly and ketchup processing technician State how to conduct yourself at the workplace State the personal hygiene and sanitation guidelines State the food safety and hygiene standards to follow in an organization	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
7.	<b>Prepare and Maintain Work Area and Process Machineries for pulp processing</b>  <b>Theory Duration</b> (hh:mm)	<ul style="list-style-type: none"> <li>Identify different equipments used in fruit pulp processing</li> <li>State the materials and equipments used in cleaning and maintenance of the work area and machineries</li> <li>State the cleaning processes used to clean the work area</li> </ul>	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, authorized sanitizers, cleansers, all equipments for demonstration

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	08:00  <b>Practical Duration</b> (hh:mm) 15:00  <b>Corresponding NOS Code</b> FIC/N0120 FIC/N0121 FIC/N0122 FIC/N0123 FIC/N9001	<ul style="list-style-type: none"> <li>• Demonstrate the use of different tools and machineries used for squash and juice</li> <li>• Demonstrate the appropriate method for cleaning and maintain a work area Ensure the work area is safe and hygienic for food processing</li> <li>• Identify and set the machines and tools required for production in working condition</li> <li>• Maintain cleanliness of the process machineries required for production using recommended sanitizers</li> </ul>	
8.	<b>Food Microbiology</b>  <b>Theory Duration</b> (hh:mm) 06:00  <b>Practical Duration</b> (hh:mm) 02:00  <b>Corresponding NOS Code</b>	State the types of food microbes State the causes of food spoilage State the process of food spoilage state the criteria to check food spoilage State the need for food preservation State different types of food preservation processes Explain the method of assessing the quality of produce based on physical parameters	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, samples of fresh and spoiled food
9..	<b>Prepare for production of fruit pulp</b>  <b>Theory Duration</b> (hh:mm) 06:00  <b>Practical Duration</b> (hh:mm) 12:00  <b>Corresponding NOS Code</b> FIC/N0121 FIC/N0122	Use basic mathematics for various calculations in day-to-day processes Plan the production schedule as per organizational standards and instructions Organize for raw materials, packaging materials, manpower, equipment and machineries for the scheduled production Identify the raw materials required for production as per production schedule and formation State the methods for storing raw materials for later use Plan the production sequence to maximize capacity, utilization of resources, manpower and machinery Calculate batch size and prioritize urgent orders based on the production schedule and machine capacity	SOP; pH meter(Digital); Thermometer (Digital); Beakers; Measuring Cylinder; Measuring flask; Brinometer; Salinometer, Hydrometer; Weighing Balance (Digital); Brix Meter/ Refractometer; Deep fridge; refrigerator; Gas burner with cylinder; Fruit tray; Stainless steel mug; Pilfer proof capping machine; Cutting knives; mixer/electric mixer; water tank; fruit slicing machine; sealing machine; Vacuum gauge; pressure gauge; seam checking gauge or screw gauge; pressure cooker; coring Knives; Pitting knives;

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> <li>• Check the conformance of raw material quality to company standards</li> <li>• Organize quality raw material as per production process and company standards</li> <li>• Check the raw material quality and grade</li> <li>• Prepare the raw material for production</li> <li>• List the effect on pulp of manhandling fruits</li> </ul>	Juice extractor, crown corking machine; pulper; fruit mill; vacuum pan; mechanical peeler/ batch type of fruit and vegetable peeling; steam jacket kettle; baby boiler/ exhausting box; shredder for slicing of fruit and vegetable; liquid filling machine; Autoclaves S.S vessels with lids; micrometer; seam checking gauge; bottle brush washer;
10.	<p><b>Produce fruit pulp from various fruits</b></p> <p><b>Theory Duration</b> (hh:mm) 15:00</p> <p><b>Practical Duration</b> (hh:mm) 20:00</p> <p><b>Corresponding NOS Code</b> FIC/N0122</p>	<ul style="list-style-type: none"> <li>• Explain the process of pulping fruit</li> <li>• Define ripening</li> <li>• Explain fruit ripening process</li> <li>• Demonstrate the process of ripening, sorting, and deseeding fruit</li> <li>• State the procedures used to create the fruit pulp</li> <li>• Demonstrate the process of fruit pulping</li> <li>• State the methods of sterilizing fruit pulp</li> <li>• List the quality control parameters for checking fruit pulp</li> <li>• State the basic categories of packing</li> <li>• State the various types of packaging materials used for packing fruit pulp</li> <li>• State the factors for selecting packaging materials</li> <li>• Explain aseptic packaging in fruit processing industry</li> <li>• Define canning and its purpose</li> <li>• State the process of canning • Demonstrate the canning process of fruit pulp</li> <li>• State the methods for storing raw materials for later use</li> <li>• Explain the process of storing packaged fruit pulp</li> <li>• State the process of maintaining storage conditions</li> <li>• Demonstrate the process of cleaning the work area and machineries after production organizational standards</li> </ul>	SOP; pH meter(Digital); Thermometer (Digital); Beakers; Measuring Cylinder; Measuring flask; Brinometer; Salinometer, Hydrometer; Weighing Balance (Digital); Brix Meter/ Refractometer; Deep fridge; refrigerator; Gas burner with cylinder; Fruit tray; Stainless steel mug; Pilfer proof capping machine; Cutting knives; mixer/electric mixer; water tank; fruit slicing machine; sealing machine; Vacuum gauge; pressure gauge; seam checking gauge or screw gauge; pressure cooker; coring Knives; Pitting knives; Juice extractor, crown corking machine; pulper; fruit mill; vacuum pan; mechanical peeler/ batch type of fruit and vegetable peeling; steam jacket kettle; baby boiler/ exhausting box; shredder for slicing of fruit and

Sr. No.	Module	Key Learning Outcomes	Equipment Required
			vegetable; liquid filling machine; Autoclaves S.S vessels with lids; micrometer seam checking gauge; bottle brush washer; protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
11.	<p><b>Complete documentation and record keeping</b></p> <p><b>Theory Duration</b> (hh:mm) 03:00</p> <p><b>Practical Duration</b> (hh:mm) 01:00</p> <p><b>Corresponding NOS Code</b> FIC/N0123</p>	<ul style="list-style-type: none"> <li>• State the need for documenting and maintaining records of raw materials, processes and finished products</li> <li>• State the method of documenting and recording the details of raw material to final finished product</li> <li>• Document daily records in the ERP system effectively</li> </ul>	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, logbooks, internal audit register, food safety manual, quality policy etc.
12.	<p><b>Food Safety, Hygiene and Sanitation</b></p> <p><b>Theory Duration</b> (hh:mm) 04:00</p> <p><b>Practical Duration</b> (hh:mm) 04:00</p> <p><b>Corresponding NOS Code</b> FIC/N9001</p>	<p>State the importance of safety, hygiene and sanitation in the baking industry</p> <p>Follow the industry standards to maintain a safe and hygiene workplace</p> <p>Follow HACCP principles to eliminate food safety hazards in the process and products</p> <p>Follow safety practices in the work area</p>	Laptop, white board, marker, chart papers, projector ,trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth covers, sanitizer, safety manual ,logbooks etc.
13.	<p><b>Professional and Core Skills</b></p> <p><b>Theory Duration</b> (hh:mm) 04:00</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p>	<p>Undertake a self-assessment test</p> <p>Identify personal strengths and weaknesses</p> <p>Plan and schedule the work order and manage time effectively to complete the tasks assigned</p> <p>Prevent potential problems from occurring</p> <p>Resolve issues and problems using acquired knowledge and realize the importance of decision making</p>	Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Corresponding NOS Code</b>	Identify potential problems and make sound and timely decision Improve your reading skills State the importance of listening	
14.	<b>IT Skills</b>  <b>Theory Duration</b> (hh:mm) 05:00  <b>Practical Duration</b> (hh:mm) 08:00  <b>Corresponding NOS Code</b>	Identify parts of the computer Use the computer keyboard effectively to type Use computer applications effectively to record day-to-day activities Use the word processor effectively Use the spreadsheet application effectively Use the computer to document day-to-day activities	Laptop, white/black board, marker, chart papers, projector, Trainer's guide, Student manual
15.	<b>Field Visits</b>  <b>Theory Duration</b> (hh:mm) 05:00  <b>Practical Duration</b> (hh:mm) 19:00  <b>Corresponding NOS Code</b>	Observe the factory location, layout and safety aspects of food processing Observe the storage facilities for raw materials and finished products Observe the various machineries used in pickle processing Observe the various machineries used in pickle processing Observe the cleaning methods and processes followed to maintain the process machineries and tools Observe the raw materials used and their storage procedures Observe the packaging and storage processes of raw material and finished product Observe the post-production cleaning and maintenance process followed in the industry	All the tools and equipment listed above must be available at the site of field visit
16.	<b>Revision</b>  <b>Theory Duration</b> (hh:mm) 05:00  <b>Practical Duration</b> (hh:mm) 01:00  <b>Corresponding NOS Code</b>	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision
17.	<b>Evaluation</b>  <b>Theory Duration</b> (hh:mm) 08:00	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Practical Duration</b> (hh:mm) 10:00  <b>Corresponding NOS Code</b>		
18.	<b>On-the-job Training</b>  <b>Theory Duration</b> (hh:mm) 14:00  <b>Practical Duration</b> (hh:mm) 50:00  <b>Corresponding NOS Code</b>	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	<b>Total Duration</b> <b>240:00</b>  <b>Theory Duration</b> <b>95:00</b>  <b>Practical Duration</b> <b>145:00</b>	<b>Unique Equipment Required:</b> SOP; pH meter(Digital); Thermometer (Digital); Beakers; Measuring Cylinder; Measuring flask; Brinometer; Salinometer, Hydrometer; Weighing Balance (Digital); Brix Meter/ Refractometer; Deep fridge; refrigerator; Gas burner with cylinder; Fruit tray; Stainless steel mug; Pilfer proof capping machine; Cutting knives; mixer/electric mixer; water tank; fruit slicing machine; sealing machine; Vacuum gauge; pressure gauge; seam checking gauge or screw gauge; pressure cooker; coring Knives; Pitting knives; Juice extractor, crown corking machine; pulper; fruit mill; vacuum pan; mechanical peeler/ batch type of fruit and vegetable peeling; steam jacket kettle; baby boiler/ exhausting box; shredder for slicing of fruit and vegetable; liquid filling machine; Autoclaves S.S vessels with lids; micrometer seam checking gauge; bottle brush washer	

Grand Total Course Duration: **240Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by [SSC: Food Industry Capacity and Skill Initiative](#))*



## Trainer Prerequisites for Job role: “Fruit Pulp Processing Technician” mapped to Qualification Pack: “FIC/Q0106, v1.0”

Sr. No.	Area	Details
1	<b>Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q0106”, Version 1.0
2	<b>Personal Attributes</b>	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	<b>Minimum Educational Qualifications</b>	<ul style="list-style-type: none"> <li>B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hand on experience in a Pulping Unit or Fruits/Vegetables Processing Unit.</li> </ul>
4a	<b>Domain Certification</b>	Certified for Job Role: “Fruit Pulp Processing Technician” mapped to QP: “FIC/Q0106, v1.0”. Minimum accepted score is 80%
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “SSC/Q1402”. Minimum accepted SCORE IS 80 % as per FICSI guidelines.
5	<b>Experience</b>	<ul style="list-style-type: none"> <li>B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hand on experience in a Pulping Unit or Fruits/Vegetables Processing Unit.</li> </ul>



### Annexure: Assessment Criteria

<b>Assessment Criteria</b>	
<b>Job Role</b>	<b>Fruit Pulp Processing Technician</b>
<b>Qualification Pack</b>	<b>FIC/Q0106, v1.0</b>
<b>Sector Skill Council</b>	<b>Food Processing</b>

<b>Sr. No.</b>	<b>Guidelines for Assessment</b>
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
<b>1. FIC/Q0120: Prepare and maintain work area and process machineries for pulp processing</b>	PC.1 Prepare, clean and maintain the cleanliness of the work area using approved sanitizers and keep it free from dust, waste, flies and pests	<b>100</b>	25	10	15
	PC2. Ensure that the work area is safe and hygienic for food		10	3	7
	PC3. Dispose waste materials as per defined SOPs and industry requirements		15	5	10
	PC4. Check the working and performance of all machineries and tools used for the pickle making process such as washer, peeler, vegetable cutter/slicer, blender, packaging machines etc.		15	5	10
	PC5. Clean the machineries and tools used with approved sanitizers following SOP		15	5	10
	PC6. Place the necessary tools required for process		5	2	3
	PC7. Attend the minor repairs/ faults of all machines, if required		15	5	10
	<b>Total</b>		<b>100</b>	<b>35</b>	<b>65</b>
<b>2. FIC/Q0121: Prepare for production of fruit pulp</b>	PC1. Read and understand the production order from supervisor	<b>100</b>	10	4	6
	PC2. Check the availability of raw materials, packaging materials, equipment availability and manpower		5	2	3
	PC3. Support in planning production sequence		15	5	10
	PC4. Calculate the batch size based on the production order and machine capacity		5	2	3
	PC5. Calculate the raw material requirement (considering the process loss) to produce the required quantity of finished		5	2	3
	PC6. Calculate the raw materials, packaging materials and manpower requirement for completing the order.		5	2	3
	PC7. Ensure the working and performance of each equipment required for the process		7	2	5
	PC8. Calculate the process time for effective utilization of machineries		7	2	5
	PC9. Plan batch size considering full capacity utilization of machineries		3	1	2
	PC10. Plan to utilize machineries for multiple products without affecting the quality of		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	the finished products, and to optimize production and save energy				
	PC11. Allot responsibilities and help to assistants and workers		5	1.5	3.5
	PC12. Refer the process chart for products produced		3	1	2
	PC13. Weigh the raw materials required for the batch		3	1	2
	PC14. Check the conformance of raw material quality to organization standards, through physical analysis and by referring the quality analysis report from the supplier/ internal lab analysis report		10	4	6
	PC15. Sharpen cutter blades and change the cutter/slicer blades		2	0.5	1.5
	PC16. Fix, change, clean filters and sieves of processing machinery		5	2	3
	PC17. Ensure working and performance of required machines and tools.		5	1	4
	PC18. Keep the tools assessable to repair in case of faults/ breakdown		2	0.5	1.5
	<b>Total</b>		<b>100</b>	<b>35</b>	<b>65</b>
<b>3. FIC/Q0122: Produce fruit pulp from various fruits</b>	PC1. Receive fruits from the supplier/vendor and check weight	<b>100</b>	1	0.5	0.5
	PC2. Check quality through physical parameters such as appearance, color, texture, maturity		1	0.5	0.5
	PC3. Load fruits in fruit ripening chamber, adjust controls to set required temperature, time, relative humidity to pre-cool the fruit, monitor temperature to ensure the fruit is cooled to required temperature		3	1	2
	PC4. Open and control the regulator of the ethylene generator or use PLC to introduce ethylene into the chamber to initiate ripening of fruit, monitor air circulation system for uniform ethylene flow for specified period, adjust controlling system to maintain required temperature, relative humidity, etc. for specified period, adjust ventilation system at periodic interval by controlling the speed of exhaust fan to remove carbon-di-oxide		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC5. Open ripening chamber after specified period, start fan to ventilate ethylene gas, stop fan after ventilation, unload the ripened fruit from the ripening chamber, check the quality of ripened fruit and transfer to processing area		2	0.5	1.5
	PC6. Open valves or start pump to fill water in washing tank and control water level, dump fruits into the washing tank for washing		2	0.5	1.5
	PC7. Switch on agitator of revolving screens/blades to immerse each fruit into water to remove dirt, soil, etc		2	0.5	1.5
	PC8. Start the ladder conveyor to lift fruits from the washing tank and transfer to the washing line conveyor		2	0.5	1.5
	PC9. Open valves of the high pressure spraying system for fresh water and adjust pressure to spray water on fruits for rinsing		2	0.5	1.5
	PC10. Adjust controls to transfer washed fruit to sorting/inspecting line, start and adjust speed of sorting/inspecting line conveyor to visually inspect and manually remove damaged, blemished and rotten fruits		2	0.5	1.5
	PC11. Dump sorted fruits in the peeler or corer (depending on the type of fruits), start machine, adjust speed to remove the peel or core of fruits (or) turn valves to introduce steam and adjust controls to maintain pressure for steam peeling		3	1	2
	PC12. Open valve or pump water or open spraying system to wash peeled fruits, observe fruits emerging from peeling/coring machine to ensure removal of peel/core		2	0.5	1.5
	PC13. Cut fruits manually (or) load the fruits in the chopper/cutter/slicer machine, adjust controls to cut fruits to required size, start machine, collect sliced fruits from the discharge chute		2	0.5	1.5
	PC14. In case of mangoes, start conveyor and control speed to allow washed mangoes to pass through mango tip cutting line, cut the mango tip manually, control conveyor speed to dump the tip cut mangoes into		2	0.5	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	destoner machine to remove seed and peel				
	PC15. Control speed of waste disposal conveyor to dispose waste following sop		1	0.5	0.5
	PC16. Adjust and maintain speed of pulper conveyor to allow fruits to pass through the pulper cum finisher/ pulper refiner machine for pulping fruits and sieving pulp to required fineness, adjust position of discharge outlet to collect refined pulp in collection tank, check collected pulp to ensure it is free from seeds and fiber		8	3	5
	PC17. Replace damaged or clogged filter screen of pulper cum finisher/ pulper refiner machine		2	0.5	1.5
	PC18. Start pump to transfer measured quantity of pulp from collection tank to steam jacketed kettle/ pre-cooking tank for cooking pulp, check pumped quantity through the level indicator and glass windows of the pre-cooking tank, adjust controls to set pressure, temperature, cooking time, stirrer speed, etc., open valve to allow steam to pass through kettle for pre-cooking/ pre-heating pulp to required temperature, examine pre-cooked fruits through feel/texture		8	3	5
	PC19. Open valves to allow pre-cooked pulp to pass through de-canter machine to remove black specks, set control of the machine such as speed of screw conveyor in machine and speed/ rotation and start machine to remove black specks (in case of mango)		5	2	3
	PC20. Collect the pre-cooked pulp in the collection tank/ holding tank, sample pulp and transfer to quality lab for analysis and conformance to organisation standards		2	0.5	1.5
	PC21. Set controls of de-aerator machine to remove air from pulp for extended shelf-life, start machine, open valves/ start pump to transfer measured quantity of pre-cooked pulp into de-aeration tank to de-aerate pulp		5	2	3

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC22. Set controls of evaporator like flow rate of pulp, temperature, residence time etc to concentrate pulp (for processing concentrated pulp), switch on machine to transfer measured quantity of de-aerated pulp into continuous evaporator for concentrating pulp		5	2	3
	PC23. Open valves/start pump to transfer measured quantity of precooked(or)de-aerated and concentrated pulp into sterilization tank to sterilize pulp before aseptic packing, adjust controls to set temperature, pressure, time, etc. and open valves to allow steam to pass through sterilization tank, switch on machine to start sterilization, observe through glass windows of the sterilization tank, monitor and maintain steam pressure by adjusting gauges to sterilize fruit pulp to organisation standards		4	1	3
	PC24. Set controls to allow the sterilized pulp to pass to the aseptic surge tank for filling, maintain temperature of product surge tank until filling, set controls of the product filler of aseptic filling machine for filling volume, pressure, temperature, etc		4	1	3
	PC25. Place plastic liners in the container (drums, cartons etc), date code aseptic bags with details like date of manufacture, date of expiry etc and place inside the liner for filling pulp, start conveyor and control speed to move the drum with aseptic bags under the aseptic (product) filling machine		2	1	1
	PC26. Fix the spout of the aseptic bag to the filling nozzle of the machine, set controls like pressure, temperature, filling volume etc and start machine to fill hot sterile product and automatically seal/ close with sterile closures		2	0.5	1.5
	PC27. Start conveyor to move the container with filled aseptic bags to the weighing area, check the weight of the container, label the container with details like batch number, date of manufacture, date of expiry, volume/weight etc		2	0.5	1.5
	PC28. Cover the aseptic bags with liner, place lid on drums, close and seal lid,		1	0.5	0.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	transfer to the storage area and store by maintaining storage conditions and following SOP				
	PC29. Operate can reformer, flanger, seamer, can body beader and embossing machines to form cans		1	0.5	0.5
	PC30. Press button to activate machine-lift that raises stacked cans and transfers them onto mechanical conveyor (in mechanical units), observe passing cans and remove defective/ damaged cans from conveyor and discard following SOP		1	0.5	0.5
	PC31. Start machine that automatically feeds empty cans onto conveyors leading to washing, filling and sealing machines (or) set controls like temperature, pressure, conveyor speed of empty can machine, place empty cans in the conveyor and start machine to sterilize cans, collect sterilized cans from other end of the conveyor and transfer to the filling machine		1	0.5	0.5
	PC32. Start conveyor to allow sterilized cans to pass through the filling line (or) place sterilized cans manually in the filling line conveyor		1	0.5	0.5
	PC33. Start pump to fill pre-cooked/preheated pulp into the filling tank, set temperature, volume etc and start machine to fill pulp in cans, control speed of conveyor to transfer filled cans to the can seaming machine (or) manually place lid over the filled cans and seal in cans in can seamer machine		2	0.5	1.5
	PC34. Load the canned product manually in metal baskets, start motor to lower the basket with cans in lager tank with hot water, allow steam to pass through tank to heat continuously to sterilize can to specified temperature and time, mechanically lift basket with sterilised cans from hot water tank and place in cold water tank, open valves to circulate cold water in tanks to cool cans, dry cans manually		2	1	1



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC35. Load the canned product into the retort manually or mechanically through push trucks, close retort door or lid, and turn wheels or moves levers to seal chamber, adjust controls to set pressure, temperature and time of the retort chamber to sterilize canned product following sop		2	0.5	1.5
	PC36. Set process parameters like pressure, temperature, sterilization time etc in the retort following SOP, turns valves to admit steam to retort, observe dials and gauges and adjust controls to maintain process parameters, turn valves to release steam and allow cool water into chamber to prevent overcooking		1	0.5	0.5
	PC37. Open retort and move the canned product to the cooling line conveyor, open valves of the water spraying system and adjust pressure to spray cold water on cans passing though cooling line conveyor, transfer cooled cans to drying line conveyor and start conveyor, set and control temperature and air flow to dry adhering water from the cooled cans		2	1	1
	PC38. Load labels in the packaging machine and set date coding machine for batch number, date of manufacture, date of expiry etc, start labeling machine and date coding machine to label and date code cans, sample canned product and transfer to quality lab for analysis, pack labeled cans into cartons and transfer to storage area and store maintaining storage conditions following SOP		1	0.5	0.5
	PC39. Report discrepancies/concerns to department supervisor for immediate action		1	0.5	0.5
	PC40. Clean the work area, machineries, equipment and tools using recommended cleaning agents and sanitizers		2	0.5	1.5
	PC4. Attend minor repairs/faults of all machines (if any)		1	0.5	0.5
	PC42. Ensure periodic (daily/weekly/monthly/quarterly/half yearly/annual) maintenance of all machines		1	0.5	0.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	and equipment following the SOP or following suppliers instructions/manuals				
	<b>Total</b>		<b>100</b>	<b>35</b>	<b>65</b>
<b>4. FIC/Q0123: Complete documentation and record keeping related to production of fruit pulp</b>	PC1. Document and maintain records of details of raw materials and packaging materials as per organizational standards	<b>100</b>	10	6	4
	PC2. Document and maintain record on observations (if any) related to raw materials and packaging materials		5	3	2
	PC3. Load the raw material details in ERP for future reference		5	3	2
	PC4. Verify the documents and track from finished products to raw materials, in case of quality concerns and during quality management system audits		5	3	2
	PC5. Document and maintain records of production plan with details		10	6	4
	PC6. Document and maintain records of process details for entire production in process chart or production log for all products produced		15	9	6
	PC7. Document and maintain records of batch size, production yield, wastage of raw materials, energy utilization and final product produced		10	6	4
	PC8. Document and maintain record of observations or deviations		5	3	2
	PC9. Load the production plan and process details in ERP for future reference		5	3	2
	PC10. Verify documents and track from finished product to ingredients, in case of quality concerns and for quality management system audit		5	3	2
	PC11. Document and maintain records of finished products		3	2	1
	PC12. Document and maintain records of the finished product details as per organizational standards		7	4	3
	PC13. Document and maintain record on observations or deviations related to finished products		5	3	2
	PC14. Load the finished product details in ERP for future reference		5	3	2
	PC15. Verify the documents and track from finished product to ingredients, in case of quality concerns and for quality management system audits		5	3	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	<b>Total</b>		<b>100</b>	<b>60</b>	<b>40</b>
<b>5. FIC/N9001: Food Safety, hygiene and sanitation for processing food products</b>	PC1. Comply with food safety and hygiene procedures followed in the organization	<b>100</b>	5	2	3
	PC2. Ensure personal hygiene by use of gloves, masks ,hair net, ear plugs, boots etc.		6	1	5
	PC3. Ensure hygienic production of food by inspecting raw materials, ingredients, finished products etc for compliance to physical, chemical and microbiological procedures		5	2	3
	PC4. Pack products in appropriate packaging material, label and store them in designated area free from pests, flies etc.		10	4	6
	PC5. Clean, maintain and monitor food processing equipments periodically, using it only for the specified purpose		5	2	3
	PC6. Use safety equipment such as fire extinguisher, eye wash unit, first aid kit when required		10	4	6
	PC7. Follow housekeeping practices by having designated area for machines/tools		5	2	3
	PC8. Follow industry standards like GMP, HACCP and product recall		10	4	6
	PC9. Attend training on hazard management to understand type of physical, chemical and microbiological hazards		5	1	4
	PC10. Identify, document and report problems such as rodents and pests to management		5	1	4
	PC11. Conduct workplace checklist audit before and after work to ensure safety and hygiene		5	1	4
	PC12. Document and maintain raw material, process, packaging material to maintain the effectiveness of quality system		4	1	3
	PC13. Determine the quality of food using criteria such as odor, color, taste and best before date and take immediate measures to prevent spoilage		5	2	3
	PC14. Store raw materials, finished products and allergens separately to prevent cross contamination		5	2	3

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC15. Label raw materials and finished products and store them in different 5 2 3 storage areas according to safe food practices				
	PC16. Follow stock rotation based on FEFO/FIFO		10	4	6
	<b>Total</b>		<b>100</b>	<b>35</b>	<b>65</b>
	<b>Grand Total</b>	<b>500</b>	<b>500</b>	<b>300</b>	<b>200</b>
	<b>Percentage Weightage</b>		<b>100</b>	<b>60%</b>	<b>40%</b>
	<b>Minimum Pass% to qualify (aggregate):</b>			<b>70%</b>	





# Model Curriculum

## Supervisor-Fruits and Vegetables Processing

**SECTOR: FOOD PROCESSING**  
**SUB-SECTOR: FRUITS & VEGETABLES**  
**OCCUPATION: PROCESSING**  
**REF ID: FIC/Q0109, V1.0**  
**NSQF LEVEL: 5**





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# Supervisor-Fruits and Vegetables Processing

## CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Supervisor-Fruits and Vegetables processing”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

<b>Program Name</b>	<b>Supervisor-Fruits and Vegetables Processing</b>		
<b>Qualification Pack Name &amp; Reference ID. ID</b>	FIC/Q0109, v1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	01/08/2018
<b>Pre-requisites to Training</b>	Preferably Class 12 and 2 years’ experience in fruit and vegetable processing unit		
<b>Training Outcomes</b>	<b>After completing this programme, participants will be able to:</b> <ul style="list-style-type: none"><li>• ensure preparation of work area and process machineries for fruit &amp; vegetable processing,</li><li>• execute production planning of fruits &amp; vegetable processing,</li><li>• supervise and coordinate activities of workers engaged in production of fruits &amp; vegetable products,</li><li>• perform documentation and record keeping of raw material, ingredients and the finished good,</li><li>• apply sanitation and hygiene practices in the work environment,</li><li>• manage and lead the team.</li></ul>		

This course encompasses 6 out of 6 National Occupational Standards (NOS) of “Supervisor-Fruits and Vegetables Processing” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p><b>Introduction to Training Program and Overview of Food Processing Industry</b></p> <p><b>Theory Duration</b> (hh:mm) 07:00</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b> Bridge Module</p>	<ul style="list-style-type: none"> <li>• Define food processing</li> <li>• List the various sub sectors of food processing industry</li> <li>• Define fruits and vegetables Processing</li> <li>• List the various units within a fruits and vegetables processing industry</li> <li>• State the roles and responsibilities of supervisor-fruits and vegetables processing</li> </ul>	
2	<p><b>Organizational Standards and Norms</b></p> <p><b>Theory Duration</b> (hh:mm) 05:00</p> <p><b>Practical Duration</b> (hh:mm) 10:00</p> <p><b>Corresponding NOS Code</b> Bridge Module</p>	<ul style="list-style-type: none"> <li>• State the roles and responsibilities of a Supervisor-fruits and vegetables processing</li> <li>• State how to conduct yourself at the workplace</li> <li>• State the personal hygiene and sanitation guidelines</li> <li>• State the food safety hygiene standards to follow in a work environment</li> </ul>	Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual
3	<p><b>Ensure Preparation and Maintenance of Work Area and Process Machineries for Production of Fruit and Vegetable Products</b></p> <p><b>Theory Duration</b> (hh:mm) 10:00</p> <p><b>Practical Duration</b> (hh:mm) 20:00</p>	<ul style="list-style-type: none"> <li>• Check if the work area is cleaned using approved sanitizers</li> <li>• Describe the importance of cleanliness of the work area</li> <li>• Check if the work area is safe and hygienic for food production</li> <li>• Check the working and performance of all machineries and tools used for fruits and vegetables processing</li> <li>• Check if the equipment are washed with approved sanitizers</li> <li>• Check if the disposal of waste material is as per SOP</li> </ul>	Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Corresponding NOS Code</b> FIC/N0131		
4.	<b>Execute production planning of Fruit and Vegetable Products</b>  <b>Theory Duration</b> (hh:mm) 10:00  <b>Practical Duration</b> (hh:mm) 20:00  <b>Corresponding NOS Code</b> FIC/N0132	<ul style="list-style-type: none"> <li>• Perform the grouping of ingredients for same type of products</li> <li>• Plan production sequence</li> <li>• Demonstrate the allotting of responsibilities</li> <li>• Perform calculation for raw material requirement</li> <li>• Perform a check on the availability of raw material, ingredients and packaging materials</li> </ul>	Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual
5.	<b>Supervise Production of Fruit and Vegetable Products</b>  <b>Theory Duration</b> (hh:mm) 15:00  <b>Practical Duration</b> (hh:mm) 40:00  <b>Corresponding NOS Code</b> FIC/N0133	<ul style="list-style-type: none"> <li>• Perform a check if all the machineries are clean and in good working conditions</li> <li>• Demonstrate assembling of all components of machines</li> <li>• Perform a pre check on all machineries</li> <li>• Review of the production order</li> <li>• Check if the production area is clean for processing of fruits and vegetables</li> <li>• Check the quality report of fruits and vegetables to ensure conformance to the industry standards</li> <li>• Demonstrate the monitoring of control panel of each fruits and vegetables processing machinery</li> <li>• Co-ordinate with the maintenance team and ensure machine breakdowns are attended</li> <li>• Check for timely production of the food product</li> <li>• Complete all the documents related to production and pass them on to manager</li> <li>• Demonstrate cleaning the machineries used with recommended sanitizers following CIP (clean-in-place) procedure</li> <li>• Demonstrate cleaning the equipment and tools used using recommended cleaning agents and sanitizers</li> </ul>	Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual
6.	<b>Complete Documentation and Record Keeping</b>	<ul style="list-style-type: none"> <li>• State the need for documenting and maintaining records of raw materials, processes and finished products</li> <li>• State the method of documenting and</li> </ul>	Food Safety Manual, Log Books.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<p><b>Related to Packaging Food Products</b></p> <p><b>Theory Duration</b> (hh:mm) 06:00</p> <p><b>Practical Duration</b> (hh:mm) 05:00</p> <p><b>Corresponding NOS Code</b> FIC/N0134</p>	<p>recording the details of raw material to final finished product</p> <ul style="list-style-type: none"> <li>• Demonstrate the process of documenting records of production plan, process parameters, and finished products</li> </ul>	
7.	<p><b>Food Safety, Hygiene and Sanitation for Packaging Food Products</b></p> <p><b>Theory Duration</b> (hh:mm) 10:00</p> <p><b>Practical Duration</b> (hh:mm) 35:00</p> <p><b>Corresponding NOS Code</b> FIC/N9001</p>	<ul style="list-style-type: none"> <li>• State the importance of safety, hygiene and sanitation in the baking industry</li> <li>• Apply the industry standards to maintain a safe and hygiene workplace</li> <li>• Apply HACCP principles to eliminate food safety hazards in the process and products</li> <li>• Apply safety practices in the work area</li> </ul>	<p>Protective Gloves, Head Caps, Aprons, Safety Goggles, Safety Boots, Mouth Covers, Sanitizer, Food Safety Manual ,Log Books etc.</p>
8.	<p><b>Leadership Skills</b></p> <p><b>Theory Duration</b> (hh:mm) 04:00</p> <p><b>Practical Duration</b> (hh:mm) 10:00</p> <p><b>Corresponding NOS Code</b> FIC/N9004</p>	<ul style="list-style-type: none"> <li>• Perform a check if the team is aware about the schedule and expectations from them</li> <li>• Conduct regular meetings with the team members</li> <li>• Tell the team member to participate in various activities organized by the organization</li> <li>• Demonstrate counselling of team members</li> <li>• Conduct training of team members</li> <li>• Provide feedback to the team members</li> </ul>	<p>Computer/Laptop, Log Books</p>
9.	<p><b>Professional and Core Skills</b></p> <p><b>Theory Duration</b> (hh:mm) 04:00</p>	<ul style="list-style-type: none"> <li>• Plan a general aptitude self-assessment test</li> <li>• Identify personal strengths and weaknesses</li> <li>• Plan and schedule the work order</li> </ul>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Practical Duration</b> (hh:mm) 10:00  <b>Corresponding NOS Code</b> Bridge Module	<ul style="list-style-type: none"> <li>• Manage time effectively to complete the tasks assigned</li> <li>• Identify and resolve potential problems and take preventive measure to prevent it</li> <li>• State the importance of decision making</li> <li>• State the importance of listening</li> </ul>	
10.	<b>IT Skills</b>  <b>Theory Duration</b> (hh:mm) 04:00  <b>Practical Duration</b> (hh:mm) 15:00  <b>Corresponding NOS Code</b> Bridge Module	<ul style="list-style-type: none"> <li>• Identify parts of the computer</li> <li>• Use the computer keyboard effectively to type</li> <li>• Use computer applications effectively to record day-to-day activities</li> <li>• Use the word processor effectively</li> <li>• Use the spreadsheet application effectively</li> <li>• Use the computer to document day-to-day activities</li> </ul>	Computer/Laptop
	<b>Total Duration</b> <b>240:00</b>  <b>Theory Duration</b> <b>75:00</b>  <b>Practical Duration</b> <b>165:00</b>	<b>Unique Equipment Required:</b> Fruit Washer, Peeler, Fruit Pulper , Juice Extractor, Clarifier, Filter, Pasteurizer, Steam Jacketed Kettles, Packaging Machines, Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual, Log Books, Computer/Laptop	

Grand Total Course Duration: **240Hours, 0 Minutes**  
 Recommend OJT Hours: **60Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by SSC: Food Industry Capacity and Skill Initiative)*

## Trainer Prerequisites for Job role: “Supervisor- Fruits and Vegetables Processing” mapped to Qualification Pack: “FIC/Q0109, v1.0”

Sr. No.	Area	Details
1	<b>Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “ <u>FIC/Q0109</u> ”, Version 1.0
2	<b>Personal Attributes</b>	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	<b>Minimum Educational Qualifications</b>	<ul style="list-style-type: none"> <li>• B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hands on experience in a Fruits/Vegetables Unit</li> <li>• M.Sc/M.Tech/ME in Food Technology or Food Engineering with 1-2 years of hands on experience in a Fruits/Vegetables Unit</li> </ul>
4a	<b>Domain Certification</b>	Certified for Job Role: “ <u>Supervisor-Fruits &amp; Vegetables Processing</u> ” mapped to QP: “ <u>FIC/Q0109, v1.0</u> ”. Minimum accepted score is 80%
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “MEP/Q0102”. Minimum accepted score is 80 % as per FICSI guidelines.
5	<b>Experience</b>	<ul style="list-style-type: none"> <li>• B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hands on experience in a Fruits/Vegetables Unit</li> <li>• M.Sc/M.Tech/ME in Food Technology or Food Engineering with 1-2 years of hands on experience in a Fruits/Vegetables Unit</li> </ul>



## **Annexure: Assessment Criteria**

<b>Assessment Criteria</b>	
<b>Job Role</b>	<b>Supervisor-Fruits and Vegetables Processing</b>
<b>Qualification Pack</b>	<b>FIC/Q0109, v1.0</b>
<b>Sector Skill Council</b>	<b>Food Processing</b>

### **Guidelines for Assessment**

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, as well as the selected elective NOS/set of NOS.  
OR
4. Assessment will be conducted for all compulsory NOS, as well as the selected optional NOS/set of NOS.
5. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below)
6. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
7. To pass the Qualification Pack, every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
8. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack

<b>Total Marks: 600</b>	<b>Compulsory NOS</b>				
<b>Assessable outcomes</b>	<b>Assessment criteria for outcomes</b>	<b>Total Marks</b>	<b>Out Of</b>	<b>Theory</b>	<b>Skills Practical</b>
<b>1. FIC/N0131: Prepare and maintain work area and process machineries for production of fruits &amp; vegetables</b>	PC.1 ensure work area is cleaned using approved sanitizers and cleanliness is maintained to keep it free from dust, waste, flies and pests	<b>100</b>	15	5	10
	PC2. Ensure that the work area is safe and hygienic for food processing		20	8	12
	PC3. ensure disposal of waste materials as per defined SOPs and industry requirements		15	6	9
	PC4. ensure the working and performance of all machineries and tools used for production of fruits and vegetable products like washer, peeler, slicer, pulper, pasteurizer, drier, refractometer, salinometer, double jacketed kettle, juice extractor, clarifier, evaporator, retort, packaging machines etc.		20	8	12
	PC5. ensure machineries and tools are cleaned using recommended sanitizers following the SOP		10	4	6
	PC6. ensure tools required for process are placed accessible, to use when necessary		5	1	4
	PC7. ensure minor repairs/ faults of all machines are attended		15	3	12
			<b>100</b>	<b>35</b>	<b>65</b>
<b>2. FIC/N0132: execute production planning of fruits &amp; vegetable products</b>	PC1. plan production sequence by <ul style="list-style-type: none"> <li>grouping products of same type (varieties of juices, pulps, jams, pickles etc)</li> <li>using same equipment and machinery for various products such that one product does not impact the quality of the other</li> <li>planning maximum capacity utilization of machineries</li> <li>considering the process time for each product</li> <li>planning efficient utilization of resources/manpower</li> <li>prioritizing urgent orders</li> </ul>		27	10	17
	PC2. calculate the batch size based on the production order and machine capacity		7	2	5
	PC3. calculate lead time for production of various products planned		11	3	8
	PC4. prepare shift schedule for assistants/technicians		5	2	3
	PC5. allot responsibilities work to the assistants/technicians and helpers		5	2	3
	PC6. calculate the raw material requirement		5	2	3



Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
	(considering the process loss) to produce finished product(s) as per production order				
	PC7. calculate the raw materials, packaging materials and manpower requirement for completing the order		5	2	3
	PC8. check the availability of raw materials, packaging materials, equipment and manpower		9	3	6
	PC9. prepare indent for issue of raw materials and packaging materials from store		3	1	2
	PC10. ensure transfer of raw materials and packaging materials from store production and packaging area through helpers		2	0.5	1.5
	PC11. ensure checking the weight of raw materials and packaging materials received from store and check its conformance of quality to organisation standards through physical parameters like appearance, colour, texture etc		8	2.5	5.5
	PC12. verify quality documents from supplier and internal lab to ensure its conformance to standards		9	4	5
	PC13. ensure raw materials (including ingredients, additives, preservatives etc) for the batch are weighed accurately following the formulations		4	2	2
			<b>100</b>	<b>35</b>	<b>65</b>
<b>3. FIC/N0133: Supervise production of fruit and vegetable products</b>	PC1. check and ensure cleanliness and sterilization of all fruit and vegetable processing machineries like washer, peeler, slicer, pulper, drier, juice extractor, juice clarifier, evaporator, retort, pasteurizer, steam jacketed kettle, packaging machines etc	<b>100</b>	2	0.5	1.5
	PC2. check and ensure maintenance has been carried out on all fruit and vegetable processing machineries and equipments		2	0.5	1.5
	PC3. check and ensure all process machineries are clean and in good mechanical condition		2	0.5	1.5
	PC4. check assembling of fittings like stirrer, blades, pipes and other parts to equipment and ensure all machineries are ready for production		5	0.5	4.5
	PC5. start each process machineries and ensure its working and performance and check if required tools are kept accessible to attend repairs/faults in case of breakdown		2	0.5	1.5

<b>Total Marks: 600</b>	<b>Compulsory NOS</b>				
<b>Assessable outcomes</b>	<b>Assessment criteria for outcomes</b>	<b>Total Mark s</b>	<b>Out Of</b>	<b>Theory</b>	<b>Skills Practical</b>
	PC6. review production orders or schedules to ascertain product details such as type of products to be produced, quantities, specifications of products and scheduled delivery dates in order to plan production operation		2	1	1
	PC7. check and ensure production area is safe and clean		2	0	2
	PC8. verify the quality report on raw materials to ensure its conformance to quality standards		2	1	1
	PC9. monitor control panel of each fruit and vegetable processing machinery and ensure applicable process parameters like temperature, pressure, time etc (as applicable) are set in accordance with standards for production of various fruit and vegetable products		3	1	2
	PC10. observe control points and equipments at regular intervals to ensure operational performance and optimum utilization		3	1	2
	PC11. stop production following stop procedure, in case of machine breakdowns during production		3	1	2
	PC12. co-ordinate with maintenance team and ensure machine breakdowns are attended to immediately in order to prevent operational delays		3	1	2
	PC13. suggest control measures and corrective actions for any problems related to production, process and products, if required consult with manager and resolve problems		4	1.5	2.5
	PC14. ensure product quality by establishing and enforcing organization standards in each stage of production process		3	1	2
	PC15. monitor packaging of finished products, perform random check on weight of packed products, check label details like date of manufacture, batch number, expiry date etc and ensure products are packed as per organisation and regulatory standards		4	1.5	2.5
	PC16. monitor production activities, coordinate with cross function team and ensure production is started and completed as scheduled		4	1.5	2.5
	PC17. ensure timely production with minimum or no wastage, and quality of products		4	1.5	2.5

<b>Total Marks: 600</b>	<b>Compulsory NOS</b>				
<b>Assessable outcomes</b>	<b>Assessment criteria for outcomes</b>	<b>Total Marks</b>	<b>Out Of</b>	<b>Theory</b>	<b>Skills Practical</b>
	produced meets organisation and regulatory standards				
	PC18. analyze production performance records and data, investigate issues related to fruit and vegetable products processing, discuss with manger and identify solutions to prevent/correct problems, and ensure to implement suggested corrective action		4	1.5	2.5
	PC19. evaluate new equipment and techniques while producing new products and on installation of new machineries		4	2	2
	PC20. maintain safe and clean work environment by educating team on procedures to maintain compliance		3	1.5	1.5
	PC21. monitor activities and performance of assistants, technicians, operators and helpers		7	3	4
	PC22. provide production information to the manager by compiling, sorting, and analysing production performance records of all shifts		4	1.5	2.5
	PC23. update manager on day-to-day activities, discuss problem, suggest or understand suggested preventive and corrective action, and implement corrective actions immediately		4	1	3
	PC24. update manager on day-to-day activities, discuss problem, suggest or understand suggested preventive and corrective action, and implement corrective actions immediately		6	2	4
	PC25. monitor cleaning of work area, equipments and tools using recommended cleaning agents and sanitizers		8	3	5
	PC26. ensure minor repairs/faults (if any) of all components and machines are attended to before the start of next production		4	1	3
	PC27. ensure periodic (daily/weekly/monthly/quarterly/half yearly/annual) maintenance of all machines and equipment following the sop or following suppliers instructions/manuals		6	3	3
			<b>100</b>	<b>35</b>	<b>65</b>
<b>4. FIC/N0134: Complete documentation</b>	PC1. Document and maintain records of details of raw materials type and variety, grown area, grown season, quantity,	<b>100</b>	10	6	4

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
<b>and record keeping related to production of fruit and vegetable products</b>	vendor/supplier details, date of manufacture, expiry date, quality report from supplier and internal lab etc. as per organisation standards				
	PC2. Document and maintain record on observations (if any) related to raw materials and packaging materials		5	3	2
	PC3. Load the raw material details in ERP for future reference		5	3	2
	PC4. Verify the documents and track from finished products to raw materials, in case of quality concerns and during quality management system audits		5	3	2
	PC5. Document and maintain records of production plan with details such as product details, production sequence, equipments and machinery details, efficiency and capacity utilization of equipment		10	6	4
	PC6. Document and maintain records of process details for entire production in process chart or production log for all products produced		15	9	6
	PC7. Document and maintain records of batch size, production yield, wastage of raw materials, energy utilization and final product produced		10	6	4
	PC8. Document and maintain record of observations or deviations (if any) or deviations related to process and production		5	3	2
	PC9. Load the production plan and process details in ERP for future reference		5	3	2
	PC10. Verify documents and track from finished product to ingredients, in case of quality concerns and for quality management system audit		5	3	2
	PC11. Document and maintain records of finished products		3	2	1
	PC12. Document and maintain records of the finished product details as per organizational standards		7	4	3
	PC13. Document and maintain record on observations or deviations related to finished products		5	3	2
	PC14. Load the finished product details in ERP for future reference		5	3	2

<b>Total Marks: 600</b>	<b>Compulsory NOS</b>				
<b>Assessable outcomes</b>	<b>Assessment criteria for outcomes</b>	<b>Total Marks</b>	<b>Out Of</b>	<b>Theory</b>	<b>Skills Practical</b>
	PC15. Verify the documents and track from finished product to ingredients, in case of quality concerns and for quality management system audits		5	3	2
			<b>100</b>	<b>60</b>	<b>40</b>
<b>5. FIC/N9001: Food Safety, hygiene and sanitation for processing food products</b>	PC1. Comply with food safety and hygiene procedures followed in the organization	<b>100</b>	5	2	3
	PC2. Ensure personal hygiene by use of gloves, masks, hair net, ear plugs, boots etc.		6	1	5
	PC3. Ensure hygienic production of food by inspecting raw materials, ingredients, finished products etc for compliance to physical, chemical and microbiological procedures		5	2	3
	PC4. Pack products in appropriate packaging material, label and store them in designated area free from pests, flies etc.		10	4	6
	PC5. Clean, maintain and monitor food processing equipments periodically, using it only for the specified purpose		5	2	3
	PC6. Use safety equipment such as fire extinguisher, eye wash unit, first aid kit when required		10	4	6
	PC7. Follow housekeeping practices by having designated area for machines/tools		5	2	3
	PC8. Follow industry standards like GMP, HACCP and product recall		10	4	6
	PC9. Attend training on hazard management to understand type of physical, chemical and microbiological hazards		5	1	4
	PC10. Identify, document and report problems such as rodents and pests to management		5	1	4
	PC11. Conduct workplace checklist audit before and after work to ensure safety and hygiene		5	1	4
	PC12. Document and maintain raw material, process, packaging material to maintain the effectiveness of quality system		4	1	3
	PC13. Determine the quality of food using criteria such as odor, color, taste and best before date and take immediate measures to prevent spoilage		5	2	3
	PC14. Store raw materials, finished products and allergens separately to prevent cross contamination		5	2	3
	PC15. Label raw materials and finished products and store them in different storage areas according to safe food practices		5	2	3

<b>Total Marks: 600</b>	<b>Compulsory NOS</b>				
<b>Assessable outcomes</b>	<b>Assessment criteria for outcomes</b>	<b>Total Marks</b>	<b>Out Of</b>	<b>Theory</b>	<b>Skills Practical</b>
	PC16. Follow stock rotation based on FEFO/FIFO		10	4	6
			<b>100</b>	<b>35</b>	<b>65</b>
<b>6. FIC/N9004 (Manage and lead a team)</b>	PC1. ensure that the team is aware of the schedule and job expectations on a daily basis		12	4	8
	PC2. involve the team in regular meetings to communicate information intended for them		12	4	8
	PC3. ensure communication to the team on any changes in policies/ processes by the organization through required verbal/ written mechanisms		12	4	8
	PC4. ensure participation of the team in various engagement initiatives organized by the organization		8	2	6
	PC5. counsel and address issues among the team for any work related issues		12	4	8
	PC6. support the manager in deployment of the team as per production schedule and the organizational norms and guidelines		6	2	4
	PC7. ensure periodic training of the team and support the team by delivering trainings		6	3	3
	PC8. share knowledge of processes, techniques and products with the team to enhance their skill levels		6	3	4
	PC9. provide feedback to the manager pertaining to performance of the team		6	3	3
		PC10. motivate workers, initiate and develop cooperation within and between departments, develop personal growth opportunities		4	1
	PC11. maintain effective supervisor-worker relations, create safe work environment, establish effective communication methods, identify and solve employee problems, manage conflict, respond to grievances		4	2	2
	PC12. manage employees and team performance, provide new employee orientation, educate team on procedures to maintain compliance, train or provide adequate training and motivate employees		4	1	3
	PC13. coach, counsel and discipline employees, initiate, coordinate and enforce systems, policies and procedures through team		4	2	2
	PC14. evaluate, investigate complaints or performance concerns, implement		4	2	2

<b>Total Marks: 600</b>	<b>Compulsory NOS</b>				
<b>Assessable outcomes</b>	<b>Assessment criteria for outcomes</b>	<b>Total Mark s</b>	<b>Out Of</b>	<b>Theory</b>	<b>Skills Practical</b>
	disciplinary action as needed in consultation with proper authorities				
			<b>100</b>	<b>35</b>	<b>65</b>

# Model Curriculum

## Food Regulatory Affairs Manager

**SECTOR: FOOD PROCESSING**

**SUB-SECTOR: FRUIT & VEGETABLE, FOOD GRAIN MILLING (INCLUDING OILSEEDS), DAIRY PRODUCTS, MEAT & POULTRY, FISH & SEAFOOD, BREAD & BAKERY, ALCOHOLIC BEVERAGES, AERATED WATER/ SOFT DRINKS, SOYA FOOD, PACKAGED FOOD**

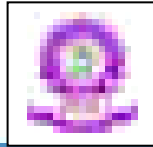
**OCCUPATION: QUALITY ASSURANCE**

**REF ID: FIC/Q9002, V1.0**

**NSQF LEVEL: 6**







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# Food Regulatory Affairs Manager

## CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Food Regulatory Affairs Manager”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

<b>Program Name</b>	<b>Food Regulatory Affairs Manager</b>		
<b>Qualification Pack Name &amp; Reference ID. ID</b>	FIC/Q9002, v1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	23/02/2016
<b>Pre-requisites to Training</b>	Master’s degree in food science with 8-10 years’ experience in food processing unit or food regulatory matters		
<b>Training Outcomes</b>	<p><b>After completing this programme, participants will be able to:</b></p> <ul style="list-style-type: none"> <li>Designing, developing, implementing and changing food regulatory systems in the organisation.</li> <li>Act as a liaison between organisation and government regulatory agencies</li> <li>Ensure that the products produced and distributed comply with regulatory standards.</li> </ul>		



This course encompasses 3 out of 3 National Occupational Standards (NOS) of “Food Regulatory Affairs Manager” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p><b>Introduction to the training program</b></p> <p><b>Theory Duration</b> (hh:mm) 01:30</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b> Bridge Module</p>	<p>Introduce each other and build rapport with fellow participants and the trainer.</p>	<p>White board/Chart papers, marker</p>
2	<p><b>Overview of the “Food Regulatory Affairs Manager” Role</b></p> <p><b>Theory Duration</b> (hh:mm) 01:00</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b></p>	<p>Understanding the roles and responsibilities of food regulatory affairs manager</p> <p>Awareness of the nature and availability of job opportunities</p>	<p>Laptop/computer white board, marker, projector, chart papers</p>
3	<p><b>Introduction to the Food Processing Industry</b></p> <p><b>Theory Duration</b> (hh:mm) 01:00</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b></p>	<p>Define food processing</p> <p>List the various sub-sectors of food processing industry</p>	<p>Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual</p>
4	<p><b>Introduction to the food regulations and affairs</b></p> <p><b>Theory Duration</b> (hh:mm) 05:00</p> <p><b>Practical Duration</b></p>	<p>List the terminology used in the food regulation process</p> <p>State various methods to ensure food regulation</p> <p>State the processes to oversee for ensuring that the food regulations are in compliance</p>	<p>Laptop, white/black board, marker, chart papers, projector, trainer’s guide, student handbook</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	(hh:mm) 30:00 <b>Corresponding NOS Code</b>	Understand what are regulatory policies of an organization and follow them	
5	<b>Design, develop and implement regulatory system</b>  <b>Theory Duration</b> (hh:mm) 13:00  <b>Practical Duration</b> (hh:mm) 21:00  <b>Corresponding NOS Code</b> FIC/N9011	Understand food safety regulations and develop regulatory policies for the organisation with clear definitions to increase consistency, legal security and to provide high level of food safety Design regulatory system with focus on risk reduction, risk-based priorities, reflect integrated and economically feasible initiatives, and ensure high quality and transparency Design and develop regulatory system with intuitive approach to food safety such that problem are recognized, understood, dealt, and checked to ensure problem has been dealt efficiently and effectively Design regulatory system with contingency planning like product traceability and product recall in case of problems, procedures for handling containment, with clear attribution of roles like lines of authority and co-ordination mechanism across food chain (from procuring raw materials, production until product reaching consumers) Design regulatory system with improved communication on food safety information in marketing materials, product labels etc, providing science based information to clear up the unjustified fear among consumers Set food safety system involving food producers, processors, distributors, retailers and consumers to recognize their primary responsibility and to share a common goal of ensuring food safety at all stages Design food regulatory system involving GMP, GHP, and monitoring systems like HACCP Design regulatory system that improve efficiency and compliance, build consumer confidence in the safety and quality of food products	Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>produced, processed, marketed, distributed and sold</p> <p>Design and develop regulatory system ensuring food and health standards are followed in each stage of production and produce food products that meet national and international regulatory standards and protect the health of consumers</p> <p>Design regulatory system including provisions for the right of consumers to have access to accurate and sufficient information and make adequate choices</p> <p>Provide strategic advice and cost effective strategies on regulatory aspects/requirements to senior management and project managing teams throughout the development of a new product</p> <p>Interpret regulatory standards and develop organisation standards meeting national and international food safety regulations like FSSAI, FDA, EU food safety regulations, codex alimentarius etc for products produced, exported and imported, and labels of products packed by the organisation</p> <p>Develop and review standard operating procedures (SOPs) and ensure that they are in compliance with current regulatory requirements and provide regulatory support for corporate quality assurance efforts</p> <p>Develop organisation standards for labels of food products produced and packed, promotional marketing materials, products imported and exported by the organisation to meet national and international food regulatory</p> <p>Evaluate labels of packed food products to ensure it meets national and international food regulatory standards and provide approval or recommend changes</p> <p>Evaluate promotional and materials for regulatory impact and provide approval</p> <p>Provide support for review of essential documents, development and review of consent forms for submission to regulatory authorities for clearance</p>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>Initiate and contribute to process improvements which have an impact on regulatory affairs, quality assurance and other departments</p> <p>Conduct audits on food processing unit for compliance with regulatory, safety and hygiene standards implemented and followed in the organisation</p> <p>Conduct periodic audits to evaluate haccp plans and their implementation in the organisation and ensure it meets the regulatory standards</p> <p>Review internal and external audit reports to check the effectiveness of the present regulatory system and recommend necessary changes in the policies and procedures to reduce failures in the future</p> <p>Identify reason for consumer cases in court related to non-compliance of food products to regulatory standards, collect relevant information's and documents transmitting evidence to produce in court to assist prosecution</p> <p>Monitor company progress toward fulfillment of regulatory commitments</p> <p>Provide training to department managers on organisation policies on food and safety regulations, national and international food laws and regulations, methods and procedures for implementing regulations for procuring raw materials, producing food products, marketing and selling quality products to the consumers</p> <p>Provide training to all department managers on the importance of food regulatory standards and need for its compliance, statutory and regulatory requirements for the products produced, labels of packed products and promotional materials, and the consequences for not following the regulatory requirements</p> <p>Provide training on procedures for collecting evidence in case of problems/consumer complaints/consumer cases in court</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>and handling them with technical and scientific approach</p> <p>Provide training to all department managers on methods to implement and monitor regulatory system in their area of function, writing reports with relevant information and data to present to local food regulatory authorities for any concerns raised / clarification required, methods to approach and maintain relationship with food regulatory authorities</p> <p>Provide training on upgradation and changes in the food regulatory system and methods to implement, monitor and achieve them</p>	
6	<p><b>Manage change in food regulatory system</b></p> <p><b>Theory Duration</b> (hh:mm) 14:00</p> <p><b>Practical Duration</b> (hh:mm) 20:00</p> <p><b>Corresponding NOS Code</b> FIC/N9012</p>	<ul style="list-style-type: none"> <li>• Identify procedures, systems, structures that need to be changed for effective implementation of food regulatory system</li> <li>• Assess gaps in the current policies and procedures and analyze the future requirements</li> <li>• Identify and assess barriers to change in regulatory system, develop strategies and plans to overcome those barriers</li> <li>• Assess risks and benefits associated with the strategies and plans, and develop contingency arrangements design new work processes, procedures, systems, structures and roles to achieve planned changes in regulatory system</li> <li>• Ensure plan for change in regulatory system include short-term as well as longer-term deliverables</li> <li>• Develop system for monitoring and assessing regulatory system to assess progress in changes implemented</li> <li>• Develop reporting and communicating system to review the effectiveness of the changes in regulatory system and to obtain feedback</li> <li>• Provide training and support to implement changes planned in regulatory system</li> <li>• Communicate reasons, importance and benefits of implementing change in regulatory system, future that can be achieved through</li> </ul>	Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy, regulatory policies



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>implementing and following the change, to management and concerned employees</p> <ul style="list-style-type: none"> <li>• Make the management and employees welcome change in regulatory system as an opportunity to deliver products of national and international quality</li> <li>• Make the management and employees understand the need and importance for change in regulatory system, result expected out of change and its effect on the organisation</li> <li>• Implement the strategies and plans for change in regulatory system with available resources</li> <li>• Make the managers responsible for implementing change in regulatory system understand their responsibilities and commitment, and use their influence and power over employees to implement change</li> <li>• Set and prioritize objectives for the change in regulatory system, identify and deal with obstacles to change, and support employees through the change process</li> <li>• Communicate progress achieved through change in regulatory system to everyone involved, and make them understand and enjoy achievement</li> <li>• Review reports on total quality management system to evaluate effectiveness of changes implemented in regulatory system of the organisation</li> <li>• Organize internal and external audit on total quality management system to evaluate effectiveness of the changes implemented in regulatory system</li> <li>• Monitor changes implemented in regulatory system , document and communicate the outcome of implemented change to the management</li> <li>• Recognize and reward employees and teams for implementing regulatory system and achieving results through new policies and procedures</li> </ul>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"> <li>Monitor and ensure changes implemented in regulatory system are effective and meet the requirements of the organisation and regulatory system laid by national and international regulatory bodies</li> </ul>	
7	<p><b>Prepare representations to regulatory authorities and for new product registrations</b></p> <p><b>Theory Duration</b> (hh:mm) 09:00</p> <p><b>Practical Duration</b> (hh:mm) 14:00</p> <p><b>Corresponding NOS Code</b> FIC/N9013</p>	<p>Prepare simple and complex regulatory documents in accordance with applicable FSSAI regulations by collecting, collating and evaluating scientific data that has been well researched on relevant aspects</p> <p>Review regulatory guidance and requirements pertaining to products produced in the organisation and prepare documents providing thoughtful and accurate comments</p> <p>Prepare regulatory documents to authorities that translate regulatory requirements into practical, workable plans with timelines for development and implementation</p> <p>Coordinate with food regulatory authorities to review disputed matters, negotiation and finalization on products and projects, and for comments and formal approvals</p> <p>Prepare documents that include check lists created and maintained to implement regulatory requirements, technical data, and declarations of conformity</p> <p>Interface with consultants, research organizations, partners, co-manufacturers etc. for preparation, review, compilation, finalization and submission of documents for regulatory approvals</p> <p>Prepare responses to communications and other requests from government food regulatory authorities</p> <p>Prepare safety reports and documents on raw materials, ingredients, additives, flavours etc used in the products produced and marketed by the organisation, for regulatory submissions and clearance</p> <p>Identify reasons related to non-compliance of food products to regulatory standards, collect relevant information's and data,</p>	<p>Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy, audit documents, regulatory policies</p>



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>prepare technical documents with scientific facts and supporting evidence, and submit to relevant authorities, respond to communications from government authorities, and follow up regularly to revoke product ban</p> <p>Interact with various regulatory authorities during concept, development and industrialization stages of projects for clarification and approvals</p> <p>Interact with the notified bodies and competent authorities for developing and reviewing regulatory standards</p> <p>Coordinate with regulatory authorities for reporting, to comment on proposed regulations, and to represent company's interest in the development of standards and guidelines</p> <p>Discuss on the differences that exist in the regulations laid down by different governments and their interpretation by the regulatory agencies and ensure that efficient and economical regulatory standards are planned</p> <p>Identify possible threats or opportunities from upcoming regulations under FSSAI, consumer affairs, other government food policies and regulations and liaise with industry associations to tackle/manage them effectively</p> <p>Participate in seminar, workshops, conferences and meetings organised by FSSAI and other industry association, representing the organisation to maintain, strengthen and expand contacts</p> <p>Work closely with regulatory and trade associations like CII (confederation of indian industries), FICCI (federation of indian chambers of commerce and industries), CIFTI (confederation of indian food trade and industry), AIFPA (all india food processors association), ASSOCHAM(the associated chambers of commerce of india) etc on national and international regulatory changes and challenges that have impact on food products produced in the</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>organisation and to manage them proactively</p> <p>Develop and write clear arguments and explanations for new product license</p> <p>Prepare and present registration documents to regulatory authorities and notified bodies for new product approvals</p> <p>Present written representation for new products and carry out negotiations with regulatory authorities to obtain necessary approvals for new product production and marketing</p> <p>Evaluate, prepare and submit new product registration applications and follow through the application during the evaluation phase to achieve favorable outcome</p> <p>Prepare responses to letter/e-mail communications and other requests from government food regulatory bodies on new product approval</p> <p>Provide regulatory and product compliance report in the area of advertising and label claims for new products</p>	
8	<p><b>Field Visits</b></p> <p><b>Theory Duration</b> (hh:mm) 04:00</p> <p><b>Practical Duration</b> (hh:mm) 20:00</p> <p><b>Corresponding NOS Code</b></p>	<p>Observe the location, layout and safety aspects of food processing</p> <p>Observe the storage facilities for raw materials and finished products</p> <p>Observe the various machineries used in process</p> <p>Observe the various machineries used in process</p> <p>Observe the cleaning methods and processes followed to maintain the process machineries and tools</p> <p>Observe the raw materials used and their storage procedures</p> <p>Observe the packaging and storage processes of raw material and finished product</p> <p>Observe the post-production cleaning and maintenance process followed in the industry</p>	All the tools and equipment listed above must be available at the site of field visit
9	<p><b>Revision</b></p> <p><b>Theory Duration</b> (hh:mm) 01:00</p>	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Practical Duration</b> (hh:mm) 01:00  <b>Corresponding NOS Code</b>		
10	<b>Evaluation</b>  <b>Theory Duration</b> (hh:mm) 06:00  <b>Practical Duration</b> (hh:mm) 28:00  <b>Corresponding NOS Code</b>	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation
11	<b>On-the-job Training</b>  <b>Theory Duration</b> (hh:mm) 08:00  <b>Practical Duration</b> (hh:mm) 24:00  <b>Corresponding NOS Code</b>	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	<b>Total Duration</b> <b>240:00</b>  <b>Theory Duration</b> <b>79:00</b>  <b>Practical Duration</b> <b>161:00</b>	<b>Unique Equipment Required:</b> Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy, audit documents, regulatory policies	

Grand Total Course Duration: **240 Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by [SSC: Food Industry Capacity and Skill Initiative](#))*

## Trainer Prerequisites for Job role: “Food Regulatory Affairs Manager” mapped to Qualification Pack: “FIC/Q9002, v1.0”

Sr. No.	Area	Details
1	<b>Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q9002”, Version 1.0
2	<b>Personal Attributes</b>	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	<b>Minimum Educational Qualifications</b>	B.Sc/B.Tech/BE in Food Process Engineering/ Food Safety and Quality Management in Food Process Engineering with 5-6 years of hand on experience in QA/regulations of a food Processing Industry or M.Sc/M.Tech/ME or in Food Process Engineering/ Food Safety and Quality Management in Food Safety/Food Process Engineering with 3-4- years of hand on experience in QA/regulations of a food Processing Industry
4a	<b>Domain Certification</b>	Certified for Job Role: “ <u>Food regulatory affairs Manager</u> ” mapped to QP: “FIC/Q9002, v1.0”. Minimum accepted score is 80%
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “SSC/Q1402”. Minimum accepted SCORE IS 80 % as per FICSI guidelines.
5	<b>Experience</b>	B.Sc/B.Tech/BE in Food Process Engineering/ Food Safety and Quality Management in Food Process Engineering with 5-6 years of hand on experience in QA/regulations of a food Processing Industry or M.Sc/M.Tech/ME or in Food Process Engineering/ Food Safety and Quality Management in Food Safety/Food Process Engineering with 3-4- years of hand on experience in QA/regulations of a food Processing Industry



## Annexure: Assessment Criteria

<b>Assessment Criteria</b>	
<b>Job Role</b>	<b>Food regulatory affairs manager</b>
<b>Qualification Pack</b>	<b>FIC/Q9002 v1.0</b>
<b>Sector Skill Council</b>	<b>Food Processing</b>

<b>Sr. No.</b>	<b>Guidelines for Assessment</b>
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
<b>1. FIC/N9011: Design, develop and implement regulatory system</b>	PC.1 understand food safety regulations and develop regulatory policies for the organisation with clear definitions to increase consistency, legal security and to provide high level of food safety	<b>100</b>	4	1.5	2.5
	PC2. design regulatory system with focus on risk reduction, risk-based priorities, reflect integrated and economically feasible initiatives, and ensure high quality and transparency		4	1.5	2.5
	PC3. design and develop regulatory system with intuitive approach to food safety such that problem are recognized, understood, dealt, and checked to ensure problem has been dealt efficiently and effectively		4	1.5	2.5
	PC4. design regulatory system with contingency planning like product traceability and product recall in case of problems, procedures for handling containment, with clear attribution of roles like lines of authority and co-ordination mechanism across food chain (from procuring raw materials, production until product reaching consumers		4	1.5	2.5
	PC5. design regulatory system with improved communication on food safety information in marketing materials, product labels etc, providing science based information to clear up the unjustified fear among consumers		4	1.5	2.5
	PC6. set food safety system involving food producers, processors, distributors, retailers and consumers to recognize their primary responsibility and to share a common goal of ensuring food safety at all stages		4	1.5	2.5
	PC7. design food regulatory system involving gmp, ghp, and monitoring systems like haccp		4	1.5	2.5
	PC8. design regulatory system that improve efficiency and compliance, build consumer confidence in the safety and quality of food products produced, processed, marketed, distributed and sold		4	1.5	2.5
	PC9. design and develop regulatory system ensuring food and health standards are followed in each stage of production and		4	1.5	2.5



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	produce food products that meet national and international regulatory standards and protect the health of consumers				
	PC10. design regulatory system including provisions for the right of consumers to have access to accurate and sufficient information and make adequate choices		4	1.5	2.5
	PC11. provide strategic advice and cost effective strategies on regulatory aspects/requirements to senior management and project managing teams throughout the development of a new product		4	1.5	2.5
	PC12. interpret regulatory standards and develop organisation standards meeting national and international food safety regulations like fssai, fda, eu food safety regulations, codex alimentarius etc for products produced, exported and imported, and labels of products packed by the organisation		4	1.5	2.5
	PC13. develop and review standard operating procedures (sops) and ensure sops are in compliance with current regulatory requirements and provide regulatory support for corporate quality assurance efforts		4	1.5	2.5
	PC14. develop organisation standards for labels of food products produced and packed, promotional marketing materials, products imported and exported by the organisation to meet national and international food regulatory		4	1.5	2.5
	PC15. evaluate labels of packed food products to ensure it meets national and international food regulatory standards and provide approval or recommend changes		4	1	3
	PC16. evaluate promotional and materials for regulatory impact and provide approval		4	1	3
	PC17. provide support for review of essential documents, development and review of consent forms for submission to regulatory authorities for clearance		3	1	2
	PC18. initiate and contribute to process improvements which have an impact on		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	regulatory affairs, quality assurance and other departments				
	PC19. conduct audits on food processing unit for compliance with regulatory, safety and hygiene standards implemented and followed in the organisation		3	1	2
	PC20. conduct periodic audits to evaluate haccp plans and their implementation in the organisation and ensure it meets the regulatory standards		3	1	2
	PC21. review internal and external audit reports to check the effectiveness of the present regulatory system and recommend necessary changes in the policies and procedures to reduce failures in the future		3	1	2
	PC22. identify reason for consumer cases in court related to non-compliance of food products to regulatory standards, collect relevant information's and documents transmitting evidence to produce in court to assist prosecution		3	1	2
	PC23. monitor company progress toward fulfillment of regulatory commitments		3	1	2
	PC24. provide training to department managers on organisation policies on food and safety regulations, national and international food laws and regulations, methods and procedures for implementing regulations for procuring raw materials, producing food products, marketing and selling quality products to the consumers		3	1	2
	PC25. provide training to all department managers on the importance of food regulatory standards and need for its compliance, statutory and regulatory requirements for the products produced, labels of packed products and promotional materials, and the consequences for not following the regulatory requirements		3	1	2
	PC26. provide training on procedures for collecting evidence in case of problems/consumer complaints/consumer cases in court and handling them with technical and scientific approach		3	1	2



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC27. provide training to all department managers on methods to implement and monitor regulatory system in their area of function, writing reports with relevant information and data to present to local food regulatory authorities for any concerns raised / clarification required, methods to approach and maintain relationship with food regulatory authorities		3	1	2
	PC28. provide training on upgradation and changes in the food regulatory system and methods to implement, monitor and achieve them		3	1	2
			<b>100</b>	<b>35</b>	<b>65</b>
<b>2. FIC/N9012: Manage change in food regulatory system</b>	PC1. identify procedures, systems, structures that need to be changed for effective implementation of food regulatory system	<b>100</b>	5	1	4
	PC2. assess gaps in the current policies and procedures and analyze the future requirements		5	1	4
	PC3. identify and assess barriers to change in regulatory system, develop strategies and plans to overcome those barriers		5	1	4
	PC4. assess risks and benefits associated with the strategies and plans, and develop contingency arrangements		5	1	4
	PC5. design new work processes, procedures, systems, structures and roles to achieve planned changes in regulatory system		5	1	4
	PC6. ensure plan for change in regulatory system include shortterm as well as longer-term deliverables.		4	1.5	2.5
	PC7. develop system for monitoring and assessing regulatory system to assess progress in changes implemented		5	2	3
	PC8. develop reporting and communicating system to review the effectiveness of the changes in regulatory system and to obtain feedback		5	2	3
	PC9. provide training and support to implement changes planned in regulatory system		4	2	2
	PC10. communicate reasons, importance and benefits of implementing change in regulatory system, future that can be achieved through implementing and		5	2	3



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	following the change, to management and concerned employees				
	PC11. make the management and employees welcome change in regulatory system as an opportunity to deliver products of national and international quality		4	1.5	2.5
	PC12. make the management and employees understand the need and importance for change in regulatory system, result expected out of change and its effect on the organisation		5	2	3
	PC13. implement the strategies and plans for change in regulatory system with available resources		5	2	3
	PC14. make the managers responsible for implementing change in regulatory system understand their responsibilities and commitment, and use their influence and power over employees to implement change		5	2	3
	PC15. set and prioritize objectives for the change in regulatory system, identify and deal with obstacles to change, and support employees through the change process		5	2	3
	PC16. communicate progress achieved through change in regulatory system to everyone involved, and make them understand and enjoy achievement		4	1.5	2.5
	PC17. review reports on total quality management system to evaluate effectiveness of changes implemented in regulatory system of the organisation		5	2	3
	PC18. organize internal and external audit on total quality management system to evaluate effectiveness of the changes implemented in regulatory system		5	2	3
	PC19. monitor changes implemented in regulatory system , document and communicate the outcome of implemented change to the management		5	2	3
	PC20. recognize and reward employees and teams for implementing regulatory system and achieving results thorough new policies and procedures		4	1.5	2.5
	PC21. monitor and ensure changes implemented in regulatory system are		5	2	3



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	effective and meet the requirements of the organisation and regulatory system laid by national and international regulatory bodies		100	35	65
<b>3. FIC/N9013: Prepare representations to regulatory authorities and for new product registrations</b>	PC1. prepare simple and complex regulatory documents in accordance with applicable FSSAI regulations by collecting, collating and evaluating scientific data that has been well researched on relevant aspects	100	5	1	4
	PC2. review regulatory guidance and requirements pertaining to products produced in the organisation and prepare documents providing thoughtful and accurate comments		5	1	4
	PC3. prepare regulatory documents to authorities that translate regulatory requirements into practical, workable plans with timelines for development and implementation		5	1	4
	PC4. coordinate with food regulatory authorities to review disputed matters, negotiation and finalization on products and projects, and for comments and formal approvals		5	1	4
	PC5. prepare documents that include check lists created and maintained to implement regulatory requirements, technical data, and declarations of conformity		4	1.5	2.5
	PC6. interface with consultants, research organizations, partners, co-manufacturers etc for preparation, review, compilation, finalization and submission of documents for regulatory approvals		4	1.5	2.5
	PC7. prepare responses to communications and other requests from government food regulatory authorities		4	1.5	2.5
	PC8. prepare safety reports and documents on raw materials, ingredients, additives, flavours etc used in the products produced and marketed by the organisation, for regulatory submissions and clearance		4	1.5	2.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC9. Identify reasons related to noncompliance of food products to regulatory standards, collect relevant information's and data, prepare technical documents with scientific facts and supporting evidence, and submit to relevant authorities, respond to communications from government authorities, and follow up regularly to revoke product ban		4	1.5	2.5
	PC10. prepare simple and complex regulatory documents in accordance with applicable fssai regulations by collecting, collating and evaluating scientific data that has been well researched on relevant aspects		5	2	3
	PC11. review regulatory guidance and requirements pertaining to products produced in the organisation and prepare documents providing thoughtful and accurate comments		5	2	3
	PC12. prepare regulatory documents to authorities that translate regulatory requirements into practical, workable plans with timelines for development and implementation		5	2	3
	PC13. coordinate with food regulatory authorities to review disputed matters, negotiation and finalization on products and projects, and for comments and formal approvals		5	2	3
	PC14. prepare documents that include check lists created and maintained to implement regulatory requirements, technical data, and declarations of conformity		4	1.5	2.5
	PC15. interface with consultants, research organizations, partners, co-manufacturers etc for preparation, review, compilation, finalization and submission of documents for regulatory approvals		4	1.5	2.5
	PC16. prepare responses to communications and other requests from government food regulatory authorities		5	2	3
	PC17. develop and write clear arguments and explanations for new product license		5	2	3



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC18. prepare and present registration documents to regulatory authorities and notified bodies for new product approvals		5	2	3
	PC19. present written representation for new products and carry out negotiations with regulatory authorities to obtain necessary approvals for new product production and marketing		5	2	3
	PC20. evaluate, prepare and submit new product registration applications and follow through the application during the evaluation phase to achieve favorable outcome		4	1.5	2.5
	PC21. prepare responses to letter/e-mail communications and other requests from government food regulatory bodies on new product approval		4	1.5	2.5
	PC22. Provide regulatory and product compliance report in the area of advertising and label claims for new products		4	1.5	2.5
	<b>Total</b>		<b>100</b>	<b>35</b>	<b>65</b>
	<b>Grand Total</b>	<b>300</b>	<b>300</b>	<b>200</b>	<b>100</b>
	<b>Percentage Weightage</b>		<b>100</b>	<b>60%</b>	<b>40%</b>
	<b>Minimum Pass% to qualify (aggregate):</b>			<b>70%</b>	





# Model Curriculum

## Production Manager

**SECTOR: FOOD PROCESSING**

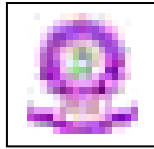
**SUB-SECTOR: FRUIT & VEGETABLE, FOOD GRAIN  
OCCUPATION: MILLING (INCLUDING OILSEEDS), DAIRY  
PRODUCTS, MEAT & POULTRY, FISH & SEAFOOD,  
BREAD & BAKERY, ALCOHOLIC BEVERAGES,  
AERATED WATER/ SOFT DRINKS, SOYA FOOD,**

**PACKAGED FOOD  
PROCESSING**

**REF ID: FIC/Q9003, V1.0**

**NSQF LEVEL: 7**





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# Production Manager

## CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “Production Manager”, in the “Food Processing” Sector/Industry and aims at building the following key competencies amongst the learner

<b>Program Name</b>	<b>Production Manager</b>		
<b>Qualification Pack Name &amp; Reference ID. ID</b>	FIC/Q9003, v1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	30/03/2016
<b>Pre-requisites to Training</b>	Preferably Class 12 and 2-3 years' experience in a food processing unit		
<b>Training Outcomes</b>	<b>After completing this programme, participants will be able to:</b> Production of food products through the process of production planning, coordinating and controlling production process to achieve quantity and quality product Reviewing production process to minimize production cost and optimizing production.		



This course encompasses 3 out of 3 National Occupational Standards (NOS) of “Production Manager” Qualification Pack issued by “Food Industry Capacity and Skill Initiative”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p><b>Introduction to the training program</b></p> <p><b>Theory Duration</b> (hh:mm) 00:30</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b> Bridge Module</p>	<p>Introduce each other and build rapport with fellow participants and the trainer.</p>	<p>White board/Chart papers, marker</p>
2	<p><b>Overview of the “Production Manager” Role</b></p> <p><b>Theory Duration</b> (hh:mm) 01:00</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b></p>	<p>Understanding the roles and responsibilities of production manager</p> <p>Awareness of the nature and availability of job opportunities</p>	<p>Laptop/computer white board, marker, projector, chart papers</p>
3	<p><b>Introduction to the Food Processing Industry</b></p> <p><b>Theory Duration</b> (hh:mm) 01:30</p> <p><b>Practical Duration</b> (hh:mm) 00:00</p> <p><b>Corresponding NOS Code</b></p>	<p>Define food processing</p> <p>List the various sub sectors of food processing industry</p>	<p>Laptop, white/black board, marker, chart papers, projector, Trainer’s guide, Student manual</p>
4	<p><b>Introduction to food processing process</b></p> <p><b>Theory Duration</b> (hh:mm) 02:00</p> <p><b>Practical Duration</b> (hh:mm)</p>	<p>List the common machineries used in food processing</p> <p>Explain the process of testing food for accepted quality standards</p> <p>Demonstrate the test for checking the quality of food</p> <p>Describe the procedure for processing various food</p>	<p>Laptop, white board, marker, chart papers, projector, trainer’s guide and student handbook</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	04:00 <b>Corresponding NOS Code</b>	Identify different equipment used in food industry	
5	<b>Organizational standards and norms</b>  <b>Theory Duration</b> (hh:mm) 04:00  <b>Practical Duration</b> (hh:mm) 02:00  <b>Corresponding NOS Code</b>	State the roles and responsibilities of a production manager State how to conduct yourself at the workplace State the personal hygiene and sanitation guidelines State the food safety hygiene standards to follow in a work environment	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, protective gloves, head caps, aprons, safety goggles, safety boots, mouth masks, sanitizer, safety manual
6	<b>Manage production process in food processing unit</b>  <b>Theory Duration</b> (hh:mm) 15:00  <b>Practical Duration</b> (hh:mm) 11:40  <b>Corresponding NOS Code</b> FIC/N9014	<ul style="list-style-type: none"> <li>• Communicate the organisation policies and goals clearly to the employees of production team, make them understand and commit their energy and expertise to achieve organisation goals</li> <li>• Achieve department targets and organisation goals by understanding the organisation and employees, developing a leadership style and applying them appropriately</li> <li>• Communicate with employees regularly and effectively, help them identify their strengths, provide support to overcome their weakness, listen to their grievances and provide appropriate solutions, and win their trust and support</li> <li>• Motivate and support employees to achieve their work and development objectives, and provide recognition when they are successful</li> <li>• Encourage employees to take responsibilities, to take own decisions within agreed boundaries, to take lead in their own areas of expertise for their development</li> <li>• Initiate personnel actions, such as promotions, transfers, discharges or disciplinary measures</li> <li>• Lead production department and team successfully through difficulties and challenges</li> <li>• Review the sales forecast for the week/month (or) monthly production</li> </ul>	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>plan discussed with plant manager (or) customer requirement (as applicable) and identify production priorities to meet market requirement</p> <ul style="list-style-type: none"> <li>• Identify and confirm resource availability such as raw materials, packing materials, equipment availability and capacity, production capacity, manpower requirement and availability, stock level, storage capacity, transport capacity etc</li> <li>• Plan details of production in terms of output quantity and quality, cost, time and manpower requirements</li> <li>• Analyze the consequences of failing to meet production/delivery timelines to meet the schedule, notify relevant authorities of any possibility that demand cannot be met within required timeframe</li> <li>• Develop production schedule to meet market demands/priorities and delivery timelines within budget and with available resources, consult production plan with inter department heads and production supervisor, instruct supervisor to allocate work to production team</li> <li>• Communicate the production schedule to cross function heads through communication system followed by the organisation such as e-mail or upload in the ERP system</li> <li>• Identify and confirm equipment requirements to meet production target, share production schedule with equipment requirement to maintenance manager/supervisor for maintenance plan that aligns with production plan</li> <li>• Co-ordinate with maintenance manager/supervisor to understand materials, consumables and manpower requirement and availability for maintenance activities, for uninterrupted production</li> <li>• Understand equipment maintenance process and procedure and co-ordinate for maintenance activities during breakdown, emergency response, routine cleaning and servicing, etc.</li> <li>• Analyze equipment maintenance data to interpret equipment</li> </ul>	



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>performance and arrive at production capability of each process equipment</p> <ul style="list-style-type: none"> <li>• Co-ordinate with maintenance team to ensure reliable equipment performance with minimal disruption to production, to minimize down time during equipment breakdowns, and to optimize equipment efficiency to achieve production target</li> <li>• Lead and build team spirit between production and maintenance personnel through effective communication to enhance equipment performance and to identify production improvement opportunities</li> <li>• Ensure maintenance procedures are followed meet food safety and environmental requirements</li> <li>• Monitor production process for usage of raw materials, packaging materials, manpower, wastage against production plan and identify reason for variances against plan</li> <li>• Address the reason for variation in achieving production schedule, production target within allocated budget</li> <li>• Adjust production schedule in response to variables affecting achievement of production target</li> <li>• Monitor production output and cost, adjust processes and resources to minimize cost and to achieve quantity and quality product</li> <li>• Reschedule production plan in case of urgent requirement or any unforeseen event, to minimize wastage and to utilize materials/utilities and resources efficiently, discuss and negotiate changes with inter department team on time for their support and team work</li> <li>• Review production schedule and process, consult /discuss with supervisor, team and cross function teams identify opportunities for improvement and develop recommendations for improvement on production process</li> <li>• Set polices, plans and procedures, and take initiative to implement the identified improvement opportunities</li> </ul>	





Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>to control cost and to achieve better yield and quality</p> <ul style="list-style-type: none"><li>• Monitor, review and ensure production details are documented to meet the documentation requirements of the organisation, and to meet audit requirements like ISO, HACCP, etc</li><li>• Understand objective of trial production, trial product processing method and specification, select production team for trial, discuss with cross function team like planning, QA, maintenance etc, clarify roles and responsibilities and level of authority to the team and cross function</li><li>• Prepare technical production procedures considering all engineering and process parameters for new product trial, educate and train supervisors and operators on trial procedure</li><li>• Identify and consider all possible hazards, prepare plan and procedures to prevent and control hazards, provide training to trial team to handle hazards</li><li>• Prepare detailed trial production schedule to manage production process without overlapping/affecting with regular production, and considering availability of raw materials and packaging materials, machine availability and capability, man power availability and competency etc</li><li>• Monitor trial production against plan to identify variances and factors that need to be adjusted to achieve product of required specification within the planned time</li><li>• Document and evaluate trial production data and identify process/parameters to be modified/changed to achieve product of required specification</li><li>• Prepare trial production report with recommendations on improvement opportunities, and share with cross function heads and relevant authorities for suggestion and consideration</li></ul>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
7	<p><b>Manage production optimization and cost efficiency</b></p> <p><b>Theory Duration</b> (hh:mm) 08:00</p> <p><b>Practical Duration</b> (hh:mm) 12:00</p> <p><b>Corresponding NOS Code</b> FIC/N9015</p>	<p>Review production reports and analyze equipment performance, process capability, change over time, maintenance, consumables, power etc, to identify factors that affect performance of production and recommend improvement opportunities</p> <p>Compile performance data on process and equipment to identify cause for lack of performance, evaluate opportunities to improve, identify cost saving options, propose changes in process, and implement proposal with proper approvals</p> <p>Review production process with supervisor and machine operators to identify reasons for slowdown or stop of production process, provide recommendations to overcome efficiency issues, take feedback, develop plans for implementing recommended changes, monitor changes implemented, and review changes and improvement</p> <p>Calculate utilities and energy usage in production area and for production process, identify methods to minimize usage</p> <p>Develop plans and procedures to minimize use of utilities and energy without affecting the production efficiency</p> <p>Identify energy and utility losses or sources of waste, analyze reason, recommend methods to improve efficient energy/utility application, ensure recommendations are implemented, and monitor improvement</p> <p>Identify areas where utilities and energy can be saved, and Identify methods to save energy like recycling energy and utilities such as steam, heat and water, following proper maintenance methods to avoid leaks and losses etc, and prepare efficient production schedule such that target is met with efficient utilization of energy and utility</p> <p>Analyze usage pattern of energy and other utilities in production area and process against budget allocation, identify cost effective options for</p>	<p>Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook ,</p>



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>minimizing wastage, and implement changes</p> <p>Identify system, production process that need to be changed, identify opportunities for implementing change in production process, analyze impact of change on product quality, impact on the team and present production process</p> <p>Communicate with relevant authorities/superiors the need for change, results and benefits expected out of change</p> <p>Design new processes, procedures, systems, structures with roles and responsibilities, key performance indicators, training needs, safety system, contingency plans, monitoring and reporting system to implement planned changes in production process</p> <p>Provide training and support to implement changes, develop a strategy to help teams implement change</p> <p>Monitor changes implemented in production process and ensure changes are effective and meet the organisation and regulatory requirements</p> <p>Document and communicate the progress achieved through implemented change to the management and everyone involved, and make them understand and enjoy achievement</p> <p>Recognize and reward employees and teams for implementing change in production system and achieving better efficiency</p> <p>Manage budget efficiently by managing production with available resource, by avoiding overtime and too many casual workers/helpers</p> <p>Plan effectively to secure, confirm and allocate required manpower to meet production target within budget, monitor resource utilization, to achieve production target within existing resource</p> <p>Identify situations where actual budget exceeds the approved budget, investigate reason for variance and take appropriate</p>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>corrective action to keep budget under control</p> <p>Identify the impact on budget of production-related decisions like scheduling holidays, adjusting production volume, scheduling equipment maintenance etc, before scheduling production, and identify opportunities to improve performance against budget</p> <p>Identify the causes for any significant variances in budget control, discuss with team and ensure prompt corrective action is taken to keep expenditure under control</p> <p>Encourage team to think and identify ways of reducing expenditure, analyse and pursue the suggested ideas</p>	
8	<p><b>Manage documentation system and implement safety and environmental policies</b></p> <p><b>Theory Duration</b> (hh:mm) 07:00</p> <p><b>Practical Duration</b> (hh:mm) 09:00</p> <p><b>Corresponding NOS Code</b> FIC/N9016</p>	<ul style="list-style-type: none"> <li>• Establish to production team the importance of documentation, provide training on documentation system, and ensure all documents are maintained systematically</li> <li>• Ensure all relevant records and documents are complete, up-to-date and accessible for audits on production process</li> <li>• During audit provide the auditor with access to all relevant information, records and documents</li> <li>• Ensure corrective actions recommended and implemented are documented to assure production process is carried in accordance with organisation and regulatory standards</li> <li>• Establish methods to track production information from documented and maintained records</li> <li>• Establish to production team importance of safety and environment requirements related to food processing unit, communicate information about safety and environmental policies and related procedures to the team</li> <li>• Co-ordinate with quality team to prepare policies and sops on safety and environment requirements related to production function, and ensure those procedure are followed in production area and during production process</li> </ul>	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, logbooks, internal audit register, food safety manual, quality policy etc.



Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<ul style="list-style-type: none"><li>• Ensure safe work procedures are followed in production area and during production process</li><li>• Ensure policies and standard operating procedures on safety and environment requirements are accessible to all employees of production team, and are followed to meet the regulatory requirements</li><li>• Identify safety and environmental hazards relevant to production processes, implement system to handle risks</li><li>• Provide or organize training through relevant authorities on safety and environmental management system, to understand methods to control and prevent hazards</li><li>• Conduct inspections in work place on use of protective clothing and accessories, and to ensure safety system is followed during production process</li><li>• Conduct audits and review records on safety and environmental system to monitor if control systems are followed by production team, and address non-compliance following organisation standards</li><li>• Implement system on waste management in production area and process, monitor and confirm waste collection, treatment, recycling or disposal is carried out meeting industry requirements and environmental regulations</li><li>• Respond to environmental management hazard identification and incidents in an appropriate and timely way</li><li>• Review practice and procedures followed on safety, conduct risk assessments, identify non-compliance, and provide recommendations to address gaps and non-conformances</li><li>• Review environmental records documents maintained, analyze data to evaluate effectiveness of the environmental management system and identify areas for improvement, plan and implement improvements to meet regulatory requirements</li></ul>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
9	<b>Professional and Core Skills</b>  <b>Theory Duration</b> (hh:mm) 03:00  <b>Practical Duration</b> (hh:mm) 05:00  <b>Corresponding NOS Code</b>	Undertake a self-assessment test Identify personal strengths and weaknesses Plan and schedule the work order and manage time effectively to complete the tasks assigned Prevent potential problems from occurring Resolve issues and problems using acquired knowledge and realize the importance of decision making Identify potential problems and make sound and timely decision Improve your reading skills State the importance of listening	Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual
10	<b>IT Skills</b>  <b>Theory Duration</b> (hh:mm) 05:00  <b>Practical Duration</b> (hh:mm) 07:00  <b>Corresponding NOS Code</b>	Identify parts of the computer Use the computer keyboard effectively to type Use computer applications effectively to record day-to-day activities Use the word processor effectively Use the spreadsheet application effectively Use the computer to document day-to-day activities	Laptop, white/black board, marker, chart papers, projector, Trainer's guide, Student manual
11	<b>Field Visits</b>  <b>Theory Duration</b> (hh:mm) 04:00  <b>Practical Duration</b> (hh:mm) 30:00  <b>Corresponding NOS Code</b>	Observe the factory location, layout and safety aspects of food processing Observe the storage facilities for raw materials and finished products Observe the various machineries used in process Observe the various machineries used in process Observe the cleaning methods and processes followed to maintain the process machineries and tools Observe the raw materials used and their storage procedures Observe the packaging and storage processes of raw material and finished product Observe the post-production cleaning and maintenance process followed in the industry	All the tools and equipment listed above must be available at the site of field visit
12	<b>Revision</b>  <b>Theory Duration</b> (hh:mm) 02:00	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<b>Practical Duration</b> (hh:mm) 02:00  <b>Corresponding NOS Code</b>		
13	<b>Evaluation</b>  <b>Theory Duration</b> (hh:mm) 08:00  <b>Practical Duration</b> (hh:mm) 20:00  <b>Corresponding NOS Code</b>	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation
14	<b>On-the-job Training</b>  <b>Theory Duration</b> (hh:mm) 30:00  <b>Practical Duration</b> (hh:mm) 65:00  <b>Corresponding NOS Code</b>	Apply the skills and knowledge acquired in the training program in the field	All the tools and equipment listed above must be available on the site at the time of OJT
	<b>Total Duration</b> <b>240:00</b>  <b>Theory Duration</b> <b>88:00</b>  <b>Practical Duration</b> <b>152:00</b>	<b>Unique Equipment Required:</b> Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, cleaning machines, destoner, pulverizer, kneader, mixer, roaster, dryer, oven, extruder, packaging machines flaker, machineries blender, Measurement Cane; Weighing balance, Timer, Gas with Burner; Knives, spatulas, packing wrap rolls, measuring cup and spoons, utensils, ladle, ladle with holes, digital hygrometer, Muslin Cloth; Weighing Machine; Milk Stirrer; Thermometer; Test Tube (Glass); Test Tube Holder; Gas with Burner,	

Grand Total Course Duration: **240Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by **SSC: Food Industry Capacity and Skill Initiative**)*



## Trainer Prerequisites for Job role: “Production Manager” mapped to Qualification Pack: “FIC/Q9003, v1.0”

Sr. No.	Area	Details
1	<b>Description</b>	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “FIC/Q9003”, Version 1.0
2	<b>Personal Attributes</b>	An aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training, and pre/post work to ensure competent, employable candidates at the end of the training. Strong communication skills, ability to work as part of a team; a passion for quality and for developing others; well-organized and focused, eager to learn and keep oneself updated with the latest in the mentioned fields.
3	<b>Minimum Educational Qualifications</b>	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 5-6 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry
4a	<b>Domain Certification</b>	Certified for Job Role: “Production Manager” mapped to QP: “FIC/Q9003, v1.0”. Minimum accepted score is 80%
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “SSC/Q1402”. Minimum accepted SCORE IS 80 % as per FICSI guidelines.
5	<b>Experience</b>	M.Sc/M.Tech/ME in Food Technology or Food Engineering with 5-6 years of hands on experience in a food industry B.Sc (home Sc) /B.Tech/BE in Food Technology or Food Engineering with 7-8 years of hands on experience in a food industry





**Annexure: Assessment Criteria**

<b>Assessment Criteria</b>	
<b>Job Role</b>	<b>Production Manager</b>
<b>Qualification Pack</b>	<b>FIC/Q9003, v1.0</b>
<b>Sector Skill Council</b>	<b>Food Processing</b>

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% (overall) in every QP
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
<b>1. FIC/N9014: Manage production process in food processing unit</b>	PC1. Communicate clearly the organisation policies and goals to the employees of production team, make them understand and commit their energy and expertise to achieve organisation goals	<b>100</b>	2.5	1	1.5
	PC2. Achieve department targets and organisation goals by understanding the organisation and employees, developing a leadership style and applying them appropriately		2.5	1	1.5
	PC3. Communicate with employees regularly and effectively, help them identify their strengths, provide support to overcome their weakness, listen to their grievances and provide appropriate solutions, and win their support		3	1	2
	PC4. Motivate and support employees to achieve their work and development objectives, and provide recognition when they are successful		2.5	1	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC5. Encourage employees to take responsibilities, to take own decisions within agreed boundaries, to take lead in their own areas of expertise for their development		2.5	1	1.5
	PC6. Initiate personnel actions, such as promotions, transfers, discharges or disciplinary measures		3	1	2
	PC7. Lead production department and team successfully through difficulties and challenges		3	1	2
	PC8. Review the sales forecast for the week/month (or) monthly production plan discussed with plant manager (or) customer requirement (as applicable) and identify production priorities to meet market requirement		3	1	2
	PC9. Identify and confirm resource availability like raw materials, packing materials, equipment availability and capacity, production capacity, manpower requirement and availability, stock level, storage capacity, transport capacity etc		3	1	2
	PC10. Plan details of production in terms of output quantity and quality, cost, time and manpower requirements		3	1	2
	PC11. Analyze the consequences of failing to meet production/delivery timelines to meet the schedule, notifying relevant authorities of any possibility that demand cannot be met within required timeframe		3	1	2
	PC12. Develop production schedule to meet market demands/priorities and delivery timelines within budget and with available resources, consult production plan with inter department heads and production supervisor, instruct supervisor to allocate work to production team		3	1	2
	PC13. Communicate the production schedule to cross function heads through communication system followed by the organisation like e-mail or upload in the erp system		2.5	1	1.5
	PC14. Identify and confirm equipment requirements to meet production target, share production schedule with equipment requirement to maintenance manager/supervisor for		2.5	1	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	maintenance plan that aligns with production plan				
	PC15. Co-ordinate with maintenance manager/supervisor to understand materials, consumables and manpower requirement and availability for maintenance activities, for uninterrupted production		3	1	2
	PC16. Understand equipment maintenance process and procedure and co-ordinate for maintenance activities during breakdown, emergency response, routine cleaning and servicing etc		2.5	1	1.5
	PC17. Analyze equipment maintenance data to interpret equipment performance and arrive at production capability of each process equipment		3	1	2
	PC18. Co-ordinate with maintenance team to ensure reliable equipment performance with minimal disruption to production, to minimize down time during equipment breakdowns, and to optimize equipment efficiency to achieve production target		3	1	2
	PC19. Lead and build team spirit between production and maintenance personnel through effective communication to enhance equipment performance and to identify production improvement opportunities		2.5	1	1.5
	PC20. Ensure maintenance procedures followed meet food safety and environmental requirements		2.5	1	1.5
	PC21. Monitor production process for usage of raw materials, packaging materials, manpower, wastage against production plan and identify reason for variances against plan		3	1	2
	PC22. Address the reason for variation in achieving production schedule, production target within allocated budget		3	1	2
	PC23. Adjust production schedule in response to variables affecting achievement of production target		3	1	2
	PC24. Monitor production output and cost, adjust processes and resources to minimize cost and to achieve quantity and quality product		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC25. Reschedule production plan in case of urgent requirement or any unforeseen event, to minimize wastage and to utilize materials/utilities and resources efficiently, discuss and negotiate changes with inter department team on time for their support and team work		3	1	2
	PC26. Review production schedule and process, consult /discuss with supervisor, team and cross function teams identify opportunities for improvement and develop recommendations for improvement on production process		3	1	2
	PC27. Set policies, plans and procedures, and take initiative to implement the identified improvement opportunities to control cost and to achieve better yield and quality		3	1	2
	PC28. Monitor, review and ensure production details are documented to meet the documentation requirements of the organisation, and to meet audit requirements like iso, haccp etc		3	1	2
	PC29. Understand objective of trial production, trial product processing method and specification, select production team for trial, discuss with cross function team like planning, qa, maintenance etc, clarify roles and responsibilities and level of authority to the team and cross function		3	1	2
	PC30. Prepare technical production procedures considering all engineering and process parameters for new product trial, educate and train supervisors and operators on trial procedure		3	1	2
	PC31. Identify and consider all possible hazards, prepare plan and procedures to prevent and control hazards, provide training to trial team to handle hazards		2.5	1	1.5
	PC32. Prepare detailed trial production schedule to manage production process without overlapping/affecting with regular production, and considering availability of raw materials and packaging materials,		3	1	2

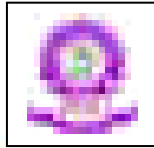


Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	machine availability and capability, man power availability and competency etc				
	PC33. Monitor trial production against plan to identify variances and factors that need to be adjusted to achieve product of required specification within the planned time		3	1	2
	PC34. Document and evaluate trial production data and identify process/parameters to be modified/changed to achieve product of required specification		3	1	2
	PC35. Prepare trial production report with recommendations on improvement opportunities, and share with cross function heads and relevant authorities for suggestion and consideration		3	1	2
<b>2. FIC/N9015: Manage production optimization and cost efficiency in food processing unit</b>	PC1. Review production reports and analyze equipment performance, process capability, change over time, maintenance, consumables, power etc, to identify factors that affect performance of production and recommend improvement opportunities	<b>100</b>	2	0.5	1.5
	PC2. Compile performance data on process and equipment to identify cause for lack of performance, evaluate opportunities to improve, identify cost saving options, propose changes in process, and implement proposal with proper approvals		3	0.5	2.5
	PC3. Review production process with supervisor and machine operators to identify reasons for slowdown or stop of production process, provide recommendations to overcome efficiency issues, take feedback, develop plans for implementing recommended changes, monitor changes implemented, and review changes and improvement		3	1	2
	PC4. Calculate utilities and energy usage in production area and for production process, identify methods to minimize usage		2	0.5	1.5
	PC5. Develop plans and procedures to minimize use of utilities and energy		2	0.5	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	without affecting the production efficiency				
	PC6. Identify energy and utility losses or sources of waste, analyze reason, recommend methods to improve efficient energy/utility application, ensure recommendations are implemented, and monitor improvement		2	0.5	1.5
	PC7. Identify areas where utilities and energy can be saved, and identify methods to save energy like recycling energy and utilities such as steam, heat and water, following proper maintenance methods to avoid leaks and losses etc, and prepare efficient production schedule such that target is met with efficient utilization of energy and utility		3	1	2
	PC8. Analyze usage pattern of energy and other utilities in production area and process against budget allocation, identify cost effective options for minimizing wastage, and implement changes		3	1	2
	PC9. Identify system, production process that need to be changed, identify opportunities for implementing change in production process, analyze impact of change on product quality, impact on the team and present production process		3	1	2
	PC10. Communicate with relevant authorities/superiors the need for change, results and benefits expected our of change		1	0.5	0.5
	PC11. Design new processes, procedures, systems, structures with roles and responsibilities, key performance indicators, training needs, safety system, contingency plans, monitoring and reporting system to implement planned changes in production process		1	0.5	0.5
	PC12. Provide training and support to implement changes, develop a strategy to help teams implement change		2	0.5	1.5
	PC13. Monitor changes implemented in production process and ensure		4	1.5	2.5



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	changes are effective and meet the organisation and regulatory requirements				
	PC14. Document and communicate the progress achieved through implemented change to the management and everyone involved, and make them understand and enjoy achievement		4	1.5	2.5
	PC15. Recognize and reward employees and teams for implementing change in production system and achieving better efficiency		5	2	3
	PC16. Manage budget efficiently by managing production with available resource, by avoiding overtime and too many casual workers/helpers		4	1.5	2.5
	PC17. Plan effectively to secure, confirm and allocate required manpower to meet production target within budget, monitor resource utilization, to achieve production target within existing resource		4	1.5	2.5
	PC18. Identify situations where actual budget exceeds the approved budget, investigate reason for variance and take appropriate corrective action to keep budget under control		1	0.5	0.5
	PC19. Identify the impact on budget of production-related decisions like scheduling holidays, adjusting production volume, scheduling equipment maintenance etc, before scheduling production, and identify opportunities to improve performance against budget		1	0.5	0.5
	PC20. Identify the causes for any significant variances in budget control, discuss with team and ensure prompt corrective action is taken to keep expenditure under control		3	1	2
	PC21. Encourage team to think and identify ways of reducing expenditure, analyze and pursue the suggested ideas		4	1	3
			<b>100</b>	<b>35</b>	<b>65</b>
<b>3. FIC/N9016: Manage documentation system and implement</b>	PC1. Establish to production team the importance of documentation, provide training on documentation system, and ensure all documents are maintained systematically	<b>100</b>	6	2	4



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
safety and environmental policies in food processing unit	PC2. Ensure all relevant records and documents are complete, up-to-date and accessible for audits on production process		6	2	4
	PC3. During audit provide the auditor with access to all relevant information, records and documents		6	3	3
	PC4. Ensure corrective actions recommended and implemented are documented to assure production process is carried in accordance with organisation and regulatory standards		6	2	4
	PC5. Establish methods to track production information from documented and maintained records		5	2	3
	PC6. Establish to production team importance of safety and environment requirements related to food processing unit, communicate information about safety and environmental policies and related procedures to the team		6	2	4
	PC7. Co-ordinate with quality team to prepare policies and sops on safety and environment requirements related to production function, and ensure those procedure are followed in production area and during production process		6	2	4
	PC8. Ensure safe work procedures are followed in production area and during production process		6	2	4
	PC9. Ensure policies and standard operating procedures on safety and environment requirements are accessible to all employees of production team, and are followed to meet the regulatory requirements		5	2	3
	PC10. Identify safety and environmental hazards relevant to production processes, implement system to handle risks		6	2	4
	PC11. Provide or organize training through relevant authorities on safety and environmental management system, to understand methods to control and prevent hazards		6	2	4
	PC12. Conduct inspections in work place on use of protective clothing and accessories, and to ensure safety		6	2	4



Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	system is followed during production process				
	PC13. Conduct audits and review records on safety and environmental system to monitor if control systems are followed by production team, and address non-compliance following organisation standards		6	2	4
	PC14. Implement system on waste management in production area and process, monitor and confirm waste collection, treatment, recycling or disposal is carried out meeting industry requirements and environmental regulations		6	2	4
	PC15. Respond to environmental management hazard identification and incidents in an appropriate and timely way		6	2	4
	PC16. Review practice and procedures followed on safety, conduct risk assessments, identify non-compliance, and provide recommendations to address gaps and non-conformances		6	2	4
	PC17. Review environmental records documents maintained, analyze data to evaluate effectiveness of the environmental management system and identify areas for improvement, plan and implement improvements to meet regulatory requirements		6	2	4
	<b>Total</b>		<b>100</b>	<b>35</b>	<b>65</b>
	<b>Grand Total</b>	<b>400</b>	<b>400</b>	<b>300</b>	<b>100</b>
	<b>Percentage Weightage</b>		<b>100</b>	<b>60%</b>	<b>40%</b>
	<b>Minimum Pass% to qualify (aggregate):</b>			<b>70%</b>	



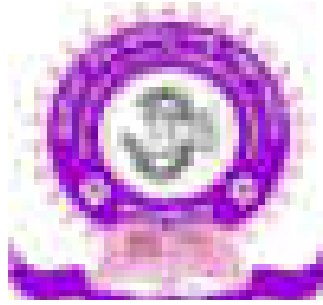
## SCHEME OF INSTRUCTION B.VOC ANIMATION AND MULTIMEDIA

### SKILL EDUCATION COMPONENT

NVEQ F LEVEL	Exit Point Level		Normal Calendar Duration	Vocational Content	L:T:P	Total credits	Theory Hrs	Tutorial Hrs	Practical Hrs	total		General content	L:T:P	Theory Hrs	Tutorial Hrs	Practical Hrs	Total Hrs	Credits	
LEVEL 4	CERTIFICATE	Character Designer	SEM 1	MES / N 0501 Understanding the script	2:0:1	3	30	0	15	45		CL Kannada	3:0:0	45	0	0	45	3	
				MES / N 0502 Ensuring consistency across all scenes	2:0:1	3	30	0	15	30		Mathematics	3:0:0	45	0	0	45	3	
				MES / N 0503 Design Characters	3:0:4	7	50	0	50	100		physics	2:0:1	30	0	15	45	3	
				MES / N 0513 Manage and store assets	1:0:2	3	20	0	15	35		Computer science	2:0:1	30	0	15	45	3	
				MES / N 0104 Maintain workplace health and safety	1:0:1	2	15	0	15	30		Total		150	0	30	180	12	
				Total		18	145	0	110	225									
LEVEL 5	DIPLOMA	Script Researcher	SEM 2	MES / N 3001 Understand and details the concept	3:0:3	6	45	0	45	90		CL English	3:0:0	45	0	0	45	3	
				MES / N 3002 Undertake research for scripts	3:0:2	5	45	0	30	75		Mathematics	3:0:0	45	0	0	45	3	
				MES / N 3005 Assist in drafting scripts	2:0:2	5	30	0	30	60		physics	2:0:1	30	0	15	45	3	
				MES / N 0104 Maintain workplace health and safety	1:0:2	3	20	0	15	35		Computer science	2:0:1	30	0	15	45	3	
				Total		18	140	0	125	265		Total		150	0	30	180	12	
LEVEL 6	ADVANCED DEPLOMA	Animation Director	SEM 3	MES / N 1304 Communicate requirements to the team	2:0:4	6	40	0	40	80		Physics	2:0:1	30	0	15	45	3	
				MES / N 1306 Direct the animation process	6:0:6	12	90	0	90	180		Electronics	2:0:1	35	0	15	45	3	
				Total								Computer science	2:0:1	30	0	15	45	3	
			SEM 4	MES / N 1307 Direct the post-production process	7:0:7	14	105	0	105	210		Indian constitution	3:0:1	45	0	0	45	3	
				MES / N 0104 Maintain workplace health and safety	2:0:1	3	30	0	20	50		Total		150	0	30	180	12	
				Total		36	265	0	255	520		Physics	2:0:1	30	0	15	45	3	
												Electronics	2:0:1	30	0	15	45	3	
								Computer science	2:0:1	30	0	15	45	3					
								Environmental science	3:0:1	45	0	0	45	3					
								TOTAL		150	0	30	180	12					



**JSS MAHAVIDYAPEETHA**



ESTD-1964

**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**

(An Autonomous College of University of Mysore)

Re-accredited by NAAC with 'A' grade

**OOTY ROAD, MYSORE-570 025, KARNATAKA**

# Syllabus

**B. Voc in Animation and Multimedia**

**2018-19 To 2022-23**

**COMPUTER SCIENCE DEPARTMENT (UG)**

**B. Voc in Animation and Multimedia  
Certificate – Level 4- Character Designer  
(National Competency Certificate)**

**Semester 1  
Vocational Content**

**MES / N 0501 - Understanding the script**

Section – A

Pre-Production Techniques: Ideas, Themes, Concepts, Story Development. Script- Format, Storyboard. Short Film, Documentary, Feature Film. Script Terms, Understanding Genre, Different Types of Genres and Sub Genres, Read-through and Identifying

Character types. Understanding Narration Style, Time, Place and society condition status of the Character. Plot Interpretation. Three act Structure.

Introduction on how to make drawings for animation, Shapes and forms, About 2d and drawings, Clay modeling, Layout design according to a storyboard. Human anatomy, skeleton structure, animal anatomy and mythical creatures. Studying Human and animal movement through sequential drawings, gesture drawing, Caricaturing – fundamentals, Exaggeration, Attitude, Silhouettes, Boundary breaking exercises and warm ups, gesture drawing, Line drawing and quick sketches, Drawing from observation, memory and imagination.

Section – B

1. Story Reading (Read-through)
2. Group Discussion
3. Observation of Character development.
4. Acting (Read-through)

**MES / N 0502 - Ensuring consistency across all scenes**

Section – A

Introduction to Pencil Drawing- Introduction to basic drawing techniques including proportions and Line, Using Pencils for shading, People and Animals, Proportion in portrait drawing, Highlighting and shadows, Drawings with the help of basic shapes, understanding of the relationship of bones and muscles at rest and in movement to able to translate and maintaining correct volumes.

Introduction to Perspectives: Perspective in 1 point, Perspective in 2 point, Perspective in 3 point, Eye levels, Vanishing point, Significance of Perspective in animation and composition, Humans and animal forms in perspective, Perspective-blocks, boxes and shapes, Scale diagrams in perspective, Different viewpoints, Importance of eye level.

## Section – B

1. Drawing Basic shapes
2. Shapes in to forms
3. One-point Perspective - Table
4. Two-points Perspective - Exterior
5. Three-points perspective – Interior
6. Drawing simple characters using simple shapes
7. Drawing cartoons
8. Drawing male characters (6&7 Heads)
9. Drawing Female Characters (4&5 Heads)
10. Drawing an animal Character
11. Drawing a Hybrid Character (Fantasy)

## **MES / N 0503 - Design Characters**

### Section – A

Introduction on how to make drawings for animation, Shapes and forms, About 2d and drawings, Clay modeling, Layout design according to a storyboard. Human anatomy, skeleton structure, animal anatomy and mythical creatures.

Studying Human and animal movement through sequential drawings, gesture drawing, Caricaturing – fundamentals, Exaggeration, Attitude, Silhouettes, Boundary breaking exercises and warm ups, gesture drawing, Line drawing and quick sketches, Drawing from observation, memory and imagination.

Intro to Raster: Foreground & background, Changing Foreground and Background colors, using the large color selection Boxes and small color swathes, using the Eyedropper tool to sample Image color, changing the Foreground Color While using a Painting Tool. Using Brushes, Selecting the Brush Shape, drawing a vertical and Horizontal Straight lines with any brush, Drawing connecting Straight Lines (at any angle) with any brush, creating a New Brush, Saving Brushes, Loading Brushes, creating a Custom Brushes, Using the Painting Modes, Fade, Airbrush Options, Pencil Options.

Intro to Vector: Understanding paths, views, selection tools, fills and strokes, setting up preferences and color settings, Creating basic geometric shapes with the Shape tools, Using a grid and smart guides to aid symmetrical drawing, Using the Bezier Pen, Direct Selection tool, and Convert tool efficiently, Applying and editing color gradients to filled regions, Creating and using swatches, tints, gradients, and patterns on filled regions.

3D MODELING: Introduction to various 3D modeling Techniques: - Organic Modeling, Mechanical & Technical Modeling. Using Templates for Modeling. Polygon and Patch. Concept of edit meshes and edit poly. Low poly modeling. Modifiers and compound objects. How to manage vertex, faces and polygon selections.

Introduction to, curves, create a curve from a surface edge, isoparm, or curve-on-surface and Bezier curve editing curves, Surface tools, Trimming, Stitching. Sculpting NURBS surfaces, NURBS Modeling Reference, import vector data as curves or generate polygonal surfaces.

#### Section – B(1)

1. Perspective art.
2. Traditional designs.
3. 2D Character Designing
4. Photo Collage
5. Matt Painting
6. Digital painting
7. 2d Animation basics
8. Gif Animation.

#### Section – B(2)

1. Modeling an Apple.
2. Modeling a simple Robot Character.
3. Modeling a Human Face.
4. Modeling Human Body.
5. Modeling Prop for Character (Costume).
6. Modeling an animal character.
7. Modeling a Fantasy Character.

### **MES / N 0513 - Manage and store assets**

#### Section – A

Understanding Management, SOP, research appropriate tools, techniques, technologies and procedures for effective asset storage, Saving the work with appropriate names and/or naming conventions so that it can be identified easily. Storing the work in an appropriate place using appropriate storage techniques to ensure it is protected from damage.

Making backup copies at appropriate time intervals of any digital files. Routinely archive any work and store it securely in a second location, if required. Identify and retrieve previous work from storage, as required.

#### Section – B

1. Arranging Materials in order
2. Writing Logs
3. Group discussion on Assets Allocation.
4. Assets handling and Proper storage Techniques
5. Data storage techniques.



## **MES / N 0104 - Maintain workplace health and safety**

### Section – A

Understand and comply with the organization's current health, safety and security policies and procedures

Understand the safe working practices pertaining to own occupation. Understand the government norms and policies relating to health and safety including emergency procedures for illness, accidents, fires or others which may involve evacuation of the premises. Participate in organization health and safety knowledge sessions and drills

### Section – B

1. Identify the people responsible for health and safety in the workplace, including those to contact in case of an emergency.
2. Identify security signals e.g. fire alarms and places such as staircases, fire warden stations, first aid and medical rooms.
3. Identify aspects of your workplace that could cause potential risk to own and others health and safety.
4. Ensure own personal health and safety, and that of others in the workplace through precautionary measures.
5. Identify and recommend opportunities for improving health, safety, and security to the designated person.
6. Report any hazards outside the individual's authority to the relevant person in line with organizational procedures and warn other people who may be affected.
7. Follow organization's emergency procedures for accidents, fires or any other natural calamity in case of a hazard.
8. Identify and correct risks like illness, accidents, fires or any other natural calamity safely and within the limits of individual's authority.

**Semester 1**  
**General Content**

**L4 – Sem 1 - GC - Communication Language Kannada**

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1. DqÀ½vÀ °sÁµÉAiÀiÁV PÀ£ÄßqÀ, ÀégÀÆ¥À ªÄÄvÀÄÜ ®PÀët

2. ÀPÀðj ¥AvÀæ, ÀégÀÆ¥À - CçüPÀÈvÀ eÁÖ¥Ä£À ªÄÄvÀÄÜ

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5. ªÄÄdÄå ¥AvÀæzÀ «zsÀ CAUÀUÀ¼ÄÄªÄÄdÄå ¥AvÀæUÀ¼ÄÄ-

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7. °sÁµÁAvÀgÀ : ÀégÀÆ¥À ªÄÄvÀÄÜ ®PÀët- PÀ£ÄßqÀçzÀ EAVè¶UÉ-

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|-----|----------------------|---|-------------------------------------|
| 1.  | $\int_0^1 x^2 dx$    | - | $\int_0^1 x^2 dx = \frac{1}{3}$     |
| 2.  | $\int_0^1 x dx$      | - | $\int_0^1 x dx = \frac{1}{2}$       |
| 3.  | $\int_0^1 x^3 dx$    | - | $\int_0^1 x^3 dx = \frac{1}{4}$     |
| 4.  | $\int_0^1 x^4 dx$    | - | $\int_0^1 x^4 dx = \frac{1}{5}$     |
| 5.  | $\int_0^1 x^5 dx$    | - | $\int_0^1 x^5 dx = \frac{1}{6}$     |
| 6.  | $\int_0^1 x^6 dx$    | - | $\int_0^1 x^6 dx = \frac{1}{7}$     |
| 7.  | $\int_0^1 x^7 dx$    | - | $\int_0^1 x^7 dx = \frac{1}{8}$     |
| 8.  | $\int_0^1 x^8 dx$    | - | $\int_0^1 x^8 dx = \frac{1}{9}$     |
| 9.  | $\int_0^1 x^9 dx$    | - | $\int_0^1 x^9 dx = \frac{1}{10}$    |
| 10. | $\int_0^1 x^{10} dx$ | - | $\int_0^1 x^{10} dx = \frac{1}{11}$ |

**L4 – Sem 1 - GC - Mathematics:**

Unit 1: Algebra

Quadratic and cubic equations – Progressions – Vectors-Scalar product- vector product – vector triple product – standard results and simple problems.

Unit 2: Analytical Geometry

Cartesian coordinate system – Distance formula – section formula – Equation of lines. simple problems – circles – parabola-ellipse-hyperbola-simple problems.

Unit 3: Trigonometry and Calculus

Trigonometric ratios- inverse trigonometric functions – simple problems . Limits – Rules of differentiation – simple problems.

**L4 – Sem 1 - GC – Physics:**

PHYSICAL WORLD

Physics: Scope and excitement of physics - Physics, technology and society -Mention of fundamental forces in nature - Nature of physical laws.

UNITS AND MEASUREMENTS

Unit of measurement - System of units - SI units - Fundamental and derived units - Length, mass and time measurements - Accuracy and precision of measuring instruments, Errors in measurement. Significant figures, Numerical problems.

SCALAR AND VECTORS

Scalars and Vectors – Position and displacement vectors - Equality of vectors - Multiplication of a vector by real number, Addition and subtraction of two vectors, Triangle method and parallelogram method.

List of Experiments:

- 1) To measure diameter of a small spherical body using Vernier Calipers.

- 2) To measure diameter of a small cylindrical body using Vernier Calipers.
- 3) To measure internal diameter and depth of a given beaker using Vernier Calipers and hence find its volume.
- 4) To measure internal diameter and depth of a given calorimeter using Vernier Calipers and hence find its volume.
- 5) To measure diameter of a given wire using screw gauge.
- 6) To measure thickness of a given sheet using screw gauge.
- 7) To measure volume of an irregular lamina using screw gauge.
- 8) To determine the masses of two different objects using a beam balance.

#### **L4 – Sem 1 – GC - Computer science:**

#### **L4-Sem-1-GC: COMPUTER SCIENCE – I**

##### Computer Fundamentals

##### Unit 1:

Knowing computer: What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Concept of Computing, Data and Information; Applications of IECT; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply. Operating Computer using GUI Based Operating System: What is an Operating System; Basics of Popular Operating Systems; The User Interface, Using Mouse; Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows; Using help; Creating Short cuts, Basics of O.S Setup; Common utilities.

##### Unit 2:

##### Programming Development life cycle

Understanding Word Processing: Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document.

Using Spread Sheet: Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet.

Introduction to Internet, WWW and Web Browsers: Basic of Computer networks; LAN, WAN; Concept of Internet; Applications of Internet; connecting to internet; What is ISP; Knowing the Internet; Basics of internet connectivity related troubleshooting, World Wide Web; Web Browsing software's, Search Engines; Understanding URL; Domain name; IP Address; Using e-governance website.

Communications and collaboration: Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails;

Document collaboration; Instant Messaging; Netiquettes.

Small Presentation Making: Basics of presentation software; Creating Presentation; Preparation and Presentation of Slides; Slide Show; Taking printouts of presentation / handouts.

Reference Books:

Computer today by Donald H. Sanders - McGraw-Hill, 1983

## **Semester 2**

### **Certificate – Level 5- Script Researcher**

(National Competency Certificate)

#### **Vocational Content**

#### **MES / N 3001 - Understand and detail the concept**

Section – A

What Is a Short Story? Finding a Story to Write, A Short Story's Basic Ingredients, Sitting Down to Write.

Choosing a Protagonist, choosing a Point of View, Bringing Your Characters to Life, Tip Sheet: Three-Dimensional Characters, Character's Bio Chart, Giving Your Characters a Voice, Tip Sheet: Dialogue

How Conflict Works in a Short Story, The Protagonist's Predicament, Bad Guys, Hurricanes, and Fatal Flaws, Conflict Equals Suspense.

Scriptwriting terminology: Action, Angle, BG close up, Exterior, fade in fade out, Pan, Parenthetical, POV, Scene Heading, Slug line, SFX, Sotto voce, track with, Voice over, Character name, Cast List, Dialogue, Script Length, Action Description, Extension, Dual-Column Dialogue, Act numbers, Scene Numbers, short lines, dialogue paragraphs, Character Arc.

Section - B

1. Exercises: Generating Ideas.
2. Exercises: Creating Characters.
3. Exercises: Finding Story Conflict.
4. Exercises: Constructing a Plot.
5. Exercises: Making a Setting Vivid.
6. Exercises: Discovering and Developing Your Voice.
7. Public domain material, Protecting the idea, Proof of ownership, Confidentiality agreement, Piracy, Animation Industry in India, Case Study.

#### **MES / N 3002 - Undertake research for scripts**

Section - A

Creating Your Own Show, Writing a TV Proposal, Drama and Comedy, Documentary and Reality, Formatting and Presentation, One hour Drama, Procedural, Serialized, Half-hour Comedy or Sitcom, Single-Camera Format, Multi-Camera Format, Limited Series or Miniseries.

Scriptwriting for both short film: Dialogue, Parenthetical, Extension, Shot Transition, Dual-Column Dialogue, Act numbers, Scene Numbers, Cast List, short lines, dialogue paragraphs, Script Styles & Types, Script Length Scene Heading Action Description , Character Name, Dialogue, Parenthetical, Extension, Transition, Shots.

#### Section - B

1. Do a Research.
2. Understanding the impact on the society.
3. Finding the common interest.
4. Creating the effective narration format.

#### **MES / N 3005 - Assist in drafting scripts**

#### Section – A

Scriptwriting for feature film: Dialogue split by Action, Emphasis in Action, Abbreviations, Short Lines, Dialogue Paragraphs, Montage & Series of Shots, Supers - Titles, Signs, etc, Phone Calls and Intercuts Two people talking at the same time.

Introduction to storyboard: Introduction, Multimedia Storyboarding Tools, The Advantages of Storyboarding, Interactive Storyboarding, Using Interactive Storyboarding to Speed-up the Content-writing Phase, Using Interactive Storyboarding to Speed-up Report Document Production.

Steps of storyboard writing: Storyboard table, Topic, Timeline, Sketches, color scheme, text attributes, Audio, camera angle, Interaction of buttons and text.

#### Section - B

Understanding Camera terms: Extreme Lon Shot, Long Shot, Mid Shot, Close-up, Extreme Close-up, Over the shoulder. Panning, Tilt, Dolly shot, Crane Shot, Moving Shot.

#### **MES / N 0104 - Maintain workplace health and safety**

#### Section – A

Understand and comply with the organization's current health, safety and security policies and procedures

Understand the safe working practices pertaining to own occupation. Understand the government norms and policies relating to health and safety including emergency procedures for illness, accidents, fires or others which may involve evacuation of the premises. Participate in organization health and safety knowledge sessions and drills

#### Section – B

1. Identify the people responsible for health and safety in the workplace, including those to contact in case of an emergency.
2. Identify security signals e.g. fire alarms and places such as staircases, fire warden stations, first aid and medical rooms.

3. Identify aspects of your workplace that could cause potential risk to own and others health and safety.
4. Ensure own personal health and safety, and that of others in the workplace through precautionary measures.
5. Identify and recommend opportunities for improving health, safety, and security to the designated person.
6. Report any hazards outside the individual's authority to the relevant person in line with organizational procedures and warn other people who may be affected.
7. Follow organization's emergency procedures for accidents, fires or any other natural calamity in case of a hazard.
8. Identify and correct risks like illness, accidents, fires or any other natural calamity safely and within the limits of individual's authority.

## **Semester 2** **General Content**

### **L5 – Sem 2 - GC - Communication English:**

**AIMS:** 1) To familiarize students with basic English  
2) To enable them to develop listening & speaking skills

**OBJECTIVES:** Students should be able to \_\_\_\_

- 1) Write English without grammatical errors
- 2) Speak English Language Effectively and Accurately
- 3) Listen and understand public announcements and news on TV & Radio

### **Module – 1 Grammar**

1. Subject and Verb Agreement
2. Voice
3. Articles
4. Speech
5. Question tag
6. Framing of Questions

### **Module – 2 Writing Skills**

1. Letter Writing  
Letter of Application/Letter of Grievances/Resume Preparation
2. Comprehension
3. Essay Writing

### **Module – 3 Speaking Skills**

1. Greeting
2. Requesting
3. Enquiring
4. Explaining
5. Reporting

6. Permission
7. Thanking

### **L5 – Sem 2 - GC - Mathematics:**

Section – A

Unit 1: Algebra

Sets –Relation - functions- Mathematical logic and Graph theory, Matrices and determinants –invertible matrices (only  $2 \times 2$  matrices) - Characteristic equations and Eigen values (only  $2 \times 2$  matrices).

Unit 2: Quadric Surfaces

Sphere - Ellipse –Cone-Ellipsoid-Paraboloid-Hyperboloid of one and two sheets – Intersection of Quadric surface and plane – Tetrahedron.

Unit 3: Integration and differential equations

Indefinite and definite integrals –simple problems – Differential equations of first order – separation of variables.

### **L5 – Sem 2 - GC - Physics:**

Section – A

**THERMODYNAMICS:**

Definition of temperature, heat, change of state, green-house effect, first law of thermodynamics, thermal equilibrium, classification of thermodynamic system, zeroth law of thermodynamics, internal energy, work, isothermal process, adiabatic process, isochoric, Isobaric Process, Second law of thermodynamics, reversible and irreversible process.

**MOTION IN A STRAIGHT LINE:**

Rest, motion, Position and frame of reference - Definitions of path length and displacement - Definitions of average speed and average velocity, instantaneous speed and instantaneous velocity & uniform and non-uniform motion – Uniformly accelerated motion.



## Section – B

### List of Experiments:

- 1) Using a simple pendulum, plot L-T and L-T<sup>2</sup> graphs, hence find the effective length of second's pendulum using appropriate graph.
- 2) To find the weight of a given body using parallelogram law of vectors.
- 3) To determine the coefficient of viscosity of a given liquid by measuring the terminal velocity of a spherical body by stoke's method.
- 4) To determine Surface tension of Water by capillary rise method.
- 5) Interfacial between Water and Kerosene.
- 6) Verification of Lami's theorem.
- 7) Verification of Gaussian distribution and calculation of standard deviation in a Monte Carlo experiment.
- 8) Determination of the moment of inertia of an irregular body using Torsional pendulum.

### L5 – Sem 2 - GC - Computer Science:

#### Section - A

1. Concepts of object oriented programming: object class. Encapsulation data hiding Inheritance. Polymorphism. Analysis and design of system using Object Oriented Approach.
2. Structure of a C++Program: Include files, Declaration of an object, Main function, I/O streams.
3. Classes: Class Declaration: Data Members, Member Functions, Private and Public members. Data hiding and encapsulation, arrays within a class. Class function Defection, scope resolution operator, Private and Public member function, Nesting of member functions.
4. Objects: Creating Objects, accessing class data members, Accessing member functions. Arrays of Objects, Objects as function arguments: Pass by value by Reference, Pointers, to Objects.

#### Section - B

5. Constructors and Destructors: Constructors: Declaration and Definition, Default Constructors, Parameterized Constructors, Copy Constructors. Destructors: Definition and use.

#### Section - C

6. Function Overloading: Function Overloading: Declaration and definition.
7. Inheritance – Extending Classes: Concept of inheritance, base, derived class, defining derived, classes, visibility modes, private, public, protected; sinle inheritance: private and protected members by member functions of a derived class, multilevel inheritance, nesting of classes.

**Reference Books:**

Object Oriented Programming with C++ By Balagurusamy- McGraw-Hill,

Object Oriented Programming And C++ By R. Rajaram

PRACTICAL: Practical's based OBJECT ORIENTED PROGRAMING (USING C++)

Objective

**Semester 3**  
**Certificate – Level 6 – Animation Director(A)**  
(National Competency Certificate)

**Vocational Content**

**MES / N 1304 - Communicate requirements to the team**

Section - A

Introduction to Communication, Verbal Communication, Face to Face communication, Tone of Voice, Body Language, Physical Communication.

Introduction to Listening Skills, Self-Awareness, Active Listening, Listening in Difficult Situations, Shades of Meaning. Formal Communication, and Informal communication.

Effective Communication: Voice with Emotions, Speaking what you thinking, Having a group discussions, Making Teams and Dividing responsibility.

Section – B

1. Writing Letter

- a. Writing a letter for Long leave
- b. Writing a letter for Pramotion

2. Improvising the Content

- a. Adding an emotional touch to your letter.
- b. Correcting the meaning.

3. Group Discussion and Games for Communication.

- a. Wordless Acting
- b. Famous Pair
- c. Listen, Interpret, Draw
- d. Role-playing and Conflict Resolution
- e. y-o-u-r-n-a-m-e

4. Communication Through Activities.

- a. Listening with Intention
- b. Record/Watch yourself talk
- c. DPR on Given Content.

## **MES / N 1306 - Direct the animation process**

### Section – A

**Basic Principles in animation:** Squash and stretch, Anticipation, Staging, straight ahead and pose to pose, follow through and overlapping action, Slow in and slow out, Arcs, Secondary action, Timing, Exaggeration, Solid drawing, Appeal, Mass and weight, Character acting, Volume, Line of action, Path of action, Walk cycles- animal and human.

**Introduction to Sculpting software interface:** Mesh Manipulation, Using different, applying strokes, Projection mapping, Dynamic topology, Adding detail to poly mesh, Using symmetry tool, Exporting the mesh.

**Introduction to basic material types & procedurals:** Study of concepts:- opacity, smoothness, specularly and color. Drawing 2D art templates, Creating complex effects like water fire and smoke. Unwrapping the map for various 3D characters.

**Introduction to the mapping and advanced texturing techniques.** Shadow maps, Raytraced shadows & radiosity. Concept of lighting system and shadows. Introduction to 3 point, 2 point and dramatic lighting. Creating photo real environments and textures. Applying on to a 3D objects. Understanding how to produce final output, rendering the scene, rendering the effects, network rendering.

**Introduction to advance lighting effects:** Mental ray rendering and Toon shade rendering. Creating various outputs as per the end user requirements and maintaining the resolution.

**Introduction to Character setup:** Riggers role, Criteria for a good rig, Joints and skeletons, Creating skeleton hierarchy, Constraints, Forward(FK) and Inverse kinematics(IK), FK, IK joint structures, Animation controllers, Blend shapes, Clusters, Biped Rig- Analyzing reference, Anatomy of human body, Bone placements, Setting up Torso, Biped Arms, Fingers, Legs/Foot controls, Skinning, Facial Rig- Anatomy of a face, The Facial Action Coding System(FACS), Mouth shapes, Phonemes, Animation controllers for Face, Character GUI.

**Introduction to Fur, Procedural textures:** Inclination, roll and polar, Fur volume and Noise, Painting fur attributes, modifying fur direction, Modifying color of a

fur descriptions, Creating nCloth collision, Constraints, Hair System: Artisan, Hair system components, Modify curve tools, Paintfx with hair, Hair collision, Hair system caching, Hairstyles.

**Muscle systems Introduction to 3D Muscle system:** Components of Muscle, Capsules, Spline based muscle system, Stretch based muscle systems, Muscle Objects and skins, Assigning weights to Muscle skin, Muscle Builder, Muscle Parameters, Custom muscle systems, Wrinkles, fold, jiggle, Slide, Collide, Muscle control.

#### Section – B(1)

1. Exercises: Ball Bounce (Heavy & Light).
2. Exercises: pendulum.
3. Exercises: Walk Cycle.
4. Exercises: Run.
5. Exercises: Vanilla Walk.
6. Exercises: Animal Walk Cycle.

#### Section – B(2)

1. Exercises: Human Nose sculpt.
2. Exercises: Human Eyes Sculpt.
3. Exercises: Human Mouth Sculpt.
4. Exercises: Human Ears Sculpt.
5. Exercises: Human Character planning.
6. Exercises: Human Character body sculpting.
7. Exercises: Human Character Face sculpting.

#### Section – B(3)

1. Exercises: Shading networks.
2. Exercises: Tire Texturing.
3. Exercises: Rusty Automotive Texturing.
4. Exercises: Human Skin Texturing.
5. Exercises: Animal Skin Texturing.
6. Exercises: 2 Point lighting.
7. Exercises: 3 Point lighting.
8. Exercises: Interior lighting (Lamps, Bulbs).

#### Section – B(4)

1. Exercises: Rigging with Deformers.
2. Exercises: Rigging simple vehicle.
3. Exercises: Rigging cartoon character-Legs.
4. Exercises: Rigging cartoon character- Arms.
5. Exercises: Rigging cartoon character- Face rigging.
6. Exercises: Face expressions using Blend shapes.

#### Section – B(5)

1. Exercises: Creating fur.
2. Exercises: Creating Hair.

3. Exercises: Simulating Sparks.
4. Exercises: Jiggle animation.
5. Exercises: Adding Muscle System to a human Arm.
6. Exercises: Muscle Weight Paint.

## **Semester 3** **General Content**

### **L6-Sem 3 – GC – Physics:**

#### LAWS OF MOTION

Newton's first law of motion: Concept of inertia and force – Concept of momentum - Newton's second law of motion - Impulse, impulsive force and examples - Newton's third law of motion: Identification of action and reaction pairs with examples in everyday life.

Collisions: Elastic and inelastic collisions

#### SYSTEMS OF PARTICLES AND ROTATIONAL MOTION

Definitions of a rigid body, translator motion and rotatory motion - Centre of mass of a two-particle system - Mention of expression for position coordinates of centre of mass of (a) n particle system (b) a rigid body and (c) a uniform thin rod.

Section – B

List of Experiments:

- 1) To study the relation between force of limiting friction and normal reaction and to find the coefficient of friction between surface of a moving block and horizontal surface.
- 2) To find the downward force, along an inclined plane, acting on a roller due to gravity and study its relationship with the angle of Inclination by plotting graph between force and  $\sin\theta$
- 3) Determination of the Moment of inertia of rectangular lamina by using torsional pendulum.
- 4) Determination of the Moment of inertia of circular lamina by using torsional

pendulum.

5) Determination of the acceleration due to gravity and the radius of gyration by using Bar pendulum(Graphical method)

6) Determination of the Moment of inertia of irregular body by using torsional pendulum.

7) To find the force constant and effective mass of a helical spring by plotting  $T^2 - m$  graph using the method of oscillation.

8) To study the relationship between the temperature of a hot body and time by plotting a cooling curve.

### **L6-Sem 3 – GC – Electronics:**

#### **Unit 1: Introduction to Electronics**

AC and DC sources.

Ohm's law – statement and limitations, numerical as applicable. Definition of power and unit. Kirchhoff's laws- statement and explanation, numerical.

Passive components

Resistors – types, fixed resistors – definition and example. Colour code. Variable resistors – definition and example. Combination of resistors in series and parallel (no derivation) numerical.

Capacitors- Types – fixed Capacitors – definition and example, Variable Capacitors – definition and example. Equivalent of capacitors in series and parallel combination (no derivation) numerical.

Inductors – types – fixed inductor - definition and example. Equivalent of inductors in series and parallel combination (no derivation) numerical.

(15 hrs)

#### **Unit 2: Semiconductor devices**

Classification of solids, Introduction to semiconductors – Intrinsic and extrinsic Semiconductors, PN Junction diodes - characteristics.

Mention of Zener diode, tunnel diode, photo diode and LED and their applications.

(15 hrs)

### **L6-Sem 3 – GC – Computer Science:**

Section – A

Unit 1:Python: Introduction, features, First Step with Python, Interactive Mode, Script Mode, Variables and Types, Mutable and Immutable Variables, Keywords, Operators and Operands, Expression and Statements, Input and Output, Comments.

Functions: Introduction, Module, Built in Function, Composition, User Defined Functions, Parameters and Arguments, Scope of Variables, ways of defining Functions.

Conditional and Looping Construct: Control Flow Structure, Looping Constructs.

Strings: introduction, Creating and initializing strings, Strings are immutable,

Traversing a string, Strings Operations & string Slicing, String methods & built in functions, Regular expressions and Pattern matching

Section - B

Unit 2:

Lists: Introduction, creating a list, accessing an element of list, traversing a List, Appending in the list, Updating array elements, Deleting Elements, Other functions & methods, List as arguments, Matrix implementation using list, Functions with list, Function call.

Dictionaries: What is dictionary? Key-value pair, Creation, initializing and accessing the elements in a Dictionary, Traversing a dictionary, Creating, initializing values during run time (Dynamic allocation), Appending values to the dictionary, Merging dictionaries: An update, Removing an item from dictionary, Dictionary functions and methods.

Tuples: What is a Tuple? Tuple Creation, Add new element to Tuple, Tuple Assignment, Tuple Slices, Tuple Functions

Reference Books:

Beginning Programming with Python for Dummies by stef Maruch & Aahz Maruch.

### **L6-Sem 3 – GC – Indian Constitution:**

#### **UNIT I**

Preamble of the Indian Constitution

- a) Salient features of Indian Constitution

#### **UNIT II**

- a) Fundamental Rights
- b) Fundamental Duties
- c) Directive principles of State Policy

#### **UNIT III**

- a) President – Election Method, Powers and Functions
- b) The Role of the Prime Minister
- c) The Parliament – Structure, Power and Functions(Lok Sabha and Rajya Sabha)
- d) Supreme Court – Organization and Jurisdiction

#### **UNIT IV**

- a) The Role of Governor in the Administration of State
- b) Powers and Functions of the Chief Minister
- c) Composition, Powers and Functions of both the Houses of State Legislature
- d) High Court – Organization and Jurisdiction

**Semester 4**  
**Certificate – Level 6 – Animation Director (B)**  
(National Competency Certificate)

**Vocational Content**

**MES / N 1307 - Direct the post-production process**

**Advanced Dynamics and pyrotechnics:** Introduction to Dynamics, and Dynamic solver, Particles, Emitters, Fields: Air, Drag, Gravity, Newton, Turbulence, Vortex, Volume, Particle collisions, Particle cache, Goals, Soft bodies, Springs, Rigid bodies, Constraints, Effect: Fire, Smoke, Fireworks, Lightning, Shatter, Curve flow, Surface flow, Rendering particles and effects, Maya Paint Effects, baking simulations, Render types. UNIT – 2 Fluid Effects Introduction to Fluids, Fluid field interaction, Fluid attributes, , Creating a non-dynamic 3d fluid effects, Creating dynamic 3D effect, Creating fire and smoke using Fluid dynamics, creating an ocean.

**Introduction to nParticles and Nucleus solver,** Nucleus node, Nucleus forces, Nucleus plane, Nucleus attributes, nParticles interaction, nConstraints, nCloth: simulations, nCloth dynamics properties, Working with nConstraints, Tearing cloth, Dynamic Property maps, Simulating cloth on moving character, nParticle caching, nConstraints, Creating Smoke simulations in nParticles, Creating liquid simulations in nParticles, Introduction to nHair, Creating Basic hair style, Creating a dynamic curve simulations.

**Introduction to Video Compositing techniques and Colour Keying** advanced 2D compositing and Ink paint techniques. Creating color models as per the model sheets. Creating color pallets as required paint and ink fields. Understand the dope sheets / X- sheets in production level. Arranging and adjusting the layers as per X- sheet. Advanced panning of camera and background, multiple cameras for showing depth in-between background, over lay and character layers. Introduction to compositing special effects into a scene using 3d graphics and 3d special effects in 2d layers. Concepts for Broadcast animation for logos, channel IDs and montages. Multi-Layer Compositing, Special Effects, Superimposition and Titling. Exporting various file format outputs as per the end user requirements.



**Introduction to Audio Editing** sound design in animated films, including recording, gathering audio, editing, mixing, and audio design principles, high-end Pro Tools editing, including use of plug-ins to premix a soundtrack, sound is a catalyst for the imagination, master/slave relationship of picture/sound, sound and memory, psychological implications of sound. Psycho-acoustics and the physics of sound. voice-over, musical composition, psychological role of Sound and aesthetic

**3D Compositing and Color Grading:** Compositing in Z axis, Creating camera and lights in compositing program, Creating shadows and reflections using layers, Blending videos, Roto Paint, using particles and advanced effects, 3D camera tracking and polishing, Integrating 3 D elements. Using Color correction tools, curve tool, masking and Isolating elements, Using adjustment layer for color grading, Noir theme, color and its meaning and impact on audience.

**Advanced Video Editing and Visual Story Narration:** post-production strategies, narrative structure, editing rhythms and cutting for performance logging and organization exercises; cutting a short scene provided by the instructor; analysis of editing in a feature film; and active participation in class discussions of student.

#### Section – B(1)

1. Exercises: 3d Disintegration/Shattering effects.
2. Exercises: Smoke Simulation and Rendering.
3. Exercises: Creating Ocean and waves.
4. Exercises: Creating Fire Blast Simulation-Configuring Container and emitter properties.
5. Exercises: Creating Fire Blast Simulation-Creating Debris.
6. Exercises: Creating Rain and fog.

#### Section – B(2)

1. Exercises: Video stabilization.
2. Exercises: Chroma Keying & Matte.
3. Exercises: 2D Camera Tracking.
4. Exercises: 3D Camera Tracking.
5. Exercises: 3D Camera Tracking and Alignment.
6. Exercises: Motion Graphics-Planning and Asset preparation
7. Exercises: Motion graphics- Final Animation
8. Exercises: Rotoscopy-Biped
9. Exercises: Rotoscopy-Quadraped.

#### Section – B(3)

1. Exercises: Adding BG Music.
2. Exercises: Mixing two tracks.
3. Exercises: Recording audio.
4. Exercises: Noise reduction Process.
5. Exercises: Adding Effects.
6. Exercises: Creating Physiological Effects
7. Exercises: Foley Lab.

#### Section – B(4)

1. Exercises: 3D camera tracking and exporting to 3D Program.
2. Exercises: adjusting Track Points.
3. Exercises: Set extension.

4. Exercises: Match Moving.
5. Exercises: matching Lighting

#### Section – B(5)

1. Creating Titles using text and images.
2. Storytelling with images.
3. Editing using video effects.
4. 180-degree dialogue shot editing.
5. Editing a Montage (Future, Past).
6. Shooting and editing a documentary- Shoot/Acquiring a footage
7. Shooting and Editing a documentary-Rough cuts
8. Shooting and Editing a documentary-Syncing Audio and Video
9. Shooting and Editing a documentary-Final cut and Export to media format.

## **Semester 4** **General Content**

### **L6 – Sem 4 – GC – Physics:**

#### Section – A

##### OPTICS:

Reflection, Refraction, Spherical mirror, Concave mirror, refractive index, Relation between focal length and radius of curvature. Laws of Refraction, Snell's law, Dispersion, wave front, interference, diffraction.

##### CURRENT ELECTRICITY:

Resistance, Capacitance and Inductance, Ohm's law, Current and Voltage, Conductors, Insulators, Semiconductors and Super conductors and their applications, Alternating current and Direct current, Transformers and their constructions, rectification.

#### Section – B

##### **List of Experiments:**

- 1) To find the focal length of a convex mirror, using a convex lens.
- 2) To find the refractive index of glass.
- 3) To find the refractive index of water.
- 4) To find the focal length of a concave mirror.
- 5) Verification of ohm's law.
- 6) To determine effective resistance of two resistances connected in series.
- 7) To determine effective resistance of two resistances connected in parallel.
- 8) To determine resistance per unit length of the wire.

## **L6 – Sem 4 – GC – Physics:**

### **Unit 1: Number Systems, Boolean algebra and Logic gates**

**Number Systems:** Introduction to decimal, binary Inter – Conversion. Addition, Subtraction, Multiplication and Division in binary Number system.

1's and 2's Complement method in binary number system. Subtraction using 1's and 2's compliment

**Boolean Algebra:** Laws of Boolean Algebra, Logic gates - AND gate, OR gate, NOT gate, NAND gate and NOR gate Logic symbol and truth table

De – Morgan's theorem, simplification of Boolean expressions. Logic circuit for Boolean expressions and vice versa.

Universal gates - NAND gate and NOR gate.

### **Unit 2: Logic circuit and Memories**

**Combinational logic circuit:** Half adder, Full adder, half subtractor, Full subtractor.

**Sequential logic circuit:** Flip – flop: RS, D, JK, and T flip - flop.

**Shift registers:** SIPO, SISO, PISO and PIPO.

**Digital computer:** Block diagram of digital computer and function of each block.

**Semiconductor Memories:** Idea of different types of semiconductor memories (RAM, ROM, PROM, EPROM and EEPROM).

## **L6 – Sem 4 – GC – Computer Science:**

Section – A

Unit 1:

Classes in Python: Introduction, Namespaces, Scope Rules, LEGB Rule, Defining Classes, Importance of self, Class Attributes v/s Instance Attributes, Instances attributes, Adding methods dynamically, Accessing Attributes and methods, Accessing Methods, Built in class attributes, Private Members - Limited Support, Data Hiding, Static methods, Destroying Objects (Garbage Collection) Inheritance: Introduction, types of Inheritance, Method-I- By using super() function, Method-II- By using name of the super class, Multiple Inheritance, Overriding Methods, Abstract Methods,

Unit 2:

Linear List Manipulation- Data Structures, Implementation of List in memory, Sequential Memory Allocation, List Operations, Traversal in a List, Insertion of an element in a sorted list, Searching Techniques, Sorting a list.

Stacks and Queues in List: Stack , Push operation, Pop operation, Traversal in a stack, Expression- Conversion of an infix expression to postfix expression, Evaluation of Postfix Expression

Queue- Queue operations,

Data File Handling: Introduction, File access modes:

Exception Handling & Generator Functions: Generator Functions, Advantages of using generator

**Reference Books:**

Beginning Programming with Python for Dummies by stef Maruch & Aahz Maruch.

**Semester 5**  
**Certificate – Level 7 – Live Action Director(A)**

**Vocational Content**

**MES / N 1301 (Evaluate production concepts and ideas)**

**SECTION A**

**Unit-I:** Film as a Storytelling Device- The history of Storytelling - Plays vs. novels vs. film - What is a “story”? - The “idea” vs. “story” vs. “screenplay”. Structure of Screen play

**Unit -II:** The three act screenplay - The scene - Plot points. Script writing formats - Master Scene script format - Split page format – Fiction Script writing - Dramatic structure - Nonfiction forms and formats-Characterization

**Unit- III:** Narrative, tone, contrast, coincidence, Surprise, Suspense, tension techniques. Nature of protagonists, antagonists. Genres of screenplays. Principles of Characterisation.

**Unit-IV** Director’s preparation. Directors role in film. Introduction to scene study and staging. Beats, fulcrum, dramatic blocks. Scene analysis. Art direction - location - floor management - out- doors and indoors.

**Unit-V:** Planning - pre-production- Concept, Story development - Casting, Locations, Financing. Production –Shooting, Direction and Cinematography. Distribution and Exhibition.

**References:**

- ✓ Writing the Script by Wells Root ,Jan 15, 1980
- ✓ Secrets of Film Writing by Tom Lazarus Jun 2, 2001

✓ Arora: Encyclopedia of Indian Cinema

## **SECTION B**

### **Exercises**

- 1. Story Development (Conceptualization)**
- 2. Script Improvisation (Shooting Script)**
- 3. Casting and Team building**
- 4. Location Scouting**
- 5. Working out the finance**
- 6. Presentation of full production planning(by PPT)**

## **MES / N 1302 (Sourcing financiers)**

### **SECTION A**

**UNIT 1: Film business:** distribution and exhibition of films - the basic mechanism of distribution and its relationship to various exhibition platforms. How the entrepreneurship of production relates to the distribution and exhibition.

**UNIT 2: Publicity platforms:** the who's/when/how's of publicity and a brief exposition of the various platforms available now.

**Certification:** a brief history and the current structure of central board of film certification. The procedure to go about film certification in India.

**UNIT 3:** Organizational structure of indian film industry: an overview of the different bodies that regulate and monitor the various constituents directly involved in making and marketing of films in india.

Budgeting for different types of films: relationship between budget, cost and time frame.

### **SECTION B**

#### **Producing practical:**

location study: creative/logistics, script breakdown, mix-n-match

Budget top sheet, scheduling & call sheet preparation.

## **MES / N 1303 (Conceptualise the creative vision)**

### **SECTION A**

**Unit I:** Vision and visualisation - The social conditions and effects of visual objects. Visual culture. Critical visual methodology- Metaphor and metonymy – codes – semiology of the television medium

**Unit II:** An introduction to compositional interpretation - Colour - Spatial organization – Light - Expressive content- the Oedipus complex – id, ego, super ego – symbols – defence mechanisms – Dreams – Aggression and guilt – psychoanalytic analysis of the media

**Unit III:** Cultural analysis of visual – semiotics, denotation, connotation and iconography.

**Unit IV:** Analysis of film and television – six levels of analysis - psychoanalytic understanding of visual images.

**Unit V:** Selling magic – Breaking the advertising code – commercials and anxiety – Laconian gaze: other ways of seeing -Laura Mulvey and visual pleasure.

## **SECTION B**

**Practical Assignment:** Actuality - field trip and writing observation report, and write a short film script on its basis. Produce photos of trip.

### **References:**

- ✓ Media Analysis Techniques, Arthur Asa Berger, SAGE Publications, New Delhi, 1976
- ✓ Visual Methodologies, Gillian Rose, SAGE Publications, New Delhi, 2001
- ✓ Mythologies, Paladin. Barthes, R. London, 1973
- ✓ Techniques of interpretation, Dallas J.R.Ewing. SAGE Publication, New Delhi.

## **MES / N 1304 (Communicate requirements to the team)**

### **SECTION A**

**Unit I:** Introduction to Communication: Purpose of Communication; Process of Communication; Importance of Communication in Business; Differences between Technical and General Communication; Barriers to Communication; Measures to Overcome the Barriers to Communication.

**Unit 2:** Types of Communication: Types of Communication; Verbal Communication- Importance of verbal communication- Advantages of verbal communication- Advantages of written communication; Significance of Non-verbal Communication  
**Listening Skills:** Listening Process; Classification of Listening; Purpose of Listening; Common Barriers to the Listening Process; Measures to Improve Listening; Listening as an Important Skill in Work Place.

**Unit 3:** Language for Communication: Language and Communication; General Principles of Writing; Improving Writing Skills, Essentials of good style, Expressions and words to be avoided; Grammar and Usage

**Unit 4:** Communication in Organizations: Internal Communication; Stake Holders in Internal Communication; Channels of Internal Communication; External

Communication; Stake Holders in External Communication; Channels of External Communication.

Communication Network: Scope and Types of Communication Network; Formal and Informal Communication Network; Upward Communication; Downward Communication; Horizontal Communication; Diagonal Communication.

### **SECTION B:**

Practical Assignment:

1. Reading Skills: Reading Skill; Purpose of Reading; Types of Reading; Techniques for Effective Reading.

2. Team Co-ordination: Create small teams of students and assign them in different production role and ask them to prepare a PPT of there production planning.

## **Semester 5** **General Content**

### **L7 – Sem 5 – GC – Advertising-Concepts and Principles:**

#### **Section – A**

**Unit I:** Advertising - Definition, Nature, scope, Origin and Growth. Roles of advertising:

Social, Communication, Marketing and Economic.

**Unit II:** Functions of advertising. - Advertising in marketing mix - Types of advertising - merits and demerits - advertising and consumers - buying systems - target plans.

**Unit III:** Advertising objectives - Advertising campaign. Conceptualization of Advertising for TV, Radio and Print. Copy, Slogans and Writings.

Media planning - developing media objectives - media budget - selection of media - implementing media plans - pre-testing and launch.

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**Unit IV:** PR Definition, Elements of PR – functions of PR – Need of PR – Growth of PR in India, - Publicity, propaganda and public opinion Corporate Communication with the public – internal and external - Community Relations.

**Unit V:** Advertising agencies, Luminaries of Advertising, Advertising Ethics. Corporate Social Responsibilities and Advertising case studies.

### **SECTION B:**

Practical Exercise: Each Student Should Choose a product and have to Create

1. Print Ad
2. Flier
3. Poster
4. Handouts

- 5. CD Cover
- 6. Ad video

Reference:

- ✓ Advertising Basics Bovell Michael Newman Wiley, Creative Leaps(Reference), John Wiley & Sons (Asia), 2003
- ✓ Innovative Promotions That Work, Lisa I.Cyr, Rock Port Publishers, 2006.
- ✓ Mass Media, Anmol Publications Pvt Ltd., J.L Kumar, New Delhi.2006
- ✓ The Public Relations, 2nd Edition, Alison Theaker, Routledge, USA, 2004
- ✓ Public Relations: Theory and Practice, Jane Johnston, Clara Zawawi, Allen & Unwin, 2009

**L7 – Sem 5 – GC – Photography and Cinematography:**

**Section – A**

**Unit I:** History of Photography, Painting and Photography, Types of Cameras – parts and functions of camera

**Unit II:** Lens and types of lenses for photography - Short, medium and long focal lengths. Exposure – Focusing, aperture, shutter speed, depth of field. Points of View, Composition and perspectives.

**Unit III:** Kinds of light- indoor and outdoor - Electronic flash and artificial lights. Capturing Colours. Light meters. Accessories and equipments for photography. Aesthetics and Technology.

**Unit IV:** Photo journalism – Basics of News Photography, specialization of Photography - Nature – Wild life – everyday life - People and places - Sports - Advertising - object photography.

**Unit V:** Ethical issues in Photography – Codes of Ethics for photographers. Tragedy image, digital improvements, privacy, moral rights of subjects etc., – Basic software of Photo Editing tools.

**SECTION B:**

**Practical Assignments:**

1. Intro to DSLR
2. Portrait Photography
3. Landscape Photography
4. Rule of third
5. Shot Composition
6. Camera moments

**Reference:**



- ✓ John hedgecoe's, New Introductory Photographic Course, Mitchell Beazley, 1990
- ✓ , 35mm Photographers Handbook, Pan Macmillan, Julian Clader, John Garrelt 1990
- ✓ Richard Newman, How to take great Photographs at Night, Collins Brown, 2003
- ✓ Photo-Journalism, Terry Hope Rotovision SA, 2001
- ✓ Lighting for Portrait Photography, Steve Bavister, Rotovision SA, 2001
- ✓ Roger Hicks & Francis Schultz, Darkroom basics and beyond, Patterson, 2000

## **L7 – Sem 5 – GC – Introduction to television broadcasting:**

### **Section – A**

**Unit I:** Origin and Development of Electronic Journalism – Broadcasting System UK, US and other developed and Third World Nations – Comparison.

**Unit II:** Indian Broadcasting Policy – Major recommendations of committees and working groups – Prasar Bharathi Bill – Question of autonomy.

**Unit III:** Planning and Production of TV, Radio Programmes – General and Special audience Programmes – Principles of writing for radio – Language – Different formats of radio programmes – Features, Debate, Talks, Drama, Interview etc.,

**Unit IV:** Planning and Production of TV Programmes – TV crews – Writing for TV –

Visualization – Anatomy of News Cast & News Gathering – Various Programmes – General and Special Audience Programmes - Various formats of TV Programmes – ETV – News, Soaps, Epics, Sports, Talk Shows etc., - TV Commercials – Sponsors – TV News Agencies – Private Channels.

**Semester 6**  
**Certificate – Level 7 – Live Action Director(B)**

**Vocational Content**

**L7 - Sem 6 – SC - MES / N 1305 (Direct the production process)**

**SECTION A**

**Unit I: Direction** : Role of a contemporary director, screen grammar, spatial connections, temporal connections, mise-en-scene.

**Unit II:** Principles of film, narrative form, non-narrative films, dividing a feature film into parts and Genres.

**Unit III:** Planning, pre-production- Concept / Story development, Scripting / Screen play writing, Budgeting, Casting – Locations - Financing.

**Unit IV:** Basics of mise-en-scene. Space and time, narrative aspect of mise-en-scene. Cinematographer – set properties - composition, duration of the shot, scene and sequences.

**Unit V:** Production – Shooting – Shots and scenes. Direction & Cinematography. Post production- Editing, Editing Equipments Sound recording, Dubbing, Special effects, Graphics & final editing.

**Unit V:** Architecture of the film's style and plot patterning, Codified formal system of narration devices. Ideological Constraints.

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**SECTION B:**

Practical Assignment: Students should Submit a Short Film or a Documentary of 5

Minutes  
in team or individually.

### References

- ✓ The Cinema of India(1896-2000), Thoraval, Yves(2000)
- ✓ The Subject of Cinema, Roberge, Gaston
- ✓ Films for an ecology of Mind, Roberge, Gaston (1977):
- ✓ Encyclopedia of indian Cinema, Arora.

## **L7 - Sem 6 – SC - MES / N 1307 (Direct the post-production process)**

### **SECTION A**

**Unit I: Direction :** Role of a contemporary director, screen grammar, spatial connections, temporal connections, mise-en-scene.

**UNIT II :** Bird's-eye view of the modern editing process and modern editing terminology

Principles of Video Editing: Various principles of Editing like Contrast, Parallelism, Symbolism, Simultaneity Continuity, Making an edit invisible, Motivation for every edit, Delivering a message, Bearing audio in mind, editing is creating, Control of Overuse technique or Visual effects.

Editing setup:-efficient editing habit, factory-standard systems to support the editing process

Non-Linear Editing (NLE) Concept.

The Three-Point Edit: Understanding Three-Point Editing, Overview of the Three-Point Editing Process, Different Ways to Do Three-Point Editing.

Working in the Timeline / Transitions / Key framing / Applying Filters / NLE

Compositing / ColorCorrection & Color Grading / Titling / Final Review &Project.

**UNIT III:** Stabilizing a Shot , Controlling shaky video, Cropping the borders efficiently, Analysing and Tracking a Point in the footage, The Tracker Panel & Motion Tracker Options, Corner Pin Tracking, Exporting Track data, Introduction to Masks, Animating Masks, Working with Mask Interpolation, Basics of Rotoscopy, Analysing the shot for Rotoscopy, Using Masks for Position Key frames, Creating a Simple Rotoscopic Animation.

**UNIT IV:** Introduction to Particle Playground, Filters, Plugins, Understanding the Gravity, Mass, Vortex, Turbulance, Color, Fields etc.

Animating the Emitter, Key frame animation, Path Animation, Basic expressions, BASIC COMPOSITING, Applying Layer Blending Modes, Creating a Track Matte,

Keying & Key light, Compound Effects: Gradient Wipe Displacement Map, Wave World & Caustics, Pre-composing & Nesting.

## **SECTION B:**

Practical Assignment :

1. Arrange the previously shot Rushes in Sequence (Rough cut 1)
2. Dubbing the audio (Recording the audio)
3. Aligning the audio with the Rushes (Rough Cut 2)
4. Compositing the Shots
5. Match moving
6. Finalizing the Edit and Adding Title Card and Credits
7. Rendering the Edit (Exporting)

## **Reference Books:**

1. Eve Light Honthaner, "The Complete film Production Handbook, Volume 1", Focal Press Publications, 2001, 3rd Illustrated Edition.
2. Adele Droblas and Seth Greenbeg, "Adobe Premiere Pro 2 Bible (W/ Cd)", Wiley – India Publications, 2007 Edition.
3. J. J. Marshall and Zed Saeed, "After Effects 5 Bible", John Wiley and Sons Publication, 2002.

## **L7 - Sem 6 – SC - MES / N 1 308 (Manage the production's marketing and release)**

### **SECTION A**

**Unit I:** Concept of Brand: Introduction, Role of brand, Advantages of Branding, Core Values of Brand. Brand Equity: Concept, Brand elements. Principles of Branding, Communication Mix Strategy. Brand Media: Communication Channels and techniques, Advertising, Brand Perception.

**UNIT II:** Role of media, selection of media for advertising, formulation of message, art of copywriting. Branding and packaging strategies: Brand equity, image and personality, packaging decisions, perceptual mapping of customers, control aspects of advertising, advertising budget.

**UNIT III:** Strategic marketing- GAP analysis, Porter's five force model, Ansoff's matrix, SWOT analysis, customer relation management.

### **SECTION B:**

Practical Assignment:

Attend a Film Launch event and write a brief Note on it with Photographic reference.

### **MES / N 0104 - Maintain workplace health and safety**

#### Section – A

Understand and comply with the organization's current health, safety and security policies and procedures

Understand the safe working practices pertaining to own occupation. Understand the government norms and policies relating to health and safety including emergency procedures for illness, accidents, fires or others which may involve evacuation of the premises. Participate in organization health and safety knowledge sessions and drills

#### Section – B

1. Identify the people responsible for health and safety in the workplace, including those to contact in case of an emergency.
2. Identify security signals e.g. fire alarms and places such as staircases, fire warden stations, first aid and medical rooms.
3. Identify aspects of your workplace that could cause potential risk to own and others health and safety.
4. Ensure own personal health and safety, and that of others in the workplace through precautionary measures.
5. Identify and recommend opportunities for improving health, safety, and security to the designated person.
6. Report any hazards outside the individual's authority to the relevant person in line with organisational procedures and warn other people who may be affected.
7. Follow organisation's emergency procedures for accidents, fires or any other natural calamity in case of a hazard.
8. Identify and correct risks like illness, accidents, fires or any other natural calamity safely and within the limits of individual's authority.

## **Semester 6** **General Content**

### **L7 – Sem 6 – GC – Film Aesthetics and appreciation:**

#### **Section – A**

**Unit I:** Introduction - Genres of films – Film History - language, style, grammar, syntax. Film perception: levels of understanding – Film as a medium: Development of cinema as a medium of art and communication.

**Unit II:** Understanding basic elements of Film: Aesthetics, Acting, Costume, Music Cinematography, Mise-en scene, Sound, Editing, Visual Effects and roles of artists. Film and Meaning.

**Unit-III:** Classic Film theory and semiotics – Sociology of films - film language - film and psycho – analysis. Post Modernism and structuralism and deconstruction. Post Colonial theory. Impressionism, expressionism, and surrealism - Subjectivity, causality and time and various schools of thoughts.

**Unit-IV:** Concepts of films – identities and issues - narrative form - non-narrative form- Film style: French New Wave, Soviet Montage Cinema, Asian Cinema.

**Unit- V:** Indian Classic Cinema. Indian Luminaries of Film and their films. Trend setters. Tamil Cinema and trends - Impact in politics, culture and economy. Film and post modernism - Film and cultural identity: Criticism and Film Review Writing.

#### **Section – B**

Practical Assignment: Students must watch select a genre and watch at least 10 movies of that genre and rank them from 1 to 10 with a brief note.

**References:**

- ✓ Indian Film, Eric Baranenn & Krishnaswamy OVP, 1980 2nd Edition
- ✓ How films are made, Khwaja Ahemad Abbas, National Book Trust, 1977
- ✓ Film as an art and appreciation, Maric Setton, NCERT, New Delhi
- ✓ Cinematography Censorship rules, Govt. of India Press, Nasik, 1969

**L7 – Sem 6 – GC – Introduction to modern media:****Section – A**

**Unit I:** Communication – Technology – Genesis – Application of Scientific Advancements – Electronic Revolution – Elementary Idea and about Electronic Devices – Valves – Transmitters, Integrated Circuits etc., Amplifiers – Oscillators – Modulators – Antenna etc.,

**Unit II:** Basic Block Diagram of Telecommunication Systems – Telegraphy – Telephone Exchange – Fax etc., - Telecommunication Networks – Policies.

**Unit III:** Principles of Radio Communication – Working of Radio Transmitters and Receivers  
Elements of Radio Transmitters – Receivers – FM / AM Radio Systems – Narrowcasting.

**Unit IV:** Printing Technology – Type Faces – Fonts – Point System – Method of Composing Machine, Photo, Computers – VDT – DTP – Printing Methods – Traditional and Modern Methods of Electronic Scanners – Laser Printers – Facsimile.

**Unit V:** Computers – Digital – Computer Networks – E-Mail – Teleconferencing – Internet  
Optical Fiber – Interactive Video – CD ROM – Transponder Data Flows – New Communication Technologies and Social Implications, Social Media, Blogging, Micro Blogging. Etc.,

**SECTION B:**

Practical Assignment:

Each student should create a Blog and a YouTube Channel.

## Reference Books

1. Asok Mitra, Information Imbalance in Asia – AMIC, 1978.
2. Binod C. Agarwal, SITE INSAT.
3. Everett M. Rogers, Communication Technology, The New Media in Society.
4. Everett M. Rogers & Others, India's Information Revolution, Sage Publication, New Delhi, 1986.

## **L7 – Sem 6 – GC – Media Ethics, Laws And Censorship:**

### **Section – A**

**Unit I:** Nature and Principles of Constitution of India (a) Fundamental Rights (b) Rights to Information (c) Freedom of Expression (d) and Freedom of Press in various political setup (i) in Capitalistic (ii) in socialistic Countries (iii) India before and after Independence.

**Unit II:** Constitutional restrictions on Media – Privileges of Media Personnel – The Indian Penal Code, Indian Evidence Act – Libel – Slander – Defamation – Contempt of Court. The Press Registration of Books Act 1867 – Copy Right Act – Periodical Changes – Post and Telegraphy Act – Official Secrets Act of 1923.

**Unit III:** Press Council – Working Journalists Act – MRPTC (Monopolies and Restrictive Trade Practice Commission) – Industrial Dispute Act – Incident Representation of Women Act of 1989. Rights and Abilities of the Editor, Printer and Publisher – Editorial autonomy and Independence – Government Information Services and their controls – PIB.

**Unit IV:** Code of Ethics in Different media – Morality of the Press and Cinema as Private Sectors - Radio and TV as States owned – Public utility undertakings. Evolution of code of ethics for media – Historical Perspectives & details.

**Unit V:** Freedom and Social Responsibility of Media - Tabloid Journalism – Investigative Journalism. Cable Media, its regulation and laws governing cable media – Internet as a media and the governing of rules of internet.

### **Reference Books**

1. Adhikari Gautam, Press Council, Press Institute of India, New Delhi.
2. Arun Bhattacharjee, The Indian Press, Profession to Industry, Vikas



- Publication,  
New Delhi, 1972.
3. Chatterjee P.C.,  
Broadcasting in India, Sage Publication, New Delhi, 1988.
  4. Christians K. Rozeth  
Media Ethics, Cases and Moral Reasoning, Longmans,  
New York/ London, 1987.
  5. Clement J. Jones,  
Mass Media, Code of Ethics and Councils.
  6. Durga Das Basu  
Laws of the Press in India, Joy Print Pack Pvt.  
Ltd, New Delhi, 1986.

**JSS MAHAVIDYAPEETHA**



**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**

(An Autonomous College of University of Mysore)  
B.N. ROAD, MYSURU-570 025 KARNATAKA

**B.Sc. (Honors) Degree Programme in Chemistry**

**NATIONAL EDUCATION POLICY  
(NEP) – 2020**

**CHOICE BASED CREDIT SYSTEM  
(CBCS) WITH MULTIPLE  
ENTRY AND EXIT OPTIONS**

**wef 2022-2023**

**SYLLABUS**



**B.Sc Programme Syllabus**  
**Syllabi and guide lines for B.Sc., Programme under NEP Scheme**  
**to be implemented in the Department of Chemistry**  
**wef 2021-2022**

**Course – Physics/ Chemistry (PC)**

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No. of credits			Total credits	Total hours		Maximum marks in theory exam	Continuous Assessment						Total	
						L	T	P		Th	Pr		Theory			Practicals				
													C1		C2		C1	C2		
													Test	Assignment	Test	Assignment/Seminar		Test		Test
I B.Sc	I	DSC-1 Theory	FSA 42031	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-1 Practicals	FSA 42031	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-1 (Open Elective)		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSC-2-Theory	FSB 42031	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-2 Practicals	FSB 42031	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-2 (Open Elective)		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

**Syllabi and guide lines for B.Sc., Programme under NEP Scheme  
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wef 2021-2022**

**Course –Chemistry/ Bio-technology (CBt)**

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No. of credits			Total credits	Total hours		Maximum marks in theory exam	Continuous Assessment						Total	
						L	T	P		Th	Pr		Theory			Practicals				
													C1		C2	C1		C2		
													Test	Assignment	Test	Assignment/Seminar	Test	Test		Record
I B.Sc	I	DSC-1 Theory	FSA 42037	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-1 Practicals	FSA 42037	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-1 (Open Elective)		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSC-2-Theory	FSB 42037	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-2 Practicals	FSB 42037	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-2 (Open Elective)		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

**B.Sc Programme Syllabus  
Syllabi and guide lines for B.Sc., Programme under NEP Scheme**

**to be implemented in the Department of Chemistry  
wef 2021-2022**

**Course –Chemistry/ Zoology (CZ)**

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No. of credits			Total credits	Total hours		Maximum marks in theory exam	Continuous Assessment						Total	
						L	T	P		Th	Pr		Theory			Practicals				
													C1		C2	C1	C2			
													Test	Assignment	Test	Assignment/ Seminar	Test	Test		Record
I B.Sc	I	DSC-1 Theory	FSA 42038	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-1 Practicals	FSA 42038	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-1 (Open Elective)		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSC-2-Theory	FSB 42038	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-2 Practicals	FSB 42038	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-2 (Open Elective)		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

**Syllabi and guide lines for B.Sc., Programme under NEP Scheme  
to be implemented in the Department(wef 2022-2023)**

**Physics, Chemistry**

**B.Sc Programme Syllabus**

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment							Total
						L	T	P		Th	Pr		Theory				Practicals			
													C <sub>1</sub>		C <sub>2</sub>		C <sub>1</sub>	C <sub>2</sub>	Record	
													Test	Assessment	Test	Assessment	Test	Test		
I BSc	I	DSC-1 Theory	FSA42031	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-1 Practicals		Chemistry-DSC-1 Lab																
		OE-1		Chemistry in daily life								03	3	-	-	03			60	10
I BSc	II	DSC-2 Theory	FSB42031	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-2 Practicals		Chemistry-DSC-2 Lab																
		OE-2		Molecules of life								03	3	-	-	03			60	10
II BSc	III	DSC-3 Theory	FSC42031	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-3 Practicals		Chemistry-DSC-3 Lab																
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry								03	3	-	-	03			60	10
II BSc	IV	DSC-4 Theory	FSD42031	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-4 Practicals		Chemistry-DSC-4 Lab																
		OE-4		Electrochemistry, corrosion and metallurgy								03	3	-	-	03			60	10

**Syllabi and guide lines for B.Sc., Programme under NEP Scheme  
to be implemented in the Department(wef 2022-2023)**

**Chemistry, Biotechnology**

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment						Total	
						L	T	P		Th	Pr		Theory		Practicals					
													C <sub>1</sub>	C <sub>2</sub>	C <sub>1</sub>	C <sub>2</sub>				
						Test	Assessment	Test		Assessment	Test		Test	Record						
I BSc	I	DSC-1 Theory	FSA42037	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-1 Practicals		Chemistry-DSC-1 Lab																25
		OE-1		Chemistry in daily life								03	3	-	-	03			60	10
I BSc	II	DSC-2 Theory	FSB42037	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-2 Practicals		Chemistry-DSC-2 Lab																25
		OE-2		Molecules of life								03	3	-	-	03			60	10
II BSc	III	DSC-3 Theory	FSC42037	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-3 Practicals		Chemistry-DSC-3 Lab																25
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry								03	3	-	-	03			60	10
II BSc	IV	DSC-4 Theory	FSD42037	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-4 Practicals		Chemistry-DSC-4 Lab																25
		OE-4		Electrochemistry, corrosion and metallurgy								03	3	-	-	03			60	10



**B.Sc Programme Syllabus**  
**Syllabi and guide lines for B.Sc., Programme under NEP Scheme**  
**to be implemented in the Department(wef 2022-2023)**

**Chemistry, Zoology**

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment						Total	
						L	T	P		Th	Pr		Theory		Practicals					
													C <sub>1</sub>	C <sub>2</sub>	C <sub>1</sub>	C <sub>2</sub>				
						Test	Assessment	Test		Assessment	Test		Test	Record						
I BSc	I	DSC-1 Theory	FSA42038	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-1 Practicals		Chemistry-DSC-1 Lab																25
		OE-1		Chemistry in daily life	03	3	-	-	32			60	10	10	10	10	-	-	-	100
I BSc	II	DSC-2 Theory	FSB42038	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-2 Practicals		Chemistry-DSC-2 Lab																25
		OE-2		Molecules of life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	III	DSC-3 Theory	FSC42038	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-3 Practicals		Chemistry-DSC-3 Lab																25
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	IV	DSC-4 Theory	FSD42038	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-4 Practicals		Chemistry-DSC-4 Lab																25
		OE-4		Electrochemistry, corrosion and metallurgy	03	3	-	-	03			60	10	10	10	10	-	-	-	100

**B.Sc Programme Syllabus**  
**Syllabi and guide lines for B.Sc., Programme under NEP Scheme**  
**to be implemented in the Department(WEF 2022-2023)**

**Chemistry, Botany**

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment						Total			
						L	T	P		Th	Pr		Theory			Practicals						
													C <sub>1</sub>	C <sub>2</sub>		C <sub>1</sub>	C <sub>2</sub>			Record		
													Test	Assessment	Test	Assessment	Test	Test				
I BSc	I	DSC-1 Theory	FSA42043	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100		
		DSC-1 Practicals		Chemistry-DSC-1 Lab																	25	50
		OE-1		Chemistry in daily life																	03	3
I BSc	II	DSC-2 Theory	FSB42043	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100		
		DSC-2 Practicals		Chemistry-DSC-2 Lab																	25	50
		OE-2		Molecules of life																	03	3
II BSc	III	DSC-3 Theory	FSC42043	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100		
		DSC-3 Practicals		Chemistry-DSC-3 Lab																	25	50
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry																	03	3
II BSc	IV	DSC-4 Theory	FSD42043	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100		
		DSC-4 Practicals		Chemistry-DSC-4 Lab																	25	50
		OE-4		Electrochemistry, corrosion and metallurgy																	03	3

## **Program Outcomes:**

**By the end of the program the students will be able to:**

**(Refer to literature on outcome-based education (OBE) for details on Program Outcomes)**

1. **PO. 1:** To create enthusiasm among students for chemistry and its application in various fields of life.
2. **PO. 2:** To provide students with broad and balanced knowledge and understanding of key concepts in chemistry
3. **PO. 3:** To develop in students a range of practical skills so that they can understand and assess risks and work safely measures to be followed in the laboratory.
4. **PO. 4:** To develop in students the ability to apply standard methodology to the solution of problems in chemistry
5. **PO. 5:** To provide students with knowledge and skill towards employment or higher education in Analytical chemistry or multi-disciplinary areas involving chemistry.
6. **PO.6:** To provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes and to cater to the demands of chemical Industries of well-trained graduates
7. **PO. 7:** To develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
8. **PO. 8:** To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible work ethics.

**Details of the B.Sc (Honors) degree programme in Chemistry**

Semester	Course Type								DSE			OE							
	DSC																		
	THEORY	L	T	P	PRACTICALS	L	T	P		L	T	P	L	T	p				
I	A1	4	0	0	P-1	0	0	2					3	0	0				
II	A2	4	0	0	P-2	0	0	2					3	0	0				
III	A3	4	0	0	P-3	0	0	2					3	0	0				
IV	A4	4	0	0	P-4	0	0	2					3	0	0				
V	A5	3	0	0	P-5	0	0	2	A1	3	0	0							
	A6	3	0	2	P-6	0	0	2											
VI	A7	3	0	0	P-7	0	0	2	A2	3	0	0							
	A8	3	0	0	P-8	0	0	2											
VII	A9	3	0	0	P9	0	0	2	A3	3	0	0							
	A10	3	0	0	P10	0	0	2								RESEARCH METHADODOLOGY	3	0	0
	A11	4	0	0															
VIII	A12	4	0	0					A4	3	0	0							
	A13	4	0	0				PROJECT								0	0	6	
	A14	3	0	0															
TOTAL CREDITS	69								21										

**DSC:** DISCIPLINESPECIFICCOURSE

**OE:** OPENELECTIVE.

**DSE:** DISCIPLINESPECIFICELECTIVE

**L : T : P** = Lecture : Tutorial :Practical

## GENERAL REQUIREMENTS AND OTHER INFORMATIONS.

### Scheme of Instructions

1. **Title and Commencement:** As per the university guidelines (12 Ref.letterUA2/379/2016-17).

2. Undergraduate programme offered with multiple entry and exit options

Faculty of Science–

Certificate – 2 semesters

Diploma– 4semesters

Bachelor of Science (B.Sc. 6 Semesters)

Bachelor of Science. Honors (B.Sc.Hons, 8 Semesters)

3. **Semester and Programme Structure:**

The credit pattern for the course is L:P

3. **Subject Combinations:** As per the university guidelines (Ref. letterUA2/379/2016-17).

4. **Eligibility for Admission.**

For B.Sc program only those students who have completed PUC with chemistry or its equivalent examination with science subjects are eligible.

5. **Medium of Instruction:** The medium of instruction shall be English/Kannada.

6. **Scheme of the Program:** As per the university guidelines (Ref.letterUA2/379/2016-17).

7. **Course Registration:** As per the university guidelines (9.1 to 9.6 Ref.letterUA2/379/2016-17).

8. **Attendance:** As per the university guidelines (10.1 and 10.2 Ref.letterUA2/379/2016-17)

9. **Valuation:** As per the university guidelines (Ref.letterAC2(S)/151/2021-22, dated 18/08/2021

10. If the student has passed in the practical exam by securing prescribed marks need not reappear for the practical exam if he/she has failed in the theory exam.

11. **Passing Criteria**

A student is considered to have passed the course, only on securing a minimum of 40% from internal assessment and end examination marks put together.

A student can take end exam irrespective of the marks scored in internal assessment of a particular course

In case a student secures less than 30% in end exam or absent for end examination, the student is said to have not completed the course. The student shall complete the course by reappearing only the end examination conducted by the university.

Makeup examination: As per the university guidelines (16. Ref. letterUA2/379/2016-17).

**Percentage and Grading:** As per the university guidelines (17 Ref. letter UA2/379/2016-17). **18 to 22.** As per the university guidelines (Ref. letterUA2/379/2016-17)

**Scheme of Examination for DSC 1 and 2  
(I and II Semester)**

Credits L : P		Theory	Practical	Maximum marks
4 : 0	<b>Internal assessment</b>	<b>40</b> C1 = 10 + 10 =20 C2= 10 + 10 =20 (test and assignment)	<b>25</b> C1= 10 C2 =10 + Record 5	
0 : 2	<b>Summative Assessment</b>	<b>60</b> (C3)	<b>25</b>	
Duration of the end examination		2 hours	4 hours	
		<b>100</b>	<b>50</b>	<b>150</b>

**Examination and Evaluation**

**Question paper pattern for DSC 1 and 2  
(I and II Semester)**

<b>Duration:</b> 2 hours		<b>Max. Marks:</b> 60
<b>The question paper contains 3 parts</b>		
Part-A	Answer any 6 out of 8 questions <b>(two questions from each unit)</b>	6 X 2 = 12
Part-B (Inorganic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-C (Organic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-D (Physical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-E (Analytical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
<b>Pattern:</b> (3 + 3) / (4 + 2)/(2+2+2)		

### Scheme of Examination for Open elective

Credits L : P	Theory	Maximum marks
3: 0	Internal assessment	<b>40</b> C1 = 10 + 10 = 20 C2 = 10 + 10 = 20 (test and assignment)
	Summative assessment	<b>60</b> (C3)
Duration of the end examination		2 hours
		100

### Question paper pattern for Open elective (I to IV Semester)

<b>Duration:</b> 2 hours		<b>Max. Marks:</b> 60
<b>The question paper contains 2 parts</b>		
Part-A	Answer any 6 out of 8 questions	6 X 2 = 12
Part-B	Answer any 8 out of 10 questions	8 x 6 = 48
<b>Pattern: Pattern: (3 + 3) / (4 + 2)/(2+2+2)</b>		

## I SEMESTER

### DSC-1: Chemistry-1

**CLASS DURATION – THEORY: 04 HOURS/WEEK**

**Theory and Practicals: Total Credits-06 (Theory-04, Practicals-02)**

#### **UNIT –I – Analytical chemistry**

Language of analytical chemistry: Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range).

Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient (R<sup>2</sup>).

Numerical problems

Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling (solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

#### **UNIT-II: Inorganic Chemistry**

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of  $\psi$  and  $\psi^2$ . Quantum numbers and their significance.

Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations- Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect, Slater's rules. Variation of effective nuclear charge in Periodic Table. **[14Hours]**

#### **UNIT-II: Organic Chemistry**

Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules, Influence of hybridization on bond properties.

Nature of bonding in Organic molecules

Formation of Covalent bond, Types of chemical bonding, localized and delocalized, conjugation and cross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect, Resonance and Hyper conjugation, cross conjugation explanation with examples. Concept of resonance, aromaticity, Huckel rule, anti-aromaticity explanation with examples. Strengths of Organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and Benzoic acid. Steric effect- Relative stability of trans and cis-2-butene.



## Mechanisms of Organic Reactions

Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking- homolytic and heterolytic. Types of reagents- Electrophiles, nucleophiles, nucleophilicity and basicity. Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples.

Chemistry of Aliphatic hydrocarbons, Carbon-Carbon Sigma bonds

Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitution, Halogenation- relative reactivity and selectivity

Carbon-carbon pi bonds

Formation of alkenes and alkynes by elimination reaction. Mechanism of E1, E2, E1cb reaction. Saytzeff and Hofmann eliminations. Addition of HBr to propene, Free radical addition of HBr to propene.

Addition of halogens to alkenes- carbocation and halonium ion mechanism. Stereospecificity of halogen addition. Ozonolysis mechanism - ozonolysis of propene. Addition of hydrogen halides to alkenes, mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes, explanation with examples, 1,2 and 1,4- addition reactions in conjugated dienes. Diels-Alder reaction, Allylic and benzylic bromination and mechanism in propene, 1-butene, 1-toluene and ethylbenzene.

[14 hours]

## UNIT-III: Physical Chemistry

### Gaseous State

Elementary aspects of kinetic theory of gases, Ideal and real gases. Boyle temperature (derivation not required), Molecular velocity, collision frequency, collision diameter, Collision cross section, collision number and mean free path and coefficient of viscosity, calculation of  $\sigma$  and  $\eta$ , variation of viscosity with temperature and pressure.

Maxwell's Boltzmann distribution law of molecular velocities (Most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies. (Mathematical derivation not required), law of equipartition of energy.

Behaviour of real gases: Deviation from ideal gas behaviour. Compressibility factor (Z) and its variation with pressure for different gases. Causes of deviation from ideal behaviour, vander Waals equation of state (No derivation) and application in explaining real gas behaviour. Critical phenomena - Andrews isotherms of CO<sub>2</sub>, critical constants and their calculation from van der Waals equation, Continuity of states, Law of corresponding states. Numerical problems.

### Liquid State

**Surface Tension:** Definition and its determination using stalagmometer, effect of temperature and solute on surface tension

**Viscosity:** Definition, Coefficient of viscosity. Determination of viscosity of a liquid using Oswald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces.

**Refraction:** Specific and molar refraction- definition and advantages. Determination of refractive index by Abbe's Refractometer. Additive and constitutive properties.

**Parachor:** Definition, Atomic and structure parachor, Elucidation of structure of benzene and benzoquinone. Viscosity and molecular structure. Molar refraction and chemical constitution. Numerical Problems.

[14Hours]

**I Semester Practicals**  
**CHEMISTRY-DSC 1 LAB: 04HOURS/WEEK**

**Content of Practical Course 1: List of Experiments**

**PART-A Inorganic Chemistry**

1. Preparation of standard sodium carbonate solution and standardization of hydrochloric acid solution (methyl orange indicator). Estimation of sodium hydroxide present in the solution using phenolphthalein indicator.
2. Determination of carbonate and hydroxide present in a mixture.
3. Determination of oxalic acid and sodium oxalate in a given mixture using standard  $\text{KMnO}_4/\text{NaOH}$  solution
4. Estimation of ferrous and ferric iron in a given mixture using standard potassium dichromate solution
5. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of hydrogen peroxide present in the solution.
6. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of ferrous ammonium sulphate present in the solution.

**PART-B Organic Chemistry**

1. Preparation of acetanilide from aniline using  $\text{Zn}/\text{acetic acid}$  (Green method).
2. Synthesis of p-nitro acetanilide from acetanilide using nitrating mixture.
3. Bromination of acetanilide
4. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventional method)
5. Synthesis of diazoaminobenzene from aniline (conventional method).
6. Preparation of dibenzalacetone (Green method).

## LEARNING OUTCOMES / COURSE OUTCOMES

### Chemistry as Discipline Specific Course (DSC)

#### B.Sc. Semester – I

#### CHEMISTRY:1

- The concepts of chemical analysis, accuracy, precision and statistical data treatment
- Prepare the solutions after calculating the required quantity of salts in preparing the reagents/solutions and dilution of stock solution.
- Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their related problems.
- Quantum mechanics. Derivation of Schrodinger's wave equation. Radial and angular Orbital shapes of s, p, d and f atomic orbitals, nodal planes. Electronic configurations of the atoms.
- Pauli's exclusion principle, Hund's rule, Aufbau's principle and its limitation.
- The concepts of Organic reactions and techniques of writing the movement of electrons, bond breaking, bond forming
- The Concept of aromaticity, resonance, hyper conjugation, etc.
- Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity of amines.
- Understand basic concept of organic reaction mechanism, types of organic reactions.
- Understand the preparation and reactions of alkanes.
- Understand the stability and conformational analysis of cycloalkanes.
- Understand the concept of resonance, aromaticity and antiaromaticity.
- Describe relative strength of aliphatic and aromatic carboxylic acids.
- Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion
- Understand the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquid state.
- Understand the properties of liquids in terms of intermolecular attractions.
- Understand the existence of different states of matter in terms of balance between

intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion

- Understand the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquid state.
- Understand the properties of liquids in terms of intermolecular attractions.

### **CHEMISTRY LAB (volumetric (inorganic) and Organic preparations):P-1**

After studying this course and performing the experiments set in it student will be able to:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.
2. Explain the principles of acid-base, redox and iodometric titrations.
3. Work out the stoichiometric relations based on the reactions involved in the titrimetric analysis.
4. Describe the significance of organic quantitative analysis.
5. Understand the preparation of organic compounds involving addition, substitution, hydrolysis, diazotization and condensation reactions.

## II SEMESTER

### DSC-2: Chemistry-2

CLASS DURATION – THEORY: 04 HOURS/WEEK

Theory and Practicals: Total Credits-06 (Theory-04, Practicals-02)

#### **UNIT-I: Analytical Chemistry**

Titrimetric analysis: Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions. Normality, Molarity and Mole fraction. Use of  $N_1V_1 = N_2V_2$  formula, Preparation of ppm level solutions from source materials (salts), conversion factors.

Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity.

Complexometric titrimetry: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application-determination of hardness of water.

Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications.

Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.

Gravimetric Analysis: Requisites of precipitation, mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents, reagents used in gravimetry (8-hydroxy quinoline (oxine) and dimethyl glyoxime (DMG)).

Numerical problems on all the above aspects.

[14 hours]

#### **Unit – II Inorganic chemistry**

s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements:

(a) Atomic radii (van der Waals)

(b) Ionic and crystal radii.

(c) Covalent radii

(d) Ionization enthalpy, successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

(e) Electron gain enthalpy, trends of electron gain enthalpy.

(f) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity.

Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.

[14 hours]

#### **Unit – III Organic chemistry**

Nucleophilic substitution at saturated carbon. Mechanism of  $S_N1$  and  $S_N2$  reactions with suitable

examples. Energy profile diagrams, Stereochemistry and factors effecting SN1 and SN2 reactions. Aromatic Electrophilic substitution reactions, Mechanisms,  $\sigma$  and  $\pi$  complexes, Halogenation, Nitration, Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio. Aromatic nucleophilic substitution reaction: SNAr and Benzyne mechanism with suitable examples

[14 hours]

### **Unit – IV Physical Chemistry**

#### **Liquid Crystals**

Explanation, classification with examples- Smectic, nematic, cholesteric, discs shaped and polymeric. Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing.

#### **Solids**

Forms of solids: Unit cell and space lattice, anisotropy of crystals, size and shape of crystals, Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes. Miller indices and its calculation, X-Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals. Numerical problems.

#### **Distribution Law**

Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation. Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems.

[14 hours]

## **II Semester Practicals**

### **CHEMISTRY-DSC 2 LAB: 04HOURS/WEEK**

#### **Content of Practical Course 2: List of Experiments**

##### **PART-A Physical Chemistry**

1. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald's viscometer (Ethyl acetate, Toluene, Chloroform, Chlorobenzene or any other non-hazardous liquids)
2. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardous liquids)
3. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water & Sucrose)
4. Determination of partition/distribution coefficient - i) Acetic acid in water and cyclohexane. ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.

5. Determination of rate constant of decomposition of  $\text{H}_2\text{O}_2$  catalyzed by  $\text{FeCl}_3$
6. Determination of percentage composition of  $\text{NaCl}$  solution by determining miscibility temperature of phenol-water system.

### **PART-B Analytical Chemistry**

1. Determination of alkali present in soaps/detergents using standard  $\text{HCl}$
2. Determination of iron(II) using potassium dichromate
3. Determination of oxalic acid using standard potassium permanganate solution
4. Determination of hardness of water Standardized EDTA solution
5. Determination of alkali content in antacids using standard  $\text{HCl}$  solution.
6. Determination of chlorine in bleaching powder by iodometry (standard solution to be given)

### **LEARNING OUTCOMES / COURSE OUTCOMES**

#### **Chemistry as Discipline Specific Course (DSC)**

#### **B.Sc. Semester II**

#### **CHEMISTRY:2**

- Understand principles of titrimetric analysis.
- Understand principles of different types of titrations. Titration curves for all types of acids – base titrations.
- Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.
- Understand titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.
- Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.
- Understand periodic table, classification and properties of s p d and f block elements
- Understand different scales for the measurement of electro-negativity and factors affecting it.
- Understand the chemistry of the hydrides, carbides, oxides and halides of group 13 to 17
- Understand nucleophilic substitution at saturated carbon, energy profile diagram stereochemistry and factors affecting  $\text{S}_\text{N}^1$  and  $\text{S}_\text{N}^2$  reactions.
- Aromatic electrophilic substitution reactions like nitration sulphonation Friedel-Crafts reactions etc
- Understand liquid crystals, classification with examples
- Understand the different forms of solids, laws of crystallography, Miller indices and its calculation, X-ray diffraction studies. Bragg's law and its equation

- Defects in solids , properties of glasses and concept of liquidcrystals

### **CHEMISTRY LAB (volumetric (inorganic) and Organic preparations): P-1**

After studying this course and performing the experiments set in it student will be able to:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standardsolutions.
2. Explain the principles of acid-base, redox and iodometric titrations.
3. Describe the significance of inorganic quantitative analysis.
4. Determine of density followed by the determination of viscosity and surface tension of different liquidsamples.
5. Determination of partition coefficient of different liquidmixtures
6. Determination of rate constant in the decomposition reaction of hydrogenperoxide



1. Organic Chemistry - L. Ferguson, Von Nostrand,1985.
2. Organic Chemistry - M. K. Jain, Nagin& Co.,1987.
3. Organic Chemistry- Mehta and Mehta, PHI Learning Pvt. Ltd, NewDelhi,2005.

### **Physical Chemistry**

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill,2007.
2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa,2004.
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning IndiaPvt. Ltd., New Delhi,2009.
4. P.W. Atkins: Physical Chemistry,2002.
5. W.J. Moore: Physical Chemistry,1972.
6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co.,1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd.,1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co.1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons,1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill,1986.
11. Physical Chemistry (3<sup>rd</sup> Edition) - Gilbert W. Castilian, Narosa Publishing House,1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., NewDelhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York,1981.

### **Analytical Chemistry**

1. Jeffery, G.H., Bassett, J., Mendham, J.& Denney,R.C.
2. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons,1989.
3. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, 7<sup>th</sup> Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
4. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York,2004.
5. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman,2001.
6. Skoog, D. A. Holler F.J. &Nieman, T.A. Principles of Instrumental Analysis,Cengage Learning India Ed,2017.
7. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand,1974.

## Open Elective Course - Semester – I

### Title of the Course: OE-1: CHEMISTRY IN DAILY LIFE

#### Unit- I

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages. Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food. [14 hours]

#### Unit- II

Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1. Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test. Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition and uses [14 hours]

#### Unit- III

Chemical and Renewable Energy Sources: principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storers. Polymers: Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers. [14 hours]

## COURSE OUTCOMES OEC-1 Chemistry

On completion of the course students will be able to:

1. Understand the chemical constituents in various day to day materials using by a commonman.
2. Understand the chemical constituents in vitamins, soaps and detergents
3. Understand the renewable chemical energy resources
4. Understand different types of polymers and their applications.

### Reference Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut(1998)
2. Medicinal Chemistry- AshtoushKar.
3. Analysis of Foods – H.E. Cox:13.
4. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4thed. New Age International(1998)
6. Physical Chemistry – P I Atkins and J. de Paula – 7thEd. 2002, Oxford University Press.
7. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6th ed. 2001,FAI.
8. Organic Chemistry by I. L. Finar, Vol. 1 & 2. 9. Polymer Science and Technology, J. R. Fried (Prentice Hall).

## Open Elective Course - Semester – II

### Title of the Course: OE-2: Molecules of Life

#### UNIT I

##### Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structures.Epimers, mutarotation and anomers.

Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

##### Amino Acids, Peptides and Proteins

Classification of amino acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins.Determination of primary structure of peptides.

#### UNIT II

##### Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity),

Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non competitive inhibition including allosteric inhibition).

Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH<sub>2</sub> group, double bond and aromatic ring

##### Lipids

Introduction to lipids, classification.Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

### UNIT III

#### **Nucleic Acids**

Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

#### **Concept of Energy in Biosystems**

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates

#### **Course Outcome / Learning Outcome:**

After studying this paper the student would be able to

1. Acquire knowledge about different types of sugars and their chemical structures.
2. Identify different types of amino acids and determine the structure of peptides.
3. Explain the actions of enzymes in our body and interpret enzyme inhibition.
4. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication. Explain production of energy in our body.

#### **Reference Books:**

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed.,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, 2002.

# III & IV SEMESTER

### III

### SEMESTER

#### DSC-3: Chemistry-III

(L:T:P = 4:0:0)

Contact Hours: 56

Credits: 4

Workload: 4 Hours/Week

#### *Course Objectives:*

1. Inter relationship among frequency, wavelength and wave number and importance of validation parameters of an instrumental method will be taught.
2. Principle, instrumentation and applications of spectrophotometry, nephelometry and turbidometry will be taught.
3. Inter relationship among frequency, wavelength and wave number and importance of validation parameters of an instrumental method will be taught.
4. The concept of mechanism and its importance will be taught to the student.
5. Concept and importance of intermediates in organic chemistry will be taught taking proper examples.
6. The various techniques for identification of reaction mechanism will be taught to the student taking proper examples.
7. Different types of bonding in molecules/compounds/ions.
8. The theoretical and experimental aspects of chemical kinetics including basic theories of reaction rates and methods of determining order.
9. Electrochemistry dealing with electrolytes in solution. Conductance measurements and applications. Concept of ionic mobility and their determination.

**Course Specific Outcomes:** After the completion of this course, the student would be able to;

1. Understand the importance of fundamental law and validation parameters in chemical analysis.
2. Apply solvent extraction method for quantitative determination of metal ions in different samples.
3. Utilize the ion-exchange chromatography for domestic and industrial applications.
4. Explain mechanism for a given reaction.
5. Predict the probable mechanism for a reaction.
6. Explain the importance of reaction intermediates, its role and techniques of generating such intermediates.
7. Predict the nature of the bond formed between different elements.
8. Identify the possible type of arrangements of ions in ionic compounds.
9. Write Born - Haber cycle for different ionic compounds.
10. Relate different energy parameters like, lattice energy, entropy, enthalpy and solvation energy in the dissolution of ionic solids.
11. Explain covalent nature in ionic compounds.
12. Understand the concept of rate of a chemical reaction, integrated rate equations, energy of activation and determination of order of a reaction based on experimental data.
13. Know different types of electrolytes, usefulness of conductance and ionic mobility measurements and to determine the transport numbers.

## DSE-3: Chemistry III

(L:T:P = 4:0:0)

Contact Hours: 56

Credits: 4

Workload: 4 Hours/Week

### Unit-I:

#### Separation methods:

**Fundamentals of chromatography:** General description, definition, terms and parameters used in chromatography, classification of chromatographic methods, criteria for selection of stationary and mobile phase and nature of adsorbents. Principles of paper, thin layer, column chromatography. Column efficiency, factors affecting the column efficiency, vanDeemter's equation and its modern version. **3 Hrs.**

**Paper chromatography:** Theory and applications

**Thin layer chromatography (TLC):** Mechanism, R<sub>f</sub> value, efficiency of TLC plates, methodology—selection of stationary and mobile phases, development, spray reagents, identification and detection, qualitative applications. **4 Hrs.**

**Solvent Extraction:** Types- batch, continuous, efficiency, selectivity, distribution coefficient, Nernst distribution law, derivation, factors affecting the partition, relationship between % extraction and volume fraction, Numerical problems on solvent extraction. Solvent extraction of iron and copper. **4 Hrs.**

**Ion exchange chromatography:** resins, types with examples- cation exchange and anion exchange resins, mechanism of cation and anion exchange process and applications of ion-exchange chromatography (softening of hard water, separation of lanthanides, industrial applications). **3 Hrs.**

### Unit-II:

**Structure and Bonding-I: The ionic bond:** Structures of ionic solids. Radius ratio rules, Calculation of some limiting radius ratio values, Coordination number 3 (planar triangle), Coordination number 4 (tetrahedral and square planar), Coordination number 6 (octahedral), Close packing. **3 Hrs.**

#### Classification of ionic structures:

Ionic compounds of the type AX (ZnS, NaCl, CsCl), Ionic compounds of the type AX<sub>2</sub> (Calcium fluoride (fluorite) and Rutile structure Layer structures CdI<sub>2</sub>, Cadmium iodide structure. Limitations of radius ratio concept **2 Hrs.**

Lattice energy and Born-Haber cycle, Derivation of Born-Landé equation and its drawbacks, Kapustinskii equation, solvation energy and solubility of ionic solids, polarizing power and polarizability, Fajan's rules with applications. Numerical problems **5 Hrs.**

**Covalent bond:** Valence bond theory, The Lewis theory, The octet rule, Exceptions to the octet rule, Sidgwick-Powell theory. Valence shell electron pair repulsion (VSEPR) theory, Effect of lone pairs, electronegativity, isoelectronic principle, Examples using VSEPR theory: BF<sub>3</sub> and BF<sub>4</sub><sup>-</sup>, NH<sub>3</sub> and NH<sub>4</sub><sup>+</sup>, H<sub>2</sub>O, PCl<sub>5</sub>, ClF<sub>3</sub>, SF<sub>4</sub>, I<sub>3</sub><sup>-</sup> and I<sub>3</sub><sup>+</sup>, SF<sub>6</sub>, and IF<sub>7</sub>. Limitations of VSEPR. **7 Hrs.**

### Unit-III:

**Reaction Intermediates:** Generation, structure, stability and reactions involving;

- i. **Carbocations:** Dienone-phenol and Pinacol-Pinacolone Rearrangement.
- ii. **Carbanions:** Perkin Reaction, Aldol condensation, Claisen-Schmitt condensation.
- iii. **Free Radicals:** Chlorination of methane, formation of gamma-xene (lindane).
- iv. **Carbenes:** Singlet and triplet states, their relative stability. Riemeier-Tiemann, and Wolff rearrangement.
- v. **Nitrenes:** Singlet and triplet states, their relative stability. Hoffman and Curtius reactions.
- vi. **Arynes:** Formation, detection. Bromobenzene to aniline, (4+2) cycloaddition reaction.

**8 Hrs.**

**Methods for Identifying Reaction Mechanism:** Product analysis, Isolation and Identification of Intermediates, Stereochemical Evidences, Effect of Catalyst, crossover Experiments, Isotopic studies, Kinetic Studies. **6 Hrs.**

**Unit-IV:**

**Chemical Kinetics:** Introduction, rate of reaction, order and molecularity with examples. Rate constant-definition and explanation. Differential and integrated form of rate expressions up to second order reactions, Derivation of expression of rate constant of second order reaction ( $a=b$  and  $a \neq b$ ), Problems on rate constant ( $a=b$ ), Methods of determination of order of a reaction (half-life method, isolation method), temperature dependence of reaction rates; Arrhenius equation, activation energy, Numerical problems on Arrhenius equation in calculating energy of activation and rate constants. Collision theory of reaction rates, Lindemann's mechanism, qualitative treatment of the theory of absolute reaction rates. Experimental determination of kinetics of (i) inversion of cane sugar by polarimetric method (ii) spectrophotometric method for the reaction between potassium persulphate and potassium iodide. **7 Hrs.**

**Electrochemistry – I:** Introduction, strong and weak electrolytes, definition with examples. Arrhenius theory of electrolytic dissociation. Merits and Demerits, Conductance, Specific conductance, equivalent and molar conductivity and their variation with dilution. Molar conductivity at infinite dilution. Numerical problems.

Kohlrausch's law of independent migration of ions and its applications, Debye-Hückel-Onsager equation. Ionic mobilities and their determinations, transference numbers and their relation to ionic mobility's, determination of transference numbers using Hittorf and Moving Boundary methods.

**Applications of conductance measurement:** (i) Degree of dissociation of weak electrolytes (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts (iv) conductometric titrations (acid base titrations only) and (v) Hydrolysis constants of salts. Numerical problems. **7 Hrs.**

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### DSC-3: Chemistry-III Practical

(L:T:P = 0:0:2)    Contact Hours: 56    Credits: 2    Workload:4Hours/Week

**Course objectives:** To attain practical knowledge about:

1. Analytical skills in detecting the constituents present in unknown samples by systematically carrying out the qualitative analysis.
2. The methods of determining rates of chemical reactions.
3. Designing electrochemical cells and making measurements related to it.
4. Determination of physical characteristics of electrolytes using conductivity measurements in solution.
5. Adsorption phenomenon, mechanism and basic models to explain adsorption.
6. Simple techniques like conductometry to obtain physicochemical parameters of electrolytes.

**Course Specific outcomes:** At the end of the course student would be able to;

1. Understand the chemical reactions involved in the detection of cations and anions.
2. Explain basic principles involved in classification of ions into groups in semi-micro qualitative analysis of salt mixture
3. Carryout the separation of cations into groups and understand the concept of commonion effect.
4. Understand the choice of group reagents used in the analysis.
5. Analyze a simple inorganic salt mixture containing two anions and cations
6. Use instruments like conductivity meter to obtain various physicochemical parameters.
7. Apply the theory about chemical kinetics and determine the velocity constants of various reactions.
8. Learn about the reaction mechanisms.
9. Interpret the behavior of interfaces, the phenomena of physisorption and chemisorption's and their applications in chemical and industrial processes.
10. Learn to fit experimental data with theoretical models and interpret the data

#### **Part A: Inorganic Chemistry Practicals**

Qualitative semi-micro analysis of mixtures containing 2 anions and 2 cations. Emphasis should be given to the understanding of different reactions.

The following cations and anions are suggested.

**Cations:**  $\text{NH}_4^+$ ,  $\text{Pb}^{2+}$ ,  $\text{Bi}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Co}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Mg}^{2+}$ ,

$\text{Na}^+$ ,  $\text{K}^+$  and  $\text{Li}^+$ .

**Anions:**  $\text{CO}_3^{2-}$ ,  $\text{CH}_3\text{COO}^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{C}_2\text{O}_4^{2-}$  and  $\text{PO}_4^{3-}$ .

Spot tests and flame tests to be carried out wherever possible.

#### **Part B: Physical Chemistry Practicals**

1. Determination of the enthalpy of neutralization of a strong acid with strong base.
2. Verification of Freundlich and Langmuir isotherms for adsorption of acetic acid on

- activated charcoal.
3. The study of kinetics of potassium persulphate and potassium iodide volumetrically.
  4. Determination of velocity constant for acid catalyzed hydrolysis of methyl acetate volumetrically.
  5. Determination of velocity constant for the saponification of ethyl acetate ( $a = b$ ) volumetrically.
  6. Determination of equivalent conductivity of strong electrolyte and verification of DHO equation using meter bridge.
  7. Determination of dissociation constant of weak acid by conductivity method using meter bridge.
  8. Conductometric titration of strong acid and strong base.
  9. Conductometric titration of weak acid and strong base.
  10. Determination of the hydrolysis constant of aniline hydrochloride by conductometric method.
  11. Determination of solubility product of sparingly soluble salt by conductometric method.

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## SEMESTER IV

### DSC-4: Chemistry-IV

**(L:T:P = 4:0:0)    Contact Hours: 56    Credits: 4    Workload: 4 Hours/Week**

#### **Course Objectives:**

1. Principle, instrumentation and applications of spectrophotometry, nephelometry and turbidometry will be taught.
2. Principle, types and applications of solvent extraction will be taught.
3. Concept of stereochemistry and its importance will be taught.
4. The various projection formulae and the techniques of designating the molecules in to R,S, D, L will be taught taking proper examples.
5. The theory and concept of Cis-, Trans- isomerism and its importance and the techniques to differentiate between them will be taught taking examples.
6. The structures of molecules/compounds/ions based on different models/theories.
7. Properties of compounds based on bonding and structure.
8. The fundamentals of thermodynamics including the laws, the concept of entropy and free energy functions and their applications.
9. The concepts of surface chemistry, catalysis and their applications.

**Course Specific Outcomes:** After the completion of this course, the student would be able to;

1. Understand the importance of fundamental law and validation parameters in chemical analysis.

2. Know how different analytes in different matrices (water and real samples) can be determined by spectrophotometric, nephelometric and turbidimetric methods.
3. Explain the importance of Stereochemistry in predicting the structure and property of organic molecules.
4. Predict the configuration of an organic molecule and able to designate it.
5. Identify the chiral molecules and predict its actual configuration.
6. Write the M.O. energy diagrams for simple molecules.
7. Differentiate bonding in metals from their compounds.
8. Learn important laws of thermodynamics and their applications to various thermodynamic systems.
9. Understand adsorption processes and their mechanisms and the function and purpose of a catalyst.
10. Apply adsorption as a versatile method for waste water purification.

### **Unit-I:**

**Quantitative analysis-Instrumental methods:** Electromagnetic spectrum, absorption of electromagnetic radiation, Definition and units of frequency, wavelength, wave number, Beer's law, Beer-Lambert law derivation, deviations from Beer's law, limitations, construction of calibration graph (Plot of absorbance versus concentration), Evaluation Procedures- standard addition, Internal standard addition, validation parameters- detection limits, sensitivity, dynamic/linearity range, Instrumentation, single beam and double beam spectrophotometers, quantitative applications of colorimetry (determination of Fe, Mo, Cu, Ti and  $\text{PO}_4^{3-}$ ) and numerical problems on application of Beer's law. **10 Hrs.**

**Nephelometry and Turbidimetry:** Introduction, principle, instrumentations of nephelometry and turbidimetry; effects of concentration, particle size and wavelength on scattering; choice between nephelometry, applications of nephelometry & turbidimetry (determination of  $\text{SO}_4^{2-}$  and  $\text{PO}_4^{3-}$ ). **4 Hrs.**

### **Unit-II:**

#### **Structure and Bonding -II:**

Concept of resonance, resonance energy, hybridization, types of hybridization,  $sp$ ,  $sp^2$ ,  $sp^3$ ,  $dsp^2$ ,  $dsp^3$ ,  $d^2sp^3$ ,  $sp^3d^2$  with one example each, and energetics of hybridization. Bent's rule, Limitations of Valence Bond Theory. **3 Hrs.**

**Molecular Orbital theory:** LCAO concept: s-s, s-p, p-p, p-d and d-d combinations of orbitals, bonding, nonbonding and antibonding molecular orbitals, non-bonding combinations of orbitals, Rules for linear combination of atomic orbitals.

Examples of molecular orbital treatment for homonuclear diatomic molecules:  $\text{H}_2$  molecule,  $\text{H}_2^+$  molecule ion,  $\text{He}_2$  molecule,  $\text{He}_2^+$  molecule ion,  $\text{Li}_2$  molecule,  $\text{Be}_2$  molecule,  $\text{B}_2$  molecule,  $\text{C}_2$  molecule,  $\text{N}_2$  molecule,  $\text{N}_2^+$  molecule ion,  $\text{O}_2$  molecule,  $\text{O}_2^-$  and  $\text{O}_2^{2-}$  molecule ions.

M.O. Energy diagrams of heteronuclear diatomic molecules with examples ( $\text{NO}$ ,  $\text{NO}^+$ ,  $\text{CO}$  and  $\text{HCl}$ ). Calculation of bond order, relationship between bond order, bond energy, and bond length, magnetic properties based on MOT. **7 Hrs.**

Metallic Bonding: General properties of metals-conductivity, lustre, malleability and cohesive force. Crystal structures of metals and Bond lengths.

Theories of bonding in metals: Free electron theory, valence bond theory, molecular orbital or band theory of solids. Prediction of conducting properties of conductors, insulators and semiconductors, extrinsic and intrinsic semiconductors using M.O. theory.

*4 Hrs.*

### **Unit-III:**

#### **Structure and Stereochemistry of Organic Compounds:**

Concept of isomerism, types of isomerism. Projection formulae of chiral molecules-Fischer (glyceric acid), Newman (2,3-dibromobutane), Sawhorse (2,3-dibromobutane) and Fly- wedge (glyceric acid) projection formulae. Interconversion of projection formulae: Conversion of; Fisher into Sawhorse projection (tartaric acid), Sawhorse into Fisher projection (2,3-dibromobutane), Sawhorse to Newman to Fisher projection (3-amino-3-bromo-2-chlorobutan-2-ol), Fisher to Newman to Sawhorse (3-chloro-2,4-dihydroxybutanal), Fisher into Fly-wedge formula and vice-versa (2-bromo propanoic acid),

**4 Hrs.**

**Geometrical isomerism:** Cause of geometrical isomerism. Cis-trans isomerism (cinnamic acid, but-2-enedioic acid) and syn-anti isomerism (benzaldoxime, ethyl methyl ketoxime), E/Z notations with examples following C.I.P rules.

**Optical Isomerism:** Optical activity, conditions for optical activity-Elements of symmetry (plane, centre,  $C_2$ -axis, rotation-reflection with examples). Specific rotation, Chirality/Asymmetry, Enantiomers-definition with examples, properties, Molecules with two or more chiral centres, Diastereoisomers-definition with examples (threo and erythro isomers), properties. Meso compounds- definition with examples. optical isomerism in tartaric acid, and biphenyls. Asymmetric synthesis, Walden inversion. Racemic modification- Definition with examples. Resolution-definition with examples, chemical and biochemical methods of resolution, Relative and absolute configuration, D/L convention, limitations, and R/S designations-CIP rules with examples.

**10 Hrs.**

### **Unit-IV:**

**First Law of Thermodynamics:** Introduction, system, surroundings, types of systems. Thermodynamic Processes (isothermal, adiabatic, isochoric, isobaric and cyclic), Nature of Heat and Work, Internal Energy, First Law of Thermodynamics, Enthalpy of a System, Work done in isothermal and adiabatic expansion of an ideal gas, Numerical problems, Joule - Thomson Expansion, Relation between Joule-Thomson coefficient and other thermodynamic parameters.

**Second law of Thermodynamics:** Limitations of first law of thermodynamics. Reversible and Irreversible Processes, Concept of entropy, thermodynamic scale of temperature, Statements of the Second Law of Thermodynamics, molecular and statistical interpretation of entropy, Calculation of entropy change for reversible and irreversible processes, Free Energy Functions: Gibbs and Helmholtz energy, variation of S, G, A with T, V and P, Numerical problems, Free energy change and spontaneity, Gibbs-Helmholtz equation.

**Third Law of Thermodynamics:** Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules. **10 Hrs.**

**Surface Chemistry Adsorption:** Introduction, types of adsorptions with examples. Types of adsorption isotherms. Freundlich adsorption isotherm (only equation), its limitations. Langmuir adsorption isotherm (derivation to be done) and BET equation (derivation not included).

**Catalysis:** Types of Catalysis (positive, negative, auto and induced), characteristics of catalysis, and theories with examples (intermediate compound theory and adsorption theory), Theory of acid base catalysis, Michaelis-Menten mechanism. Heterogeneous catalysis: surface reactions, unimolecular, bimolecular surface reactions. Autocatalysis with examples. Applications: Design process to removal of toxic compounds from industrial wastewater and treatment of portable water requirements. **4 Hrs.**

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### **DSC-4: Chemistry-IV Practical**

**(L:T:P = 0:0:2)    Contact Hours: 56    Credits: 2    Workload:4Hours/Week**

#### ***Course objectives:***

1. To impart skills related to preparation of stock and working solutions and handling of instrumental methods.
2. To know the principle of colorimetric analysis and construction of calibration plot.
3. To understand the chemistry involved in colorimetric determination of metal ions and anions.
4. To determine R<sub>f</sub> values of different metal ions present in a mixture.
5. To impart knowledge on the importance of functional groups in organic compounds.
6. Techniques to identify the functional groups in a compound by performing physical and chemical tests.
7. To record its melting point/boiling point.
8. To prepare suitable derivative for that compound and to characterize it.

**Course Specific outcomes:** After the completion of this course, the student be able to

1. Understand the importance of instrumental methods for quantitative applications.
2. Apply colorimetric methods for accurate determination of metal ions and anions in water or real samples.
3. Understand how functional group in a compound is responsible for its characteristic properties.
4. Learn the importance of qualitative tests in identifying functional groups.
5. Learn how to prepare a derivative for particular functional groups and how to purify it.

#### ***PART-A: Analytical Chemistry Practicals***

1. Colorimetric determination of copper using ammonia solution.
2. Colorimetric determination of iron using thiocyanate solution.

3. Colorimetric determination of nickel using DMG solution.
4. Colorimetric determination of titanium using hydrogen peroxide.
5. Colorimetric determination of nitrite in a water sample (diazo coupling Reaction/Griess reagent).
6. Colorimetric determination of phosphate as ammonium phosphomolybdate.
7. Determination of R<sub>f</sub> values of two or three component systems by TLC.
8. Separation of different metal ions by paper chromatography/ Solvent extraction of iron using oxine solution (demonstration).

### ***PART-B: Organic Chemistry Practical***

Qualitative analysis of mono and bifunctional Organic compounds: Benzoic acid, Salicylic acid, *p*-Nitro benzoic acid, Anthranilic acid, *p*-Chloro benzoic acid, *o*-Cresol, *p*-Cresol, Resorcinol, *o*- Nitrophenol, *p*-nitrophenol, *o*-Nitro aniline, *p*-Nitroaniline, *p*-Toluidine, *p*-Chloroaniline, *p*- Bromoaniline, Ethyl Salicylate, Salicylaldehyde, Acetophenone, Urea, Thiourea, Aniline, Benzaldehyde, acetanilide, Naphthalene, Chlorobenzene, *p*-Dichlorobenzene, *p*-Nitro toluene, Benzamide etc. (At least 6-8 compounds to be analyzed in a semester).

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### **REFERENCE BOOKS:**

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8<sup>th</sup> Ed., Saunders College Publishing, New York (2005).
2. Analytical Chemistry, G.D. Christian, 6<sup>th</sup> edition, Wiley-India (2007).
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6<sup>th</sup> edition, PHI Learning Pvt. Ltd. New Delhi (2009).
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, Pearson Education Pvt. Ltd. (2007).
5. Organic Reaction Mechanism by V.K. Ahluwalia and R.K. Parashar (Narosa Publishers).
6. Organic Chemistry by S.M. Mukherji, S.P. Singh and R.K. Kapoor (Narosa Publishers).
7. Morrison R.N and Boyd R.N, Organic Chemistry, Darling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar I.L, Organic Chemistry (Volume I); Finar I.L (Volume II) Stereochemistry and the Chemistry of Natural Products., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Kalsi P.S. Stereochemistry, conformation and Mechanism, New age International.
10. Eliel E.L and Wilen S.H, Stereochemistry of Organic Compounds, Wiley, (London).
11. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6<sup>th</sup> Ed. Third Indian Reprint, Pearson Education Pvt. Ltd. (2007).
12. Vogel's Text Book of Qualitative Chemical Analysis, ELBS.
13. Peter Atkins & Julio De Paula, Physical Chemistry, 9<sup>th</sup> Ed., Oxford University Press

- (2010).
14. G W Castellan, Physical Chemistry, 4<sup>th</sup> Ed., Narosa (2004).
  15. R G Mortimer, Physical Chemistry 3<sup>rd</sup> Ed., Elsevier: Noida, UP (2009).
  16. B R Puri, L R Sharma and M S Pathania, Principal of Physical Chemistry, Vishal Publishing Co.
  17. B S Bahl, G D Tuli and Arun Bahl, Essentials of Physical Chemistry, S Chand & Comp. Ltd.
  18. A S Negi and S C Anand, A textbook of Physical Chemistry, New Age International.
  19. B N Bajpai, Advanced Physical chemistry, S Chand and Company ltd.
  20. R L Madan, Chemistry for Degree Students, Semester I, II, III and IV, S Chand and Company Ltd.
  21. P L Soni, O P Dharmarha and U N Dash, Textbook of Physical Chemistry, Sultan Chand and Sons.
  22. Vogel's Qualitative analysis, Revised by G. Svehla, Pearson education, 2002
  23. J B Yadav, Advanced Physical Chemistry, Krishna Prakashan Media (P) Ltd, Meerut.
  24. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, S. Chand &Co.: New Delhi (2011).
  25. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8<sup>th</sup> Ed.; McGraw-Hill: New York (2003).
  26. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3<sup>rd</sup> Ed.; W.H. Freeman & Co.: New York (2003).

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## OPEN ELECTIVE COURSE

### III SEMESTER

#### OE-3: Atomic Structure, Bonding and Concepts in Organic Chemistry

(L:T:P = 3:0:0)    Contact Hours: 42    Credits: 3    Workload:3Hours/Week

#### *Course Objectives:*

1. To develop an understanding of principles of atomic structure.
2. To know the importance of quantum numbers, writing of electronic configurations and representation of orbitals.
3. To develop an understanding of the periodic trends.
4. To understand the nature of bonding and to predict the shapes of molecules.
5. To construct MO energy level diagrams and predict the properties of molecules.
6. To understand the formation of sigma and pi bonds and the bond strength.
7. To study the classification of organic reactions.
8. To learn nomenclature preparation and reactions of alkanes, alkenes, alkynes and stability of alicyclic compounds.

**Course Specific Outcomes:** On completion of the course the student will learn and be able to understand/explain;

1. The concept of atomic structure, significance of quantum numbers, filling of electrons of atoms/ions in various orbitals as per rules.
2. The trends in periodic properties.
3. The structures of ionic solids, applications of B-H cycle, solubility of compounds and consequences of polarization of ions.
4. The shapes of molecules/ions based on VSEPR theory.
5. The construction of MO energy level diagrams and prediction of properties of molecules/ions like bond order, bond energies, bond lengths and magnetic properties.
6. The formation of sigma and pi bonds and the bond strength.
7. The classification of organic reactions.
8. Nomenclature preparation, and reactions of alkanes, alkenes, alkynes and stability of alicyclic compounds.

### ***Unit I: Atomic Structure and Periodic Properties***

History of an atom. Idea of de Broglie matter waves. Heisenberg uncertainty principle. Schrödinger wave equation, significance of wave functions, Bohr's model of hydrogen atom and its limitations. Quantum numbers and their importance, atomic orbitals and shapes of s, p, d orbitals, multi-electron atoms, Aufbau and Pauli exclusion principle and Hund's multiplicity rule- Electronic configurations of the elements (atomic no. up to 30), effective nuclear charge and shielding. **8 Hrs.**

**Periodic Properties:** Atomic radius, Covalent, ionic and van der Waal radii-explanation with examples. Definition and periodicity of the following properties - ionic radii, ionization potential, electron affinity and electronegativity, methods of determination of electronegativity. Factors affecting the values of ionization energy. **6 Hrs.**

### ***Unit II: Chemical Bonding:***

Ionic Solids- Ionic structures (NaCl, CsCl, TiO<sub>2</sub>, ZnS), radius ratio rule and coordination number, limitation of radius ratio rule, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule and their consequences. **4 Hrs.**

Covalent Bond - Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization with examples and shapes of simple inorganic molecules and ions. Shapes of NH<sub>3</sub>, I<sub>3</sub><sup>+</sup>, I<sub>3</sub><sup>-</sup>, SF<sub>4</sub>, ClF<sub>3</sub>, IF<sub>5</sub>, ICl<sub>2</sub><sup>-</sup> and H<sub>2</sub>O using valence shell electron pair repulsion (VSEPR) theory, linear combination of atomic orbitals (LCAO), bonding, nonbonding and antibonding molecular orbitals, physical picture of bonding and antibonding wave functions. Applications of MO theory to explain the stability of homo dinuclear (He<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, F<sub>2</sub>, C<sub>2</sub>) and hetero dinuclear (NO and CO) molecules. Comparison of M.O. and V.B. Models. **7 Hrs.**

Metallic bond-free electron, Band theory-electrical properties of metals, semiconductors



and insulators. Weak interactions – Hydrogen bonding and its consequences, van der Waals forces. **3 Hrs.**

**Unit III: Bonding and molecular structure and hydrocarbons**

**Bonding and molecular structure:** Introduction to organic chemistry, atomic orbitals, sigma and pi bond formation-molecular orbital [MO] method, sp, sp<sup>2</sup> and sp<sup>3</sup> hybridization, bond length, bond dissociation energies and bond angles (open chain and cyclic compounds). Electronegativity and polarity of the bonds. Classification and reactions of organic compounds (with examples). **7 Hrs.**

**Alkanes, Alkenes and Alkynes:** Definition, Nomenclature, preparations (any two methods). Reactions: Electrophilic, nucleophilic and free radical addition reactions.

**Alicyclic compounds:** Nomenclature, preparation and stability of cyclopropane, cyclobutane, cyclopentane and cyclohexane. **7 Hrs.**

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**REFERENCE BOOKS:**

1. Concise Inorganic Chemistry, J. D. Lee, ELBS, 1996.
2. Inorganic Chemistry, A. K. Das.
3. Inorganic Chemistry: Principles of Structure and Reactivity, Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Pearson Education India, 2006.
4. Inorganic Chemistry, Shriver, D.F. & Atkins, P.W. Oxford University Press.
5. Schaum's Outline Series Theory and Problems of Organic Chemistry.SI (metric) Ed Herbert Meislich, Howard Nechamkin and Jacob Sharefkin.
6. Organic chemistry. Robert T. Morrison Robert N. Boyd, 6<sup>th</sup> Ed.
7. Organic Chemistry Volume-1, I.L. Finar.

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**OPEN ELECTIVE COURSE  
IV SEMESTER**

**OEC-4: Electrochemistry, Corrosion and Metallurgy**

**(L:T:P = 3:0:0) Contact Hours: 42 Credits: 3 Workload:3Hours/Week**

**Course Objectives:** This course will deal with

1. Types of conductance, concept of electrolytes, electrolysis, redox reactions and EMF.
2. Concept of different types of electrochemical cells, Types of electrodes and electrode potential. Application of electrochemical series.
3. Basic principles and applications of conductometric, potentiometric and pH titrations.
4. Different types of Batteries their principle construction and working - lead-acid storage and lithium ion battery. Study of Fuels cells.
5. Concept of corrosion, types of corrosion and its prevention by different methods. Introduction to electroplating.
6. Introduction to ores and minerals, extraction of metals from their ores, and

purification. Eg., Manganese, Titanium and Uranium. Study of alloys, classification, production and uses of alloys.

**Course Specific Outcomes:** Upon completion of the course students will be able to;

1. Understand the concept of conductance in electrolytic solutions, electrolysis and redox reactions involved in electrode reactions.
2. Learn the different types of electrochemical cells, their symbolical representation and application of electrochemical series.
3. Apply conductometric, potentiometric and pH titrations.
4. Know the principle, construction and working of batteries.
5. Understand different types of corrosion and its prevention by different methods.
6. Learn the methods of extraction of metals from their ores and purification.

**Unit I: Electrochemistry:** Conductance, specific and molar conductance Types of Electrolytes, Conductivity in electrolytic solution, Electrolysis, Kohlrausch's law and its application, Equivalent Conductance of Weak electrolyte at Infinite dilution.

Oxidation -reduction reactions, electrode potential, EMF of an electrochemical cell, cell reaction, Daniel cell, dry Cells - electrolytic and Galvanic cell, Representation of a cell. Standard electrode potential, Nernst equation (No derivation) and its application to chemical cell, Electrochemical series and its importance. Types of Electrodes.

Basic Principles of (i) Conductometric titrations- HCl Vs NaOH, CH<sub>3</sub>COOH Vs NaOH

Potentiometric titrations: Acid-base titration HCl Vs NaOH, Redox titration (FAS Vs K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>)

Determination of PH using glass electrode.

**12 Hrs.**

Batteries- Primary and Secondary batteries, Battery components and their role. Working of the following Batteries- Lead acid, Lithium Storage, Batteries, Fuel cells.

**2 Hrs.**

**Unit II: Corrosion:** Introduction, definition, Types of Corrosion, Corrosion rate, Factors affecting corrosion rate, Metallic factor-purity, electrode potential of metal, hydrogen over voltage, nature of corrosion product. Environmental Factors-Temperature, pH of the medium, humidity, presence of impurities, electrical conductivity of the medium, velocity of the medium, concentration of the medium.

Prevention of Corrosion: Material selection - Metals and alloys, metal purification, non-metallic, Alteration of environment - Changing media, inhibitors, Design-wall thickness, design rules, Coating-Metallic and other inorganic coatings, organic coating.

Electroplating: Introduction, Electroplating of chromium (hard and decorative). Electroless plating: Introduction, distinction between electroplating and electroless plating processes.

Electroless plating of copper.

**14 Hrs.**

**Unit III: Metallurgy:** Introduction: Ore, minerals, important ores of some common elements in India, General Principles of pyrometallurgy, roasting, Calcination, Gangue, Smelting, Flux, Gravity separation, Froth flotation process, leaching. Techniques employed for Purification of metal (Distillation process, Bessemerization, Electro-refining, Van Arkel

and De Boer's Filament. **7 Hrs.**

**Extraction of metals:** Extraction of Manganese (Pyrolusite), Titanium (Ilmanite) and Uranium. **4 Hrs.**

**Alloys:** Introduction, Classification of alloys, commercially important alloys, gold karats,

**Production of Ferro alloys;** Ferrochrome, Ferro Manganese, Uses of alloys. **4 Hrs.**

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#### REFERENCE BOOKS:

1. Barrow. G.M, Physical Chemistry, Tata McGraw-Hill, (2007).
2. An introduction to electrochemistry, Samuel Glasstone, East-West edition New Delhi, (1942).
3. Text book of physical chemistry, Samuel Glasstone, 2ndEdition, Mac Millan India Ltd, (1991).
4. Principles and applications of Electrochemistry, D. R. Crow, 3rd edition, Chapman Hall London, (1988).
5. Fundamentals of electrochemical deposition, Milan Paunovic and Mordechay Schlesinger, Wiley Interscience Publications, New York, (1998).
6. Engineering Chemistry, V R Kulkarni and K Ramakrishna Reddy, New Age International, (2015).
7. Electrochemistry and Corrosion Science, Nestor Perez, Springer (india) Pvt. Ltd.,(2004).
8. Principles and Prevention of Corrosion, D. A. Jones, Macmillan Publ. Co., (1996).
9. Essential of Materials Science and Engineering, Donald R. Askeland, Thomson Learning, 5th Edition, (2006).
10. Introduction to Engineering Materials, B. K. Agarwal, Tata McGraw Hill, 1st Edition.
11. Material Science and Engineering, V. Raghavan, PHI Learning, 5th Edition.
12. Engineering Materials and Metallurgy, R. K. Rajput, S. Chand - 1st Edition, (2011).

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#### Scheme of Examination for DSC-3 and DSC-4 (III and IV Semesters): Credits (4:0:0)

Continuous Internal Assessment	Marks		
	Assignment	Test	Total
C1	10	10	20
C2	10	10	20
<b>Semester End Examination</b>	<b>Duration: 02 Hours</b>		
C3			60
<b>Total Marks</b>			<b>100</b>

**Question Paper pattern for DSC-3 and DSC-4 (III and IV Semesters)**

Duration: 02 Hours		Max. Marks: 60
Part-A	Answer any six out of eight questions (Two questions from each unit)	6 x 2 = 12
Part-B (Analytical Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-C (Inorganic Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-D (Organic Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-E (Physical Chemistry)	Answer any two out of three questions	2 x 6 = 12
Sub-questions Pattern: (3 + 3)/(4 + 2)/(2 + 2 + 2)		

**Scheme of Examination for DSC-3 and DSC-4 practical (III and IV Semesters) Credits (0:0:2)**

Continuous Internal Assessment	Marks			
	Test	Continuous assessment/ Attendance	Record	Total
C1	10	-	--	10
C2	--	10	05	15
Semester End Examination	Duration: 04 Hours			
C3				25
<b>Total Marks</b>				<b>50</b>

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**Scheme of valuation: Practical**

***III Semester: Inorganic and Physical Chemistry Practical***

**Part-A: Semimicro Qualitative Inorganic Analysis** **13 Marks**  
(Two acid radicals and two basic radicals be given, two radicals in a group be avoided)

<b>DISTRIBUTION OF MARKS</b>		
<b>Preliminary tests:</b> State, color, solubility		1 Mark
<b>Identification of 2 anions:</b>	Group Identification: 1 + 1 Mark	2 Mark
	Confirmatory tests: 1 + 1 Mark	2 Mark
<b>Group Separation of cations</b>	Group Identification: 1 + 1 Mark	2 Mark
<b>Identification of 2 cations:</b>	Confirmatory tests: 2 + 2 Mark	4 Mark
	Ionic equations for CT tests: 1 + 1 Mark	2 Mark

**Part-B: Physical Chemistry Practical****12 Marks**

The following experiments be given, but not more than two candidates be given the same experiment.

1. The study of kinetics of potassium persulphate and potassium iodide volumetrically.
2. Determination of velocity constant for acid catalyzed hydrolysis of methyl acetate.
3. Determination of velocity constant for the saponification of ethyl acetate(a = b) volumetrically.
4. Determination of equivalent conductivity of strong electrolyte and verification of DHO equation.
5. Determination of dissociation constant of weak acid by conductivity method.
6. Conductometric titration of strong acid and strong base.
7. Conductometric titration of weak acid and strong base.

<b>DISTRIBUTION OF MARKS (For Experiments 1, 2 and 3)</b>		
<b>k values</b>	5 Constant values	7 Marks
	4 Constant values	6 Marks
	3 Constant values	5 Marks
	Any other values	3 Marks
Graph (straight line)		2 Marks
Unit of k		1 Mark
Calculation		2 Marks

<b>DISTRIBUTION OF MARKS (For Experiments 4 and 5)</b>	
Determination of cell constant	3 Marks
Determination of specific conductance	2 Marks
Determination of equivalent conductance	3 Marks
SI unit of k and $\lambda$ (1 + 1 Mark)	2 Marks
Verification of DHO or $k_a$ Calculations	2 Marks

<b>DISTRIBUTION OF MARKS (For Experiments 6 and 7)</b>		
<b>Deviation</b>	$\pm 0.2 \text{ cm}^3$	8 Marks
	$\pm 0.3 \text{ cm}^3$	6 Marks
	$\pm 0.4 \text{ cm}^3$	4 Marks
	Any other value	3 Marks
Graph		2 Marks
Calculation of Normality		1 Mark
Calculation of weight/dm <sup>3</sup>		1 Mark

## IV Semester: Analytical and Organic Chemistry Practical

### Part-A: Analytical Chemistry Experiments

13 Marks

Any one of the Colorimetric determination experiments be given, but not more than two candidates be given the same experiment.

- Colorimetric determination of copper using ammonia solution.
- Colorimetric determination of iron using thiocyanate solution.
- Colorimetric determination of nickel using DMG solution.
- Colorimetric determination of titanium using hydrogen peroxide.
- Colorimetric determination of nitrite in a water sample (diazo coupling Reaction/Griess reagent).
- Colorimetric determination of phosphate as ammonium phosphomolybdate.

<b>DISTRIBUTION OF MARKS</b> (For all colorimetric determinations)		
Preparation of solutions		4 Marks
Determination of $\lambda_{\max}$		2 Marks
<b>Accuracy</b>	$\pm 5\%$	5 Marks
	$\pm 10\%$	3 Marks
	Any other value	2 Marks
Graph		2 Marks

### Part-B: Qualitative Organic Analysis

12 Marks

<b>DISTRIBUTION OF MARKS</b>	
Preliminary tests	2 Marks
Physical constant	1 Mark
Detection of elements (one each)	3 Marks
Solubility (complete chart/table)	2 Marks
Functional group tests (minimum two important tests)	3 Marks
Naming and structure	1 Mark

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## Examination and Evaluation

### Question paper pattern for DSC I & II Semester (I & II Semester)

<b>Duration:</b> 2 hours		<b>Max. Marks:</b> 60
<b>The question paper contains 3 parts</b>		
Part-A	Answer any 6 out of 8 questions <b>(two questions from each unit)</b>	6 X 2 = 12
Part-B (Inorganic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-C (Organic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-D (Physical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-E (Analytical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
<b>Pattern:</b> (3 + 3) / (4 + 2)/(2+2+2)		

### Question paper pattern for DSC III & IV Semester (III & IV Semester)

<b>Duration:</b> 2 hours		<b>Max. Marks:</b> 60
<b>The question paper contains 3 parts</b>		
Part-A	Answer any 6 out of 8 questions <b>(two questions from each unit)</b>	6 X 2 = 12
Part-B (Analytical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-C (Inorganic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-D (Organic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-E (Physical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
<b>Pattern:</b> (3 + 3) / (4 + 2)/(2+2+2)		

**CBCS SYLLABUS**  
**III BSc(V AND VI semester)**



**BSc UG Syllabus PROGRAMME PCM**  
**PROGRAMME CODE: BSc-01,Credit pattern**  
**L:Lecture, T:Tutorial, P:Practicals ) PCM01**

Semester	Course Type	Course code	Course Title	L:T:P	Total Credit
V	DSE 1A	DME24001	<b>INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE</b>	4:0:0	4
	DSE1A	DME24101	Practical 5: <b>INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE</b>	0:0:2	2
	DSE1B	DME24201	<b>INDUSTRIAL CHEMICALS AND ENVIRONMENT</b>	4:0:0	4
	DSE1B	DME24301	Practical 6: <b>INDUSTRIAL CHEMICALS AND ENVIRONMENT</b>	0:0:2	2
	SEC1A	DME24401	<b>FUEL CHEMISTRY</b>	2:0:0	2
	SEC1B	DME24601	<b>BASIC ANALYTICAL CHEMISTRY</b>	2:0:0	2
VI	DSE2A	DMF24001	<b>ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY</b>	4:0:0	4
	DSE2A	DMF24101	Practical 7: <b>ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY</b>	0:0:2	2
	DSE2B	DMF24201	<b>QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY</b>	4:0:0	4
	DSE2B	DMF24301	Practical 8: <b>QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY</b>	0:0:2	2

## Scheme for Examination and Assessment

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSC	15	7.5	15	7.5	70	35	3h	3h
DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	35	-	2h	-

### SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the exam should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours
- Practical record has to be valued by the examiners at the time of examination
- IA for **FIFTEEN** marks in practical is awarded in the lab

#### I. EVALUATION OF EXPERIMENTS:

Sl. no	Component	Marks
1	Conducting experiment	25
2	Viva-voce	05
3	Practical record	05
<b>TOTAL</b>		<b>35</b>

**BSc UG Syllabus PROGRAMME CZBt**  
**PROGRAMME CODE: BSc-05,Credit pattern**  
**L:Lecture, T:Tutorial, P:Practicals )CZBt05**

Semester	Course Type	Course code	Course Title	L:T:P	Total Credit
V	DSE 1A	DME24005	INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	4:0:0	4
	DSE1A	DME24105	Practical 5: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	0:0:2	2
	DSE1B	DME24205	INDUSTRIAL CHEMICALS AND ENVIRONMENT	4:0:0	4
	DSE1B	DME24305	Practical 6: INDUSTRIAL CHEMICALS AND ENVIRONMENT	0:0:2	2
	SEC1A	DME24405	FUEL CHEMISTRY	2:0:0	2
	SEC1B	DME24605	BASIC ANALYTICAL CHEMISTRY	2:0:0	2
VI	DSE2A	DMF24005	ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY	4:0:0	4
	DSE2A	DMF24105	Practical 7: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY	0:0:2	2
	DSE2B	DMF24205	QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY	4:0:0	4
	DSE2B	DMF24305	Practical 8: QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY	0:0:2	2

**Scheme for Examination and Assessment**

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSC	15	7.5	15	7.5	70	35	3h	3h

DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	35	-	2h	-

## SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the exam should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours
- Practical record has to be valued by the examiners at the time of examination
- IA for **FIFTEEN** marks in practical is awarded in the lab

## II. EVALUATION OF EXPERIMENTS:

Sl. no	Component	Marks
1	Conducting experiment	25
2	Viva-voce	05
3	Practical record	05
<b>TOTAL</b>		<b>35</b>

**BSc UG Syllabus PROGRAMME CBZ**  
**PROGRAMME CODE: BSc-08,Credit pattern**  
**L:Lecture, T:Tutorial, P:Practicals )CBZ08**

Semester	Course Type	Course code	Course Title	L:T:P	Total Credit
V	DSE 1A	DME24008	INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	4:0:0	4
	DSE1A	DME24108	Practical 5: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	0:0:2	2
	DSE1B	DME24208	INDUSTRIAL CHEMICALS AND ENVIRONMENT	4:0:0	4
	DSE1B	DME24308	Practical 6: INDUSTRIAL CHEMICALS AND ENVIRONMENT	0:0:2	2
	SEC1A	DME24408	FUEL CHEMISTRY	2:0:0	2
	SEC1B	DME24608	BASIC ANALYTICAL CHEMISTRY	2:0:0	2
VI	DSE2A	DMF24008	ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY	4:0:0	4
	DSE2A	DMF24108	Practical 7: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLY NUCLEAR HYDROCARBONS AND UV,IR SPECTROSCOPY	0:0:2	2
	DSE2B	DMF24208	QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY	4:0:0	4
	DSE2B	DMF24308	Practical 8: QUANTUM CHEMISTRY, SPECTOSCOPY AND PHOTOCHEMISTRY	0:0:2	2

**Scheme for Examination and Assessment**

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSC	15	7.5	15	7.5	70	35	3h	3h

DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	35	-	2h	-

### SCHEME OF VALUATION FOR PRACTICAL EXAMINATION

- A candidate appearing for the exam should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of three hours
- Practical record has to be valued by the examiners at the time of examination
- IA for **FIFTEEN** marks in practical is awarded in the lab

### III. EVALUATION OF EXPERIMENTS:

Sl. no	Component	Marks
1	Conducting experiment	25
2	Viva-voce	05
3	Practical record	05
<b>TOTAL</b>		<b>35</b>

## **DEPARTMENT OF CHEMISTRY**

### **Programme Outcome for Bachelor of Science in Physics, Chemistry and Mathematics:**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1. Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics.
- PO2. Demonstrate the ability to justify and explain their thinking and/or approach.
- PO3. Demonstrate the ability to think, express and present in a clear, logical and succinct arguments.
- PO4. Develop state-of-the-art laboratory skills and professional communication skills.
- PO5. Apply the scientific method to design, execute, and analyze an experiment and also to explain their scientific procedures as well as their experimental observations.
- PO6. Appreciate the role of chemistry in the society
- PO7. Use this as a basis for ethical behaviour in issues facing chemists /drugs.
- PO8. Understand chemistry as an integral part for addressing social, economic, and environmental problems.
- PO9. Develop and understand the value of Mathematical proof and demonstrate proficiency in writing and understanding proofs.
- PO10. Investigate and apply mathematical problems and solutions in aspects of science and technology.
- PO11. Gain experience investigating the real world problems
- PO12. Apply mathematical ideas and models to those problems.

## **Program Specific Outcome:**

### **Bachelor of Science in Physics, Chemistry and Mathematics**

After completing the graduation in Physics, Chemistry and Mathematics the students are able to:

PSO1. Find career opportunities and develop competence to write competitive examinations.

PSO2. Develop proficiency in the analysis of complex physical problems and the use of mathematical or other appropriate techniques to solve them.

PSO3. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO4. Create a hypothesis and appreciate how it relates to broader theories.

PSO5. Demonstrate skills in the use of Computers.



## **Programme Outcome for Bachelor of Science in Chemistry, Zoology and Biotechnology:**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1. Demonstrate the ability to justify, explain, and/or approach the concept both in written and oral forms
- PO2. Demonstrate the ability to present clear, logical and succinct arguments
- PO3. Develop state-of-the-art laboratory skills and professional communication skills.
- PO4. Apply the scientific method to design, execute, and analyze an experiment.
- PO5. Appreciate the central role of chemistry in the society and use this as a basis for ethical behaviour in issues facing chemists/drugs.
- PO6. Understand Chemistry as an integral part for addressing social, economic, and environmental problems.
- PO7. Identify the major groups of organisms with an emphasis on animals and plants.
- PO8. Compare and contrast the characteristics of animals that differentiate themselves from other living and non-living creatures.
- PO9. Give specific examples of physiological adaptations.
- PO10. Design and develop solution to Biotechnology problems keeping in mind the safety measures for environment and society.
- PO11. Support Biotechnology research activity with strong technical background knowledge.

## **Programme Specific Outcome for Bachelor of Science in Chemistry, Zoology and Biotechnology:**

After completing the graduation in Chemistry, Zoology and Biotechnology the students are able to:

- PSO1. Find jobs at all level of chemical, pharmaceutical, food products and life oriented material Industries
- PSO2. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.
- PSO3. Recognize the relationship between different structures and functions at different levels.
- PSO4. Characterize the biological, chemical and physical features of environments that Animals inhabit.
- PSO5. Demonstrate effectively the applications of biochemical and biological sciences.
- PSO6. Know and apply appropriate tools and techniques in biotechnological manipulation
- PSO7. Understand his or her responsibilities in biotechnological practices.

## **Programme Outcome for Bachelor of Science in Chemistry, Botany, Zoology:**

After completing the graduation in the Bachelor of Science the students are able to:

- PO1. Demonstrate the ability to justify, explain, and/or approach the concept both in written and oral forms
- PO2. Demonstrate the ability to present clear, logical and succinct arguments
- PO3. Develop state-of-the-art laboratory skills and professional communication skills.
- PO4. Apply the scientific method to design, execute, and analyze an experiment.
- PO5. Appreciate the central role of chemistry in the society and use this as a basis for ethical behaviour in issues facing chemists/drugs.
- PO6. Identify the taxonomic position of plants using required principles and methods.
- PO7. Understand the impact of the plant diversity in societal and environmental context, and demonstrate the knowledge of, and need for sustainable development.
- PO8. Use interdisciplinary approaches with quantitative skills to work on biological problems.
- PO9. Understand Chemistry as an integral part for addressing social, economic, and environmental problems.
- PO10. Identify the major groups of organisms with an emphasis on animals and plants.

## **Programme Specific Outcome**

### **Bachelor of Science in Chemistry, Botany and Zoology**

After completing the graduation in the Bachelor of Science the students are able to:

- PSO1. Find jobs at all level of chemical, pharmaceutical, food products, life oriented material industries, etc.
- PSO2. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.
- PSO3. Explicate ecological interconnectedness of life
- PSO4: Analyze the avenues and remedies for burning environmental issues
- PSO5. Recognize the relationship between different structures and functions at different levels.
- PSO6. Characterize the biological, chemical and physical features of environments that Animals inhabit.



**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**Theory: 60 Lectures**

**Course outcome:**

After completion of the course the student is able to:

- CO1: Understand the synthesis and applications of glass and ceramics, vitamins, hormones, soaps and detergents; and higher aspects of spectroscopy.
- CO2: Understand the types and manufacture of different fertilizers.
- CO3: Understand the different methods of prevention of corrosion.

**CHEMISTRY-DSE:**

**Silicate Industries**

**Glass:** Rawmaterials, Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

**Ceramics:** Important clays and feldspar, ceramic, their types and manufacture. Hightechnology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

**Cement:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

**Abrasives:** Definition, classification with examples – hardness, manufacture and applications of carborundum, alundum and tungsten carbide.

**Refractories:** Definition, properties, classification with examples. Different steps involved in the manufacture of refractories. Applications of refractories.

**Inorganic polymers:**

Definition – examples, general properties, comparison with organic polymers, glass transition temperature Silicones: Definition, nomenclature, preparation (linear, cross-linked and cyclic). Factors affecting the nature of silicon polymers, properties (chemical and thermal stabilities( chemical properties) uses of silicon polymers, silicon fluids/oils – uses, silicon elastomers / rubbers, silicon resins (preparation and uses)

**Phosphazenes:** Definition, types, structures, preparation, properties and uses. Crystalline polymetaphosphates – Maddrell's and Kuroll's salts – properties and uses. Nature of bonding in phosphazenes.

**Fluorocarbons:** Definition, examples, preparation, properties and uses of Freon-12, Freon-22, PTFE and poly per fluorovinyl chloride.

**Non-aqueous solvents:**

**Liquid ammonia-** Reasons for the solvent properties, typical reactions- solubility of alkali metals; acid-base, precipitation, ammonolysis, Ionization of weak acids,

advantages and disadvantages.

**Liquid SO<sub>2</sub>**- Reasons for the solvent properties, typical reactions-acid-base, solvolysis, precipitation, amphoteric and redox reactions **(25 Lectures)**

**Fertilizers:**

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate. **(5 Lectures)**

**Surface Coatings:**

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

**(10 Lectures)**

**Batteries:**

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

**(4 Lectures)**

**Alloys:**

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Properties and applications of steel. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels. Production of Ferro alloys: Ferro chrome and Ferro manganese.

**(8 Lectures)**

**Catalysis:**

General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples). Theories of catalysis, Auto catalyst. Industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.

**(4 Lectures)**

**Chemical explosives:**

Origin of explosive properties in organic compounds, Classification with examples, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

**(4 Lectures)**

**Reference:**

- E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
- R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
- W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
- P. C. Jain & M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
- R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
- B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meeru



DME24201/ DME24205/ DME24208

DSE!B

SEMESTER V

## INDUSTRIAL CHEMICALS AND ENVIRONMENT

Theory: 60 Lectures

### Course outcome:

After completion of the course the student is able to:

- CO1: Understand the environmental issues
- CO2: Know about the metallurgy of metals
- CO3: Understand the hazards and handling certain gases and chemicals

### Industrial Gases and Inorganic Chemicals

*Industrial Gases:* Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

*Inorganic Chemicals:* Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda,

common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

(10 Lectures)

### Industrial Metallurgy

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology

(4 Lectures)

### Environment and its segments

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution

Pollution by SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>x</sub>, H<sub>2</sub>S and other foul smelling gases. Methods of estimation of CO, NO<sub>x</sub>, SO<sub>x</sub> and control procedures

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates

*Water Pollution:* Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems

Water purification methods: Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water

**(30 Lectures)**

### **Energy & Environment**

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

**(10 Lectures)**

### **Biocatalysis**

Introduction to biocatalysis: Importance in “Green Chemistry” and Chemical Industry.

**(6 Lectures)**

### **Reference:**

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
- K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
- S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).
- G.T. Miller, *Environmental Science* 11th edition. Brooks/ Cole (2006).
- A. Mishra, *Environmental Studies*. Selective and Scientific Books, New Delhi (2005).

**ORGANOMETALLICS, BIOINORGANIC CHEMISTRY,  
POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY**

**Theory: 60 Lectures**

**Course outcome:**

After completion of the course the student is able to:

- CO1: Understand the techniques involved in metallurgy.  
CO2: Understand the role of ions in different biological systems.  
CO3: Understand the applications of spectroscopy.

**DSE-1A:**

**Section A: Inorganic Chemistry-4**

**(30 Lectures)**

**Metallurgy:** Terms and principles involved in metallurgy, Ellingham's diagram, Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- general metallurgy followed by Mond's process ( purification, Manganese from oxides ores- Reduction by the Aluminothermite process- refining by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quaternary process.

Electro metallurgy: Extraction of Lithium by fusion method Followed by electrolysis of lithium chloride.

Powder metallurgy: Importance, metal powder production & applications. Production of Tungsten powder. Principles of Electroplating. **(10 Lectures)**

**Organometallic Compounds**

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti.

Nature of M-CO bonding in carbonyls. Preparation, properties and structures of mononuclear and binuclear metal carbonyls- $\text{Ni}(\text{CO})_4$ ,  $\text{Cr}(\text{CO})_6$ ,  $\text{Fe}(\text{CO})_5$ ,  $\text{Mn}_2(\text{CO})_{10}$ ,  $\text{Co}_2(\text{CO})_8$ . Applications of EAN rule to mononuclear metal carbonyls.

Behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies). **(10 Lectures)**

**Chemistry of nonmetals:**

Boron: Boron hydrides – Diborane – preparation, properties, uses and structure Carbon: Fullerenes- Production, structure of  $\text{C}_{60}$  and  $\text{C}_{70}$ . Diamond and Graphite- Properties and structure.

Silicon: Structure of silica. Silicates- types of silicates with examples.

Nitrogen: Preparation (any two methods), properties, uses, structure of hydrazine, hydroxyl amine and hydrazoic acid.

Sulphur: Preparation, properties, structures and applications of thionyl chloride, sulphuryl chloride and SF<sub>6</sub>.

Halogens: Preparation, properties and structure of bleaching powder.

Pseudo halogens: preparation, properties and structure of cyanogens, thiocyanogen, tellurocyanogen and oxocyanogen. (any one method of preparation and any three properties to be discussed). **(5 Lectures)**

### **Bio-Inorganic Chemistry**

A brief introduction to bio-inorganic chemistry. Essential and trace elements in biological process. Role of metal ions present in biological systems with special reference to Na<sup>+</sup>, K<sup>+</sup> and Ca<sup>2+</sup>, Mg<sup>2+</sup> ions: Na/K pump; Role of Mg<sup>2+</sup> ions in energy production and chlorophyll. Role of Ca<sup>2+</sup> in blood clotting, Enzymatic role of Iron in Hemoglobin and myoglobin, Magnesium in Chlorophyll, Cobalt in Vitamin B12.

Stabilization of protein structures and structural role (bones).

Biological functions and toxicity of Cr, Mn, Co, Ni, I, Hg, Mo, and Se. **(5 Lectures)**

### **Section B: Organic Chemistry-4**

**(30 Lectures)**

#### **Polynuclear and heteronuclear aromatic compounds:**

Polynuclear Hydrocarbons: Resonance structures of Naphthalene, anthracene and Phenanthracene.

Structural elucidation of naphthalene. Reactions of naphthalene- oxidation, reduction and electrophilic substitution reactions

**Heterocyclic Compounds:** Definition, classification with examples, synthesis of Furan, thiophene, pyrrole, pyridine, indole (Fischer method), quinoline (Skrap's synthesis), isoquinoline, pyrimidine (one method each). Aromaticity and basicity of pyrrole and pyridine. Electrophilic substitution reactions of pyrrole and pyridine.

**Uric acid-** Structure, Synthesis. Conversion of uric to purine and caffeine

**Dyes:** Colour and Constitution, Witt's theory, Classification of dyes based on structures with examples, synthesis of Methyl orange, Bismark brown, indigo and malachite green, structural elucidation of alizarin and its synthesis.

**Drugs:** Chemotherapy and chemotherapeutic agents, definition of drugs, types of drugs, antipyretics, analgesics, anaesthetics, sedatives, narcotics, antiseptics, antibacterials, antibiotics, antimalarials and sulphadiazine with examples. Synthesis of paracetamol, sulphanilamide, sulphaguanidine **(13 lectures)**

**Active methylene compounds:** Definition, Ethyl acetoacetate and diethyl malonate preparation, Mechanism of Claisen condensation, keto-enol tautomerism and its evidence. Synthetic applications of EAA and DEM:- Synthesis of mono carboxylic acids, dicarboxylic acids-succinic acid, adipic acid, antipyrine, Barbituric acid, acetyl acetone, Crotonic acid and Cinnamic acid. **(4 lectures)**

#### **Application of Spectroscopy to Simple Organic Molecules**

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions,  $\lambda_{max}$ , chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating  $\lambda_{max}$  of conjugated dienes

**IR-Spectroscopy:** Introduction, functional group region and finger print region stretching frequency, Graphical representation of IR spectra of benzoic acid and methyl benzoate. Absorption frequencies of Simple functional groups

**NMR Spectroscopy:** Basic principles of proton magnetic resonance , nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, magnetic resonance-chemical shift (  $\delta$  value), use of TMS as reference, nuclear shielding effects, equivalent and non-equivalent protons, spin-spin splitting.

NMR spectra of Simple organic molecules (like ethyl alcohol, ethane, propane, benzene, toluene, acetone, and methyl chloride) to be discussed.. **(13 Lectures)**

**Reference:**

- James E. Huheey, Ellen Keiter& Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
- G.L. Miessler& Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
- J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
- F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley & Sons.
- I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
- John R. Dyer: Applications of Absorption Spectroscopy of OrganicCompounds, Prentice Hall.
- R.M. Silverstein, G.C. Bassler& T.C. Morrill: Spectroscopic Identification ofOrganic Compounds, John Wiley & Sons.
- R.T. Morrison & R.N. Boyd: Organic Chemistry, Prentice Hall.
- Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
- ArunBahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand

**QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY**

Theory: 60 Lectures

**COURSE OUTCOME:**

After completion of the course the student is able to:

- CO1: Understand the concepts in quantum chemistry  
 CO2: Know about photochemistry  
 CO3: Know the concept of spectroscopy with applications

**Quantum Chemistry**

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and “particle-in-a-box” (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.

Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution.

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.

Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of  $H_2$  + . Bonding and antibonding orbitals. Qualitative extension to  $H_2$ . Comparison of LCAO-MO and VB treatments of  $H_2$  (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH). Localised and non-localised molecular orbitals treatment of triatomic ( $BeH_2$ ,  $H_2O$ ) molecules. Qualitative MO theory and its application to  $AH_2$  type molecules.

**(24 Lectures)****Molecular Spectroscopy:**

Interaction of electromagnetic radiation with molecules and various types of spectra; BornOppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence

and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

**(24 Lectures)**

### **Photochemistry**

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

**(12 Lectures)**

### **Reference:**

- Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006).
- Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).
- House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).
- Lowe, J. P. & Peterson, K. Quantum Chemistry, Academic Press (2005).
- Kakkar, R. Atomic & Molecular Spectroscopy: Concepts & Applications, Cambridge University Press (2015).

## SEC1A

## FUEL CHEMISTRY

### SKILL ENHANCEMENT COURSE-SEC

30 Lectures

#### Course outcome:

After completion of the course a student is able to:

- CO1: Understand soil sample for calcium and magnesium content.
- CO2: Understand water parameters.
- CO3: Identify food adulterants.
- CO4: Understand chromatography.

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value

**Coal:** Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

**Petroleum and Petrochemical Industry:** Composition of crude petroleum, Refining and different types of petroleum products and their applications.

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

**Lubricants:** Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants.

Properties of lubricants (viscosity index, cloud point, pour point) and their determination.

#### Reference :

- Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
- Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
- Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

**DME24601/ DME24605/ DME24608**

## SEC1B

### BASIC ANALYTICAL CHEMISTRY

30 Lectures



## Course outcome:

After completion of the course a student is able to:

- CO1: Analyze food products
- CO2: Analyze soil sample
- CO3: Determine the contaminants in water
- CO4: Study about chromatography

**Introduction:** Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

**Analysis of soil:** Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

- a. Determination of pH of soil samples.
- b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

**Analysis of water:** Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

- a. Determination of pH, acidity and alkalinity of a water sample.
- b. Determination of dissolved oxygen (DO) of a water sample.

**Analysis of food products:** Nutritional value of foods, idea about food processing and food preservations and adulteration.

- a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
- b. Analysis of preservatives and colouring matter.

**Chromatography:** Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

- a. Paper chromatographic separation of mixture of metal ion ( $\text{Fe}^{3+}$  and  $\text{Al}^{3+}$ ).
- b. To compare paint samples by TLC method. **Ion-exchange:** Column, ion-exchange chromatography etc.  
Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

**Analysis of cosmetics:** Major and minor constituents and their function

- a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
- b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

**Suggested Applications (Any one):**

- a. To study the use of phenolphthalein in trap cases.
- b. To analyze arson accelerants.

- c. To carry out analysis of gasoline.

**Suggested Instrumental demonstrations:**

- a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry. 104
- b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
- c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

**Reference:**

- Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*. 7<sup>th</sup> Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
- Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- Skoog, D.A.; West, D.M. & Holler, F.J. *Fundamentals of Analytical Chemistry* 6<sup>th</sup> Ed., Saunders College Publishing, Fort Worth (1992).
- Harris, D. C. *Quantitative Chemical Analysis*, W. H. Freeman.
- Dean, J. A. *Analytical Chemistry Notebook*, McGraw Hill.
- Day, R. A. & Underwood, A. L. *Quantitative Analysis*, Prentice Hall of India.
- Freifelder, D. *Physical Biochemistry* 2<sup>nd</sup> Ed., W.H. Freeman and Co., N.Y. USA (1982).
- Cooper, T.G. *The Tools of Biochemistry*, John Wiley and Sons, N.Y. USA. 16 (1977).
- Vogel, A. I. *Vogel's Qualitative Inorganic Analysis* 7<sup>th</sup> Ed., Prentice Hall.
- Vogel, A. I. *Vogel's Quantitative Chemical Analysis* 6<sup>th</sup> Ed., Prentice Hall.
- Robinson, J.W. *Undergraduate Instrumental Analysis* 5<sup>th</sup> Ed., Marcel Dekker, Inc., New York (1995)

## **Chemistry Syllabus for practicals for B.Sc Course**

**Note: Students should be trained to use both chemical and electronic balances (three digit)  
DMA24101/ DMA24105/ DMA24108**

**V Semester: Practical 5A**

**3 hours per week**

**DME24101/ DME24105/ DME24108**

**Part 1: Gravimetric estimation**

1. Gravimetric estimation of Barium as Barium sulphate.
2. Gravimetric estimation of Iron as Iron(III) oxide

3. Gravimetric estimation of copper as copper thiocyanate
4. Gravimetric estimation of Nickel as nickel dimethyl glyoximate
5. Gravimetric estimation of magnesium as magnesium hydroxyl quinolate

**Part 2 : Volumetric estimations**

1. Estimation of iron in the given sample of haematite by dichromate method.
2. Estimation of percentage of calcium in limestone by oxalate method
3. Estimation of manganese in the given sample of pyrolusite.
4. Estimation of magnesium in the given sample of dolomite by EDTA method.
5. Determination of % purity of copper in the given sample of copper wire.

**V Semester: Practical 5B**

**3 hours per week**

**DME24301/ DME24305/ DME24308**

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO<sub>3</sub> and potassium chromate).
6. Estimation of total alkalinity of water samples (CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup>) using double titration method.
7. Measurement of dissolved CO<sub>2</sub>.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

**VI Semester : Practical 6 A**

**3 hours per week**

**DMF24101/ DMF24105/ DMF24108**

**Part 1: Physical chemistry experiments (instrumental)**

1. Determination of Equivalent conductance of the given electrolyte(both strong and weak electrolyte)
2. Determination of percentage composition of benzene and carbon tetra chloride by using Abbe's refractrometer.
3. Determination of concentration of an acid/ base by conductometric method.
4. Potentiometric titration of Ferrous ammonium sulphate and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
5. Determination of PKa of weak acid by potentiometric method
6. PH titration of strong acid and strong base.
7. Calorimetric estimation of Fe<sup>3+</sup> ion using Ammonium thiocyanate
8. Calorimetric estimation of Cu<sup>2+</sup> ion using NH<sub>4</sub>OH
9. Calorimetric estimation of Aspirin using FeCl<sub>3</sub>

## Part 2 : Isolation of organic compounds from natural products

1. Isolation of hesperidins from orange peels
2. Isolation of caffeine from Tea leaves
3. Isolation of Nicotine from Tobacco leaves.

## **VI Semester : Practical 6B**

**3 hours per week**

**DMF24301/ DMF24305/ DMF24308**

### **DSE LAB**

#### UV/Visible spectroscopy

1. Study the 200-500 nm absorbance spectra of  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  (in 0.1 M  $\text{H}_2\text{SO}_4$ ) and determine the  $\lambda_{\text{max}}$  values. Calculate the energies of the two transitions in different units ( $\text{J molecule}^{-1}$ ,  $\text{kJ mol}^{-1}$ ,  $\text{cm}^{-1}$ , eV).
2. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of  $\text{K}_2\text{Cr}_2\text{O}_7$ .
3. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.
  - i. Colourimetry
4. Verify Lambert-Beer's law and determine the concentration of  $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$  in a solution of unknown concentration
5. Determine the concentrations of  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  in a mixture.
6. Study the kinetics of iodination of propanone in acidic medium
7. Determine the amount of iron present in a sample using 1,10-phenanthroline.
8. Determine the dissociation constant of an indicator (phenolphthalein).
9. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.
10. Analyse the given vibration-rotation spectrum of  $\text{HCl}(\text{g})$

#### **Reference:**

- A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
- A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.

Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960

**Pattern of question paper for DSC/DSE  
I to VI semesters**

**Time : 3.00hrs**

**Max marks: 70**

**PART-A**

I. Answer the following questions

1x10=10

- a)
- b)
- c)
- d)

- e)
- f)
- g)
- h)
- i)
- j)

**PART-B**

II Answer any three questions

(Questions carrying 4,4,2- 3,3,4- 6,4 and 5,5 marks may be given)

3x10=30

- 2)
- 3)
- 4)
- 5)

**PART-C**

III Answer any three questions

(Questions carrying 4,4,2- 3,3,4- 6,4 and 5,5 marks may be given)

3x10=30

- 6)
- 7)
- 8)
- 9)

**Pattern of question paper for SEC**

**Time : 2 hrs**

**Max marks: 35**

**PART-A**

I. Answer the following questions

1x5=5

- a)
- b)

- c)
- d)
- e)

## PART-B

II Answer any three questions

(Questions carrying 4,4,2- 3,3,4- 6,4 and 5,5 marks may be given)

3x10=30

- 2)
- 3)
- 4)
- 5)

### **Panel of Examiners**

1. Smt J S Vidya  
Chairperson, JSS College,  
Ooty Road, Mysore

2. Dr. B K Kendagannaswamy  
JSS College, Ooty Road,  
Mysore
3. D S Prabhakar  
JSS College, Ooty Road,  
Mysore
4. Shwetha P  
JSS College, Ooty Road,  
Mysore
5. Shambhavi S  
JSS College, Ooty Road,  
Mysore

## **EXTERNAL MEMBERS**

1. Dr. GirijaNagendraswamy . Maharani's Science College for Women, Mysuru
2. Dr. Jayarooma .Maharani.s Science College for Women, Mysuru
3. DrKempegowda,. Maharani's Science College for Women, Mysuru
4. Dr. Jamuna rani. Maharani's Science College for Women Mysuru
5. Prof B Manjunath . Maharani's Science College for Women ,Mysuru
6. Dr Lakshmi Hebbar,.Maharani's Science College for Women ,Mysuru
7. DrMadhusudana Reddy , Maharani's Science College for Women, Mysuru
8. Dr. K KPadmanabha,.Maharani's Science College for Women,. Mysuru
9. Prof. Tara, Maharani's Science College for Women, Mysuru
10. Dr. Chennu, Maharani's Science College for Women ,Mysuru
11. Smt. Kavitha ,Maharani's Science College for Women ,Mysuru
12. Smt. Radhika ,Maharani's Science College for Women, Mysuru
13. Dr. Ramesh baba Maharani's Science College for Women, Mysuru
14. Dr. T S Yamuna ,Maharani's Science College for Women,Mysuru
15. Smt. Ayesha, Kuvempu Nagar first Grade College., Mysuru
16. Dr. Mousinabegam Maharani's Science College for Women Mysuru
17. Dr. K Ajay Kumar, Yuvaraja's College, Mysuru
18. Dr. Chandrashekar, Yuvaraja's College, Mysuru
19. Dr. DevaRaj, Yuvaraja's College, Mysuru
20. Dr. Sudha B S ,Yuvaraja college ,Mysuru
21. Dr. Shaukatharakhanum ,Yuvaraja'sCollege,Mysuru
22. Dr. Ahamabidi, Yuvaraja's College ,Mysuru
23. Jayadevappa ,Yuvaraja'sCollege,Mysuru
24. Dr. Ashaiyengar, Yuvaraja's College ,Mysuru
25. Dr. Govindaraju M ,Sharadavilas College, Mysouru



26. Prof. Prakash K, Govt. College for boys(Autonomous) ,Mandya
27. Dr. ShivaprakashVijayanagar first Grade college Mysuru
28. Dr. AlphonsusDsouza, St. PhilominasCollege,Mysuru
29. Smt. Agnes Dsouza St. Philominas College Mysuru
30. Prof. Britto Dominik,rayan,,Sri D DUrs College, Hunsur
31. Smt. Pushpa ,JSS CW, ,Sarswathipuram, Mysuru
32. SmtLokeswari ,JSS CW Sarswathipuram, Mysuru
33. Rajeshwari P R, JSS CW Sarswathipuram, Mysuru
34. SmtRakshitha, JSS college ,Nanjangud
35. Sri Siddaraju, JSS College, Chamarajanagar
36. Dr. Laval Devi, Govt first grade College, K R Nagar.
37. Archana P Mendora, St. Philominas College,Mysore
38. Bindu Noronha, St. Philominas College,Mysore
39. Sudeep P, YCM, Mysore
40. Vageesh, YCM, Mysore
41. Dileep P, YCM, Mysore
42. Prakash , YCM, Mysore
43. Pallavi H M, YCM, Mysore
44. Sumana, YCM, Mysore
45. Dr. Nandeesh, YCM, Mysore
46. Guruprasad, YCM, Mysore
47. Jagadeesh, YCM, Mysore
48. Mahima, YCM, Mysore
49. Rekha G R, YCM, Mysore
50. Kemparaje Gowda, YCM, Mysore
51. Gangadhar, YCM, Mysore
52. Vivek, YCM, Mysore
53. Sindhushree, YCM, Mysore
54. Mamatha M, MSCW, Mysore
55. Noor Fatima, MSCW, Mysore
56. Bindushree, MSCW, Mysore
57. Mamatha , JSS College, Chamarajnagar
58. Sowmya, JSS College, Chamarajnagar







**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
(Autonomous)

**Ooty Road, Mysuru-570025**

**Model Curriculum Structures for  
Bachelor of Science (Basic and Honours) Programme  
with Computer Science as Major & Minor Course  
Model Syllabus for I and II Semesters  
and  
Open Elective Courses in Computer Science**

**As per  
NATIONAL EDUCATION POLICY - 2020  
(NEP-2020)**

**2021-22**

**DEPARTMENT OF COMPUTER SCIENCE**



## **The objectives of the B.Sc. - Computer Science Program**

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This programme provides students with options to specialize in various software system.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem- solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

## **Program Outcomes:**

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems.
4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. **Application Systems Knowledge:** Possessing a minimum knowledge to practice existing computer application software.
6. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.
7. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
9. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

## **Additional Program Outcomes for B. Sc. (Hons) in Computer Science**

The four years Bachelors in Computer Science (Hons) program enables students to attain the following additional attributes besides the afore-mentioned attributes:

1. Apply standard Software Engineering practices and strategies in real -time software project development
2. Design and develop computer programs/computer-based systems in the areas related to AI, algorithms, networking, web design, cloud computing, IoT and data analytics.
3. Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems
4. The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
5. The ability to work independently on a substantial software project and as an effective team member.





**IIIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka**  
**Bachelor of Science (Basic/Hons.) in subjects with practical with both subjects as majors**

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC),		Skill Enhancement Courses (SEC)			Total Credits
					Skill based credits (L+T+P)	Value based (Credits) (L+T+P)		
I	Discipline A1(4+2) Discipline B1(4+2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)	Environmental Studies (3)		Physical Education for fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	25
II	Discipline A2(4+2) Discipline B2(4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)		SEC-1: Digital Fluency (2)(1+0+2)	Physical Education - Yoga(1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1) (0+0+2)	25
Exit option with Certificate (50 credits)								
III	Discipline A3(4+2) Discipline B3(4+2)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs. each)	Constitution of India (3)		Physical Education- Sports (1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1)(0+0+2)	25
IV	Discipline A4(4+2) Discipline B4(4+2)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs. each)		SEC-2: Artificial Intelligence (2) (1+0+2)	Physical Education -Games (1) (0+0+2)	NCC/NSS/R&R(S&G) /Cultural (1)(0+0+2)	25
Exit option with Diploma (100 credits) or continue the third year with both the subjects as majors								
V	Discipline A5(3+2), Discipline A6(3+2) Discipline B5(3+2), Discipline B6(3+2)				SEC-3: SEC such as Cyber Security (2) (1+0+2)			23
VI	Discipline A7(3+2), Discipline A8(3+2) Discipline B7(3+2) Discipline B8(3+2) Internship (2)				SEC-4: Professional Communication (2)			24
Exit option with Bachelor of Arts, B.A./ Bachelor of Science, B. Sc. Basic Degree (146 credits) or choose one of the Disciplines as Major								
VII	Discipline A/B-9(3+2) Discipline A/B-10(3+2) Discipline A/B-11(3)		DS-A/B Elective-1(3) DS-A/B Elective-2(3) Res.Methodology(3)					22
VIII	Discipline A/B-12(3+2) Discipline A/B-13(3) Discipline A/B-14(3)		DS-A/B Elective-3(3) Research Project (6) *					20



**NEP 2020 Syllabus – B.Sc. (Cs M) and B.Sc. (P Cs) 2021-22 onwards**

Year	Sem	Combination	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
					L	T	P	L	T	P	Th. IA		Pr. IA		Exam			
											C1	C2	C1	C2	Th.	Pr.		
I	I	Cs M	FSA45034 [DSC-1]	Computer Fundamentals and Programming in C	4	0	0	4	0	0	20	20	-	-	60	-	3 Hours	100
		P Cs	FSA45035 [DSC-1]	Computer Fundamentals and Programming in C	4	0	0	4	0	0	20	20	-	-	60	-	3 Hours	100
		Cs M	FSA45034 [DSC-1L]	C Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		P Cs	FSA45035 [DSC-1L]	C Programming Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50
		IBA EG	FHA21031	SEC-DIGITAL FLUENCY	1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA HP	FHA21032		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA KG	FHA21033		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA HE	FHA21034		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		IBA JP	FHA21035		1	0	1	1	0	2	-	-	10	15*	-	25	1 Hours	50
		FSA880	OE-Open Elective Office Automation	3	0	0	3	0	0	-	-	10	15*	-	25	2 Hours	50	
		FSA890	OE- C – Programming Concepts	3	0	0	3	0	0	-	-	10	15*	-	25	2 Hours	50	
	II	Cs M	FSB45034 [DSC-2]	Data Structures using C	4	0	0	4	0	0	20	20	-	-	60	-	3 Hours	100
		P Cs	FSB45035 [DSC-2]	Data Structures using C	4	0	0	4	0	0	20	20	-	-	60	-	3 Hours	100
Cs M		FSB45034 [DSC-2 L]	Data structures Lab	0	0	4	0	0	2	-	-	10	15*	-	25	3 Hours	50	







**Note: 15\* is split 10 marks for Practical's C2 + 5 marks for practical Record/Report**

<b>Discipline Specific Elective Courses:</b>		
<b>Group 1:</b> <ul style="list-style-type: none"> <li>• IoT</li> <li>• Cyber Law and Cyber Security</li> <li>• Web Programming - PHP and MySQL</li> <li>• Clouds, Grids, and Clusters</li> <li>• Software Testing</li> </ul>	<b>Group-2:</b> <ul style="list-style-type: none"> <li>• Information and Network Security</li> <li>• Data Compression</li> <li>• Discrete Structures</li> <li>• Opensource Programming</li> <li>• Multimedia Computing</li> <li>• Big Data</li> </ul>	<b>Group-3:</b> <ul style="list-style-type: none"> <li>• Data Analytics</li> <li>• Storage Area Networks</li> <li>• Pattern Recognition</li> <li>• Digital Image Processing</li> <li>• Parallel Programming</li> <li>• Digital Signal Processing</li> </ul>
<b>Open Electives in Computer Science:</b>		
(For BA, BSc, BCom, BSW, BBA, BBM students studying Core Courses other than Computer Science/ Computer Applications)		
<ul style="list-style-type: none"> <li>• Office Automation</li> <li>• Multimedia Processing</li> <li>• Computer Animation</li> <li>• Accounting Package</li> </ul>	<ul style="list-style-type: none"> <li>• C Programming Concepts</li> <li>• Python Programming Concepts</li> <li>• R Programming</li> </ul>	<ul style="list-style-type: none"> <li>• E-Content Development</li> <li>• E-Commerce</li> <li>• Web Designing</li> </ul>





# Model Syllabus for BSc (Basic and Honors), Semesters I and II

## Semester: I

Course Code: DSC-1	<b>Course Title:</b> Computer Fundamentals and Programming in C
Course Credits: 04	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03

### Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

### Course Content

Content	Hours
<b>Unit - 1</b>	
<b>Fundamentals of Computers:</b> Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples. <b>Introduction to C Programming:</b> Over View of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C.	13
<b>Unit - 2</b>	
<b>C Programming Basic Concepts:</b> C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants. <b>Input and output with C:</b> Formatted I/O functions - <i>printf</i> and <i>scanf</i> , control stings and escape sequences, output specifications with <i>printf</i> functions; Unformatted I/O functions to read and display single character and a string - <i>getchar</i> , <i>putchar</i> , <i>gets</i> and <i>puts</i> functions. <b>C Operators &amp; Expressions:</b> Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associativity; Evaluation of arithmetic expressions; Type conversion.	13
<b>Unit - 3</b>	
<b>Control Structures:</b> Decision making Statements - <i>Simple if</i> , <i>if_else</i> , <i>nested if_else</i> , <i>else_if ladder</i> , <i>Switch-case</i> , <i>goto</i> , <i>break</i> & <i>continue</i> statements; Looping Statements - Entry controlled and Exit controlled statements, <i>while</i> , <i>do-while</i> , <i>for</i> loops, Nested loops.	13

Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions - <i>strlen</i> , <i>strcmp</i> , <i>strcpy</i> and <i>strcat</i> ; Character handling functions - <i>tolower</i> , <i>isalpha</i> , <i>isnumeric</i> etc.	
<b>Unit - 4</b>	
<b>Pointers in C:</b> Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers; <b>User Defined Functions:</b> Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type. <b>User defined data types:</b> Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions.	13

### Text Books

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balgurusamy: Programming in ANSI C (TMH)

### References

1. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
2. V. Rajaraman: Programming in C (PHI – EEE)
3. S. ByronGottfried: Programming with C (TMH)
4. Kernighan & Ritchie: The C Programming Language (PHI)
5. Yashwant Kanitkar: Let us C
6. P.B. Kottur: Programming in C (Sapna Book House)

Course Code: <b>DSC-1L</b>	<b>Course Title: C Programming Lab</b>
Course Credits: 02	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03

### Practice Lab

The following activities be carried out/ discussed in the lab during the initial period of the semester.

1. Basic Computer Proficiency a. Familiarization of Computer Hardware Parts
  - b. Basic Computer Operations and Maintenance.
  - c. Do's and Don'ts, Safety Guidelines in Computer Lab
2. Familiarization of Basic Software – Operating System, Word Processors, Internet Browsers, Integrated Development Environment (IDE) with Examples.
3. Type Program Code, Debug and Compile basic programs covering C Programming fundamentals discussed during theory classes.

### Programming Lab

#### Part A:

1. Write a C Program to read radius of a circle and to find area and circumference
2. Write a C Program to read three numbers and find the biggest of three

3. Write a C Program to demonstrate library functions in *math.h*
4. Write a C Program to check for prime
5. Write a C Program to generate n primes
6. Write a C Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
7. Write a C Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
8. Write a C Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder)
9. Write a C Program to find the roots of quadratic equation (demonstration of switch-case statement)
10. Write a C program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
11. Write a C Program to remove Duplicate Element in a single dimensional Array
12. Program to perform addition and subtraction of Matrices

**Part B:**

1. Write a C Program to find the length of a string without using built in function
2. Write a C Program to demonstrate string functions.
3. Write a C Program to demonstrate pointers in C
4. Write a C Program to check a number for prime by defining *isprime( )* function
5. Write a C Program to read, display and to find the trace of a square matrix
6. Write a C Program to read, display and add two m x n matrices using functions
7. Write a C Program to read, display and multiply two m x n matrices using functions
8. Write a C Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Write a C Program to Reverse a String using Pointer
10. Write a C Program to Swap Two Numbers using Pointers
11. Write a C Program to demonstrate student structure to read & display records of n students.
12. Write a C Program to demonstrate the difference between structure & union.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

**Evaluation Scheme for Lab Examination**

Assessment Criteria		Marks
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
<b>Total</b>		<b>25</b>

## Semester: II

Course Code: <b>DSC-2</b>	<b>Course Title:</b> Data Structures using C
Course Credits: 04	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 03 Hours

### Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting and searching

### Course Content

Content	Hours
<b>Unit - 1</b>	
Introduction to data structures: Definition; Types of data structures - Primitive & Non-primitive, Linear and Non-linear; Operations on data structures. Algorithm Specification, Performance Analysis, Performance Measurement Recursion: Definition; Types of recursions; Recursion Technique Examples - Fibonacci numbers, GCD, Binomial coefficient ${}^nC_r$ , Towers of Hanoi; Comparison between iterative and recursive functions.	13
<b>Unit - 2</b>	
Arrays: Basic Concepts – Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory; Traversing linear arrays; Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices. Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - <i>malloc</i> , <i>calloc</i> , <i>realloc</i> and <i>free</i> .	13
<b>Unit - 3</b>	
Linked list: Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly linked list, Header linked list, Circular linked list; Representation of Linked list in Memory; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection. Stacks: Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls.	13

Unit - 4	
Queues: Basic Concepts – Definition and Representation of queues; Types of queues - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues; Trees: Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth; Binary tree: Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; <i>preorder</i> , <i>inorder</i> and <i>postorder</i> traversal; Reconstruction of a binary tree when any two of the traversals are given.	13

#### Text Books

1. Satraj Sahani: Fundamentals of Data Structures

#### References

1. Tanenbaum: Data structures using C (Pearson Education)
2. Kamathane: Introduction to Data structures (Pearson Education)
3. Y. Kanitkar: Data Structures Using C (BPB)
4. Kottur: Data Structure Using C
5. Padma Reddy: Data Structure Using C
6. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007))

Course Code: <b>DSC-2Lab</b>	<b>Course Title: Data Structures Lab</b>
Course Credits: 02	Hour of Teaching/Week: 04
Total Contact Hours: 52	Formative Assessment Marks: 25
Exam Marks: 25	Exam Duration: 03

#### Programming Lab

##### Part A:

1. Write a C Program to find GCD using recursive function
2. Write a C Program to display Pascal Triangle using binomial function
3. Write a C Program to generate n Fibonacci numbers using recursive function.
4. Write a C Program to implement Towers of Hanoi.
5. Write a C Program to implement dynamic array, find smallest and largest element of the array.
6. Write a C Program to create two files to store even and odd numbers.
7. Write a C Program to create a file to store student records.
8. Write a C Program to read the names of cities and arrange them alphabetically.
9. Write a C Program to sort the given list using selection sort technique.
10. Write a C Program to sort the given list using bubble sort technique.

##### Part B:

1. Write a C Program to sort the given list using insertion sort technique.
2. Write a C Program to sort the given list using quick sort technique.
3. Write a C Program to sort the given list using merge sort technique.
4. Write a C Program to search an element using linear search technique.
5. Write a C Program to search an element using recursive binary search technique.
6. Write a C Program to implement Stack.
7. Write a C Program to convert an infix expression to postfix.

8. Write a C Program to implement simple queue.
9. Write a C Program to implement linear linked list.
10. Write a C Program to display traversal of a tree.

**Evaluation Scheme for Lab Examination**

<b>Assessment Criteria</b>		<b>Marks</b>
Program – 1 from Part A	Flowchart / Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Program -2 from Part B	Flowchart/Algorithm	02
	Writing the Program	05
	Execution and Formatting	03
Viva Voice based on C Programming		05
<b>Total</b>		<b>25</b>

## **Open Elective courses offered by the Department of Computer Science**

### **Open Elective 1: Office Automation**

#### **Course Outcomes (COs):**

- Be familiar various office automation tools.
- Create and format a document.
- Create and analyse data using Excel.
- Create and customize a presentation for a specific topic.

#### **Unit-1**

**14 Hrs**

Introduction, Block diagram of a computer, Input and output devices, memory and storage devices, Types of software, Introduction to operating system – functions, types of operating system and examples.

Introduction to word processing – creating and saving a document, formatting a document – Line spacing, paragraph, Fonts, inserting symbols, header and footer, shape, Tables, Find and replace, Mail merge, saving a document in different formats.

#### **Unit-3**

**14 Hrs**

Introduction to spread sheet – entering different types of data like text, numbers, date, , functions and formulae- different categories of functions, chart-creating and formatting a chart, filter, working with single and multiple work books, cell referencing, printing and previewing a document.

#### **Unit-3**

**14 Hrs**

Introduction to presentation tools-creating and viewing a presentation, applying design template, formatting options, inserting different objects in a presentation, customize a presentation, adding audio to a presentation, Slide animation, preview Slide transitions Slide show options, adding effect to presentation.

#### **Reference books**

1. Computer Basics with Office Automation- Archana Kumar, Dreamtech press, First Edition.
2. The Handbook of Office Automation- Ralph Tomas Reilly, Iuniverse publication, First Edition.



## **Open Elective-2: C Programming Concepts**

Course Outcomes (COs): After completing this course satisfactorily, a student will be able to

- Confidently operate Desktop Computers to carry out computational tasks.
- Understand working of Hardware and Software and the importance of operating systems.
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts.
- Read, understand and trace the execution of programs written in C language.
- Write the C code for a given problem.
- Perform input and output operations using programs in C.
- Write programs that perform operations on arrays.

### **Unit-1**

**14 Hrs**

Fundamentals of Computers: Introduction to Computers -Hardware, software System software, Application software, Utility software, Operating System; Computer Languages – Machine Level, Assembly Level & High-Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program – Algorithm and Flowchart with Examples.

Introduction to C Programming: Over View of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C. C Programming Basic Concepts: C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.

### **Unit-2**

**14 Hrs**

Input and output with C: Formatted I/O functions - printf and scanf, control stings and escape sequences, output specifications with printf functions; Unformatted I/O functions to read and display single character and a string - getchar, putchar, gets and puts functions, C Operators & Expressions: Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associativity; Evaluation of arithmetic expressions; Type conversion. Control Structures: Decision making Statements - Simple if, if\_else, nested if\_else, else\_if ladder, Switch-case, goto, break & continue statements; Looping Statements - Entry controlled and Exit controlled statements, while, do-while, for loops, Nested loops.

### **Unit-3**

**14 Hrs**

User Defined Functions: Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.

Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions - strlen, strcmp, strcpy and strcat; Character handling functions - toascii, toupper, tolower, isalpha, isnumeric etc. Basics of Pointers in C: Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointer Arithmetic; Advantages and disadvantages of using pointers;

### **Text Books:**

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balgurusamy: Programming in ANSI C (TMH)

### **References:**

1. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
2. V. Rajaraman: Programming in C (PHI –EEE)
3. S. ByronGottfried: Programming with C (TMH)
4. Kernighan & Ritchie: The C Programming Language (PHI)
5. Yashwant Kanitkar: Let us C 6. P.B. Kottur: Programming in C (Sapna Book House)

## Course Content

Semester: I / II

Course Title: **Digital Fluency**

Course Credits: 2

Total Contact Hours: 15 hours of theory and 30 hours of practical's

Duration of ESA:

Formative Assessment Marks: **50 marks**

Summative Assessment Marks: 50 marks

Model Syllabus Authors:

### Course Outcomes (COs):

At the end of the course the student should be able to:

(Write 3-7 course outcomes. Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course)

1. Have an intelligent conversation on the key concepts and applications of Artificial Intelligence (AI), Big Data Analytics (BDA), Internet of Things (IoT), Cloud Computing, and Cybersecurity
2. Develop holistically by learning essential skills such as effective communication, problem-solving, design thinking, and teamwork
3. Build his/her personal brand as an agile and expansive learner – one who is interested in horizontal and vertical growth?

### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

**This mapping needs to be done considering POs of respective programs.**

### Course Outcomes (COs) / Program Outcomes (POs)

**1 2 3 4 5 6 7 8 9 10 11 12**

1. Have an intelligent conversation on the key concepts and applications of AI, BDA, IoT, Cloud Computing, and Cybersecurity
2. Develop holistically by learning essential skills such as effective communication, problem-solving, design thinking, and teamwork
3. Build his/her personal brand as an agile and expansive learner – one who is interested in horizontal and vertical growth

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

### Course Content (Digital 101)

#### Details of topic

#### Module 1: Emerging Technologies

**Duration**

05 hours

Overview of Emerging Technologies:

- i. Artificial Intelligence, Machine Learning, Deep Learning,
- ii. Database Management for Data Science, Big Data Analytics,
- iii. Internet of Things (IoT) and Industrial Internet of Things (IIoT)
- iv. Cloud computing and its service models & v. Cyber Security and Types of cyber attack

**Module 2: Applications of Emerging Technologies**

05 hours

Applications of emerging technologies:

- i. Artificial Intelligence
- ii. Big Data Analytics
- iii. Internet of Things
- iv. Cloud Computing
- v. Cyber Security

**Module 3: Building Essential Skills Beyond Technology**

05 hours

Importance of the following:

- i. Effective Communication Skills
- ii. Creative Problem Solving & Critical Thinking
- iii. Collaboration and Teamwork Skills
- iv. Innovation & Design Thinking
- v. Use of tools in enhancing skills

**References to learning resources:**

1. The learning resources made available for the course titled “Digital 101” on Future Skills Prime Platform of NASSCOM

## **SEMESTER V**

**Course code: CME25002**

**DSE 3A: Elective: Computer Science – V**

**Database Management Systems**

**Credits: Theory - 04, Practical - 01**

**Theory: 60 Lectures**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Understand the characteristics of DBMS with examples
- CO2. Deliberate the details of types of database languages with examples
- CO3. Learn the details of ER- Diagrams and Relationship
- CO4. Understand in depth Basic concepts of Relational Model
- CO5. Learn in details with examples MYSQL Commands
- CO6. Learn in details with examples in PL-SQL

**Unit - 1**

**(15 Lectures)**

**Introduction to Database Management Systems:** Definition of Data, Information, DBMS, Data base system application, Purpose of database systems, Characteristics of DB – Self describing nature, Insulation between programs, data and data Abstraction (data Independence), support of multiple views of the data, sharing of data and multiples transaction processing, Storage management, Database language – DDL, DML,DCL.

File processing system v/s DBMS, Data models, Levels of Abstraction in a DBMS, Three Schema architecture,Characteristics of database approach,, data models,DBMS architecture and data independence.

**Unit - 2**

**(15 Lectures)**

**Entity Relationship and Enhanced ER Modeling:** Entity types,Entity Sets, Attributes, and Keys, Relationships, Relationship Types, Roles, and Structural Constraints,Weak Entity Types, ER Diagrams, Naming Conventions ,SQL99:Schema Definition, constraints, and object modeling

## UG-Computer Science - CBCS Scheme

### Unit - 3

(15 Lectures)

**Relational Data Model:** Basic concepts, Relational Constraints and Relational Database Schemas, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations.

**Database design:** ER and EER to relational mapping, functional dependencies, normal forms-first normal form, second normal forms, third normal form BCNF

### Unit - 4

(15 Lectures)

**MYSQL (SQL/PL-SQL) :** SQL VS. SQL \* PLUS: SQL COMMANDS AND DATA TYPES, OPERATORS AND EXPRESSIONS, INTRODUCTION TO SQL \* PLUS.

#### **MANAGING TABLES AND DATA:**

- CREATING AND ALTERING TABLES (INCLUDING CONSTRAINTS)
- DATA MANIPULATION COMMAND LIKE INSERT, UPDATE, DELETE
- SELECT STATEMENT WITH WHERE, GROUP BY AND HAVING, ORDER BY, DISTINCT, SPECIAL OPERATOR LIKE IN, ANY, ALL BETWEEN, EXISTS, LIKE
- JOIN, BUILT IN FUNCTIONS OTHER DATABASE OBJECTS
- VIEW • SYNONYMS, INDEX TRANSACTION CONTROL STATEMENTS
- COMMIT, ROLLBACK, SAVEPOINT INTRODUCTION TO PL/SQL
- SQL V/S PL/SQL • PL/SQL BLOCK STRUCTURE
- LANGUAGE CONSTRUCT OF PL/SQL (VARIABLES, BASIC AND COMPOSITE DATA TYPE, CONDITIONS LOOPING ETC.)
- % TYPE AND % ROWTYPE
- USING CURSOR (IMPLICIT, EXPLICIT)

#### **Reference:**

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010.
2. R. Ramakrishanan, J. Gehrke, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education, 2013.

**Database Management Systems Lab**

**Software Lab based on Database Management Systems**

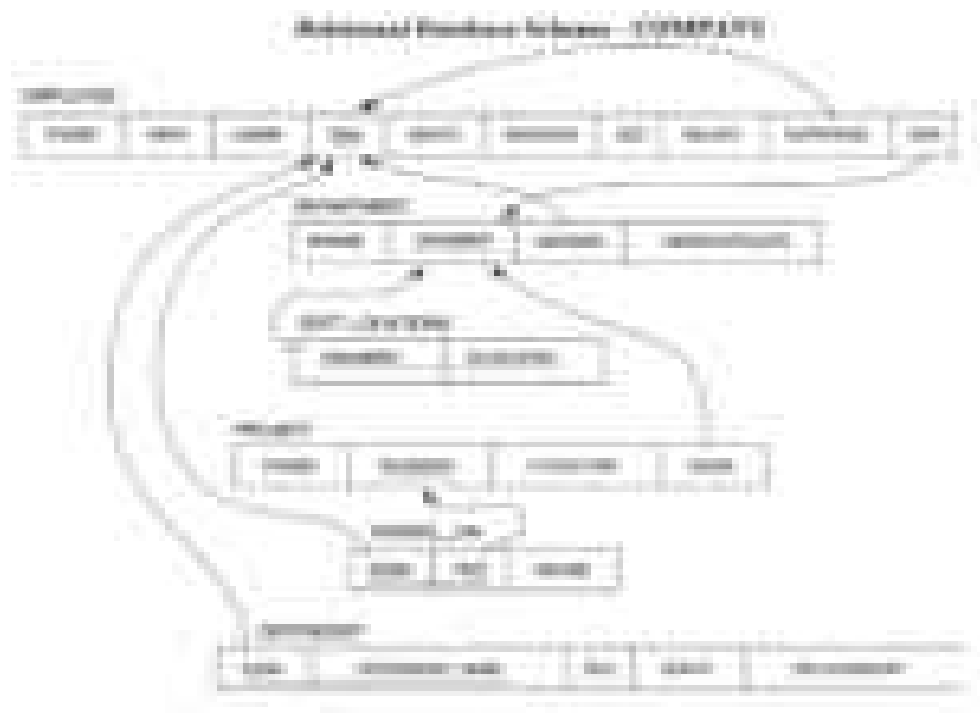
The following concepts must be introduced to the students: **Note:** MS Access/MySQL may be used.

**DDL Commands**

- Create table, alter table, drop table

**DML Commands**

- Select, update, delete, insert statements
- Condition specification using Boolean and comparison operators (and, or, not, =, <, >, <=, >=, <=)
- Arithmetic operators and aggregate functions (Count, sum, avg, Min, Max)
- Multiple table queries (join on different and same tables) • Nested select statements
- Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus, etc.)
- Categorization using group by.....having
- Arranging using order by



1. Create tables with relevant foreign key constraints
2. Populate the tables with data
3. Perform the following queries on the database :

## UG-Computer Science - CBCS Scheme

- a. Display all the details of all employees working in the company.
  - b. Displayssn, lname, fname, address of employees who work in department no 7.
  - c. Retrieve the birthdate and address of the employee whose name is 'Franklin T. Wong'
4. Retrieve the name and salary of every employee
  5. Retrieve all distinct salary values
  6. Retrieve all employee names whose address is in 'Bellaire'
  7. Retrieve all employees who were born during the 1950s
  8. Retrieve all employees in department 5 whose salary is between 50,000 and 60,000(inclusive)
  9. Retrieve the names of all employees who do not have supervisors
  10. Retrieve SSN and department name for all employees
  11. Retrieve the name and address of all employees who work for the 'Research' department
  12. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birthdate.
  13. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
  14. Retrieve all combinations of Employee Name and Department Name
  15. Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan' either as a worker or as a manager of the department that controls the project.
  16. Increase the salary of all employees working on the 'ProductX' project by 15%.  
Retrieve employee name and increased salary of these employees.
  17. Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee first name.
  18. Select the names of employees whose salary does not match with salary of any employee in department.
  19. Retrieve the name of each employee who has a dependent with the same first name and same sex as the employee.
  20. Retrieve the employee numbers of all employees who work on project located in Bellaire, Houston, or Stafford.
  21. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.
  22. Find the sum of the salaries and number of employees of all employees of the 'Marketing' department, as well as the maximum salary, the minimum salary, and the average salary in this department
  23. Select the names of employees whose salary is greater than the average salary of all employees in department 10.
  24. For each department, retrieve the department number, the number of employees in the department, and their average salary.
  25. For each project, retrieve the project number, the project name, and the number of employees who work on that project.

## UG-Computer Science - CBCS Scheme

26. Change the location and controlling department number for all projects having more than 5 employees to 'Bellaire' and 6 respectively.
27. For each department having more than 10 employees, retrieve the department no, no of employees drawing more than 40,000 as salary.
28. Insert a record in Project table which violates referential integrity constraint with respect to Department number. Now remove the violation by making necessary insertion in the Department table.
29. Delete all dependents of employee whose ssn is '123456789'.
30. Delete an employee from Employee table with ssn = '12345'( make sure that this employee has some dependents, is working on some project, is a manager of some department and is supervising some employees). Check and display the cascading effect on Dependent and Works on table. In Department table MGRSSN should be set to default value and in Employee table SUPERSSN should be set to NULL
31. Perform a query using alter command to drop/add field and a constraint in Employee table.



## **SEMESTER V**

**Course code: CME25202**

**DSE3B: Elective:Computer Science - V  
Computer Networks**

**Credits: Theory - 04, Practical - 01**

**Theory: 60 Lectures**

### **Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Understand the Elements of Data Communications and network Systems
- CO2. Learn in depth Transmission Media
- CO3. Understand in details with examples Network Models
- CO4. Understanding the various classifications and characteristics of Protocols
- CO5. Learn in depth Error Detection and Corrections Algorithms
- CO6. Learn in detail of Network Security

### **Unit - 1**

**(15 Lectures)**

**Basic concepts:** Components of data communication, standards and organizations, Network Classification, Network Topologies ; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.

### **Unit - 2**

**(15 Lectures)**

**Physical Layer:** Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway.

**Data Link Layer:** Framing techniques; Error Control; Flow Control Protocols; Shared media protocols - CSMA/CD and CSMA/CA.

### **Unit - 3**

**(15 Lectures)**

## **UG-Computer Science - CBCS Scheme**

**Network Layer:** Virtual Circuits and Datagram approach, IP addressing methods – Subnetting; Routing Algorithms (adaptive and non-adaptive)

**Transport Layer:** Transport services, Transport Layer protocol of TCP and UDP

**Unit - 4** **(15 Lectures)**

**Application Layer:** Application layer protocols and services – Domain name system, HTTP, WWW, telnet, FTP, SMTP

**Network Security:** Common Terms, Firewalls, Virtual Private Networks.

### **Reference:**

1. B.A. Forouzan: Data Communication and Networking, 4th Edition, Tata McGraw Hill, 2007.
2. D.E. Comer, Internetworking with TCP/IP, Vol. I, Prentice Hall of India, 1998.
3. W. Stalling, Data & Computer Communication, 8th edition, Prentice Hall of India, 2006.
4. D. Bertsekas, R. Gallager, Data Networks, 2nd edition, Prentice Hall of India, 1992.

## **Computer Networks Lab**

### **Software Lab based on Computer Networks:**

Implement the concepts of Computer Networks such as:

1. Simulate Checksum Algorithm.
2. Simulate CRC Algorithm
3. Simulate Stop & Wait Protocol.
4. Simulate Go-Back-N Protocol.
5. Simulate Selective Repeat Protocol.and so on....

## **SEMESTER V**

**Course code:** CME25402

### **DSE 3C: Elective: Computer Science - V Software Engineering**

**Credits: Theory - 04, Practical - 01**

**Theory: 60 Lectures**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Understand in details with examples Concepts of Software process
- CO2. Specify the details of Software requirements and analysis
- CO3. Learn in depth Design concepts and principles of software engineering
- CO4. Understand in depth software Configuration Management and Project Management
- CO5. Learn in details with examples Software Testing
- CO6. Specify in depth trends in software engineering

#### **Unit - 1**

**(15 Lectures)**

**Software Process:** Introduction ,S/W Engineering Paradigm , life cycle models (water fall, incremental, spiral, evolutionary, prototyping, object oriented) , System engineering, computer based system, verification, validation, life cycle process, development process, system engineering hierarchy.

**Software requirements:** Functional and non-functional, user, system, requirement engineering process, feasibility studies, requirements, elicitation, validation and management, software prototyping, prototyping in the software process, rapid prototyping techniques, user interface prototyping, S/W document.

#### **Unit - 2**

**(15 Lectures)**

Analysis and modeling, data, functional and behavioral models, structured analysis and data dictionary.

**Design Concepts and Principles:** Design process and concepts, modular design, design heuristic, design model and document, Architectural design, software architecture, data design, architectural design, transform and transaction mapping, user interface design, user interface design principles. Real time systems, Real time

## **UG-Computer Science - CBCS Scheme**

software design, system design, real time executives, data acquisition system, monitoring and control system.

### **Unit - 3**

**(15 Lectures)**

**Software Configuration Management:** The SCM process, Version control, Change control, Configuration audit, SCM standards.

**Software Project Management:** Measures and measurements, S/W complexity and science measure, size measure, data and logic structure measure, information flow measure. Estimations for Software Projects, Empirical Estimation Models, Project Scheduling.

### **Unit - 4**

**(15 Lectures)**

**Testing:** Taxonomy of software testing, levels, test activities, types of s/w test, black box testing, testing boundary conditions, structural testing, test coverage criteria based on data flow, mechanisms, regression testing, testing in the large. S/W testing strategies, strategic approach and issues, unit testing, integration testing, validation testing, system testing and debugging.

**Trends in Software Engineering:** Reverse Engineering and Re-engineering – wrappers – Case Study of CASE tools.

### **Reference:**

1. Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw-Hill
2. Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000.
3. PankajJalote- An Integrated Approach to Software Engineering, Springer Verlag, 1997.
4. James F Peters and WitoldPedryez, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2000.
5. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", Oxfor University Press, New Delhi, 1996.
6. Pfleeger, "Software Engineering", Pearson Education India, New Delhi, 1999.  
Carlo Ghezzi, Mehdi Jazayari and Dino Mandrioli, "Fundamentals of Software Engineering", Prentice Hall of India, New Delhi, 1991.

## **Software Engineering Lab**

### **Lab based on Software Engineering**

1. Practical Title
  - Problem Statement,
  - Process Model
2. Requirement Analysis
  - Creating a Data Flow
  - Data Dictionary,
  - Use Cases
3. Project Management
  - Computing FP
  - Effort
  - Schedule, Risk Table, Timeline chart
- 1 Design Engineering
  - Architectural Design
  - Data Design, Component Level Design
5. Testing
  - Basis Path Testing

#### **Sample Projects**

- DTC Route Information: Online information about the bus routes and their frequency and fares
- Car Pooling: To maintain a web based intranet application that enables the corporate employees within an organization to avail the facility of carpooling effectively.
- Patient Appointment and Prescription Management System
- Organized Retail Shopping Management Software
- Parking Allocation System
- Wholesale Management System

## **SEMESTER V**

**Course code: CME38002**

**SEC 4A: Elective: Computer Application (Practical)  
Office Automation**

**Credits: Theory - 00,**

**Practical - 01**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Understand the details of fundamentals of Computer
- CO2. Learn in depth Hardware and Software
- CO3. Learn the details of Computer Peripherals
- CO4. Understand the details of Programming Languages
- CO5. Deliberate in details with examples office automation Tools
- CO6. Deliberate in depth Operating System and the User Interface
- CO7. Understand in details of Internet and its usages

**Practical List for WORD:**

1. Create a **telephone directory**.
  - The heading should be 16-point Arial Font in bold
  - The rest of the document should use 10-point font size
  - Other headings should use 10-point Courier New Font.
  - The footer should show the page number as well as the date last updated.
2. Design a time-table form for your college.
  - The first line should mention the name of the college in 16-point Arial Font and should be bold.
  - The second line should give the course name/teacher's name and the department in 14-point Arial.
  - Leave a gap of 12-points.
  - The rest of the document should use 10-point Times New Roman font.
  - The footer should contain your specifications as the designer and date of creation.
3. Create the following document: A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.

**Practical List for EXCEL:**

1. Create a student worksheet containing roll numbers, names and total marks. Open a document in Word and insert the excel worksheet using:-

## UG-Computer Science - CBCS Scheme

- i) Copy/Paste
  - ii) Embedding
  - iii) Linking
2. The term wise marks for APS class of 20 students are stored in 3 separate sheets named term1, term2 and term3. Create 4<sup>th</sup> worksheet that contains student names and their total and average marks for the entire year. Give proper headings using headers. Make the column headings bold and italic. The 4<sup>th</sup> worksheet should contain college name as the first line. Make it bold, italic and center it.
3. Consider the following employee worksheet:-

Full Name (First Last)	Grade 1/2/3	Basic Salary	HRA	PF	Gross	Net	(VA)VehicleAllowance

HRA is calculated as follows:

Grade	HRA %(of Basic)
1	40%
2	35%
3	30%

Gross = Basic + HRA + VA

Net = Gross - PF

PF is 8% for all Grades

VA is 15000, 10000 and 7000 for Grades 1, 2 and 3.

- i) Find max, min and average salary of employees in respective Grade
  - ii) Count no. of people where VA>HRA
  - iii) Find out most frequently occurring grade.
  - iv) Extract records where employee name starts with "A" has HRA>10000
  - v) Print Grade wise report of all employees with subtotals of net salary and also grand totals. Use subtotal command.
  - vi) Extract records where Grade is 1 or 2 and salary is between 10000 and 20000 both inclusive.
4. In a meeting of a marketing department of an organization it has been decided that price of selling an item is fixed at Rs40. It was resolved to increase the sell of more of more items and getting the profit of Rs40,000/. Use Goal Seek of find out how many items you will have to sell to meet your profit figure.

5. Consider the following worksheet for APS 1<sup>st</sup> year students:-

S.No.	Name	PH	CH	BY	MT	CS	Total Marks	%	Grade
1									
2									

Grade is calculated as follows:-

## UG-Computer Science - CBCS Scheme

If %  $\geq 90$       Grade A

If %  $\geq 80$  &  $< 90$       Grade B

If %  $\geq 70$  &  $< 80$       Grade C

If %  $\geq 60$  &  $< 70$       Grade D

Otherwise students will be declared fail.

- i) Calculate Grade using if function
- ii) Sort the data according to total marks
- iii) Apply filter to display the marks of the students having more than 65% marks.
- iv) Draw a pie chart showing % marks scored in each subject by the topper of the class.
- v) Draw the doughnut chart of the data as in (iv)
- vi) Enter the S.No. of a student and find out the Grade of the student using VLOOKUP.
- vii) Extract all records where name
  - a) Begins with "A"
  - b) Contains "A"
  - c) Ends with "A"

### Practical List for Power Point:

- 2 Create five Power point slides. Each slide should support different format. In these slides  
Explain areas of applications of IT. Make slide transition time as 10 seconds.
- 3 Create five Power Point slides to give advantages/disadvantages of computer, application  
of computers and logical structure of computer.
- 4 Create five Power Point slides detailing the process of internal assessment. It should be a  
self-running demo.



## **SEMESTER V**

**Course code:** CME38202

**SEC 4B: Elective: Computer Application (Practical)**  
**Elective:XML Programming**

**Credits: Theory - 00, Practical - 01**

### **Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Understand the details of Elements of XML Programming
- CO2. Write down in details with examples DTD
- CO3. Deliberate in details with examples XML Schemas
- CO4. Deliberate the characteristics of CSS
- CO5. Learn in details with application CSS
- CO6. Deliberate in details with examples XSL
- CO7. Learn the details of XML Security
- CO8. Learn in details with examples XML and JAVA
- CO9. Learn in details with examples XML and ASP.Net

### **Software Lab Based on XML:**

#### **Exercise #1 - Information Structure**

In this exercise, student will practice identifying the structure of an information object.

For the sample document provided below:

Label the information structures you see, including containing structures.

12. Draw a tree representation of the structure.



#### **Exercise 2# Deconstructing an XML Document**

## UG-Computer Science - CBCS Scheme

In this exercise, student will practice identifying the explicit structure within an XML document. In a sense, this is the reverse of what you did in Exercise #1. For the sample XML markup below, create a document-like representation (or a simple drawing) for the content contained within the XML tags:

```
<book>
<coverInfo>
<title>The XML Handbook</title>
<author>Charles F. Goldfarb</author>
<author>Paul Prescod</author>
<edition>Second</edition>
<description>The definitive XML resource: applications, products, and
technologies. Revised and expanded—over 600 new pages.
</description>
</coverInfo>
</book>
```

### Exercise #3 - Creating XML Markup

In this exercise, create some XML markup based on the tree representation from Exercise #1 above, and the content from the original sample document.

### Exercise #4 - Well-Formedness

This exercise checks your understanding of the constraints for well-formedness. Are the following document instances well-formed? Explain any NO answers.

```
<list><title>The first list</title><item>An item</list>
<item>An item</item><item>Another item</item>
<para>Bathing a cat is a <emph>relatively</emph> easy task as long as
the cat is willing.</para>
<bibl><title>How to Bathe a Cat<author></title>Merlin
Bauer<author></bibl>
```

### Exercise #5-Well Formedness

This exercise is a bit more challenging than the previous example. Here is a fragment of an XML document instance. Identify all the places where it fails to match the constraints for well-formedness.

```
<PROCEDURE><TITLE>How to Bathe a Cat</TITLE>
<OVERVIEW>
This procedure tells you how to bathe a cat. <WARNING></OVERVIEW>Cats
don't like to take baths. You could get hurt doing this. Be sure to obtain all
the required protective gear before you start.
</WARNING><EQUIPEMENT><ITEM>Hockey Mask <ITEM>Padded Full-body
Kevlar Armor</ITEM><ITEM>Tub full of warm water</ITEM><ITEM>Towels
</ITEM><ITEM>First Aid kit</ITEM><ITEM>Cat
Shampoo</ITEM><EQUIPEMENT><INSTRUCTIONS><STEP> Locate the cat,
```

## UG-Computer Science - CBCS Scheme

who by now is hiding under the bed.</STEP><STEP>Place the cat in the tub of water.</STEP><ITEM>Using the First Aid kit, repair the damage to your head and arms.</STEP><STEP>Place the cat back in the tub and hold it down.</STEP><STEP>Wash it really fast, then make an effort to dry it with the towels.</STEP><STEP>Decide not to do this again.</STEP></INSTRUCTIONS>

**Note: Cover more exercises based on XML Programming theory concepts.**

## **SEMESTER V**

**Course code:** CME38402

### **SEC 4C: Elective: Computer Application (Practical) R Programming**

**Credits: Theory - 00, Practical - 01**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn in depth Elements of R Programming
- CO2. Understand the details of R programming Packages
- CO3. Understand in details with examples of Data Management
- CO4. Deliberate the characteristics of Data Management
- CO5. Understand in depth Graphical Procedures
- CO6. Deliberate in depth Portability Distribution
- CO7. Software Lab Based on R Programming

1. Write a program that prints 'Hello World' to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Write a function that tests whether a string is a palindrome.
7. Implement the following sorting algorithms: Selection sort, Insertion sort, Bubble Sort
8. Implement linear search.
9. Implement binary search.
10. Implement matrices addition, subtraction and Multiplication

## **SEMESTER VI**

**Course code: CMF25002**

**DSE6A: Elective:Computer Science - VII  
Internet Technologies**

**Credits: Theory - 04, Practical - 01**

**Theory: 60 Lectures**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn the details of HTML tags
- CO2. Understand the details of Basic CSS and implements
- CO3. Understand the details of Basic Concepts of Java Scripts
- CO4. Learn the Core Java Programming
- CO5. Write down in details with application and Usage of JDBC
- CO6. Learn in detail of JSP Environment

**Unit - 1**

**(15 Lectures)**

**Introduction to Web Design:** Introduction to hypertext markup language (html) document type definition, creating web pages, graphical elements, lists, hyperlinks, tables, web forms, inserting images, frames.

**Customized Features:** Cascading style sheets, (css) for text formatting and other manipulations.

**JavaScript:** Data types, operators, functions, control structures

**Unit - 2**

**(15 Lectures)**

Java Script events and event handling.

**Java:** Use of Objects, Array and Array List class, Designing classes, Inheritance, Input/Output, Exception Handling.

**Unit - 3**

**(15 Lectures)**

**JDBC:** JDBC Fundamentals, Establishing Connectivity and working with connection interface, Working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

## **UG-Computer Science - CBCS Scheme**

**JSP:** Introduction to JavaServer Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC

### **Unit - 4**

**(15 Lectures)**

Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, Using an expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Database Access.

#### **Reference Books:**

1. Web Enabled Commercial Application Development Using Html, Dhtml, javascript, Perl CgiBy Ivan Bayross, BPB Publications, 2009.
2. BIG Java Cay Horstmann, Wiley Publication , 3rd Edition., 2009
3. Java 7 ,The Complete Reference, Herbert Schildt, 8th Edition, 2009.
4. The Complete Reference J2EE, TMH, Jim Keogh, 2002.
5. Java Server Pages, Hans Bergsten, Third Edition, O'Reilly Media December 2003.

## **Internet TechnologiesLab**

### **Software Lab based on Internet Technologies**

#### **JAVA Script**

1. Create a student registration form. Create functions to perform the following checks:
  - a. Roll number is a 7-digit numeric value
  - b. Name should be an alphabetical value (String)
  - c. Non-empty fields like DOB
2. Implement a static password protection.
3. Write a java script
  - a. To change the colour of text using setTimeout()
  - b. To move an image across screen using setInterval()

#### **JAVA Programs**

1. WAP to find the largest of n natural numbers.
2. WAP to find whether a given number is prime or not.
3. WAP to print the sum and product of digits of an Integer and reverse the Integer.
4. Write a program to create an array of 10 integers. Accept values from the user in that array. Input another number from

## UG-Computer Science - CBCS Scheme

the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.

5. Write java program for the following matrix operations:
  - a. Addition of two matrices
  - b. Summation of two matrices
  - c. Transpose of a matrixInput the elements of matrices from user
6. Write a java program that computes the area of a circle, rectangle and a Cylinder using function overloading.

### JDBC

1. Create a table 'Student' and 'Teacher' in 'College' database and insert two rows in this newly created table using JDBC API and do the following:
  - a. Update an already created table 'Teacher' in 'College' database by updating a teacher's name, with "Dr." appended before the name, whose name is "Rita".
  - b. Repeat the same thing for all the teachers using PreparedStatement.
  - c. Delete the student with ID=3 from 'Student' database.
  - d. Insert two students to the ResultSet returned by the query which selects all students with FirstName="Ayush". The database must also get updated along with ResultSet.
2. Create a procedure in MySQL to count the number of Rows in table 'Student'. Use Callable Statement to call this method from Java code.

### JSP Practical list

1. Display the pattern:

1

1 2

1 2 3

Take 'n' in a textbox from user. Display this pattern using

- Scriptlets
  - <c:forEach> loop
2. Make two files as follows:
    - a. main.html: shows 2 text boxes and 3 radio buttons with values "addition", "subtraction" and "multiplication"

## UG-Computer Science - CBCS Scheme

b. operate.jsp: depending on what the user selects perform the corresponding function (Give two implementations: using request.getParameter() and using expression language)

3. Validate User input entered in a form. The input must include Name, DOB, Email ID, Lucky Number, Favorite food etc. (Refer Chapter 8)

4. Display Good Morning <uname>, Good Afternoon <uname> or Good Evening <uname> based on the current time of the day.

5. Create your custom library which contains two tags: <hello>, <choco>.

Usage of the tags:

- <hello name="Ajay">: Output should be Hello Ajay. It contains a mandatory attribute 'name' which can accept Dynamic value.

- <choco texture="Chewy">: Output should be FiveStar, BarOne.

- <choco texture="Crunchy">: Output should be Munch. KitKat.

That means the mandatory attribute must accept a value, and

based on the attributes value, it should give output. You must use

a bean ChocoBean for this purpose.



## **SEMESTER VI**

**Course code: CMF25202**

### **DSE6B: Elective:Computer Science - VI Mobile Applications**

**Credits: Theory - 04, Practical - 01**

**Theory: 60 Lectures**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Deliberate the details of Concepts of Event Driven Programming
- CO2. Learn in details with examples issues of Mobile applications
- CO3. Specify the details of Mobile applications Development tools and Frameworks
- CO4. Deliberate in details with examples common Mobile device UI's
- CO5. Write down in depth Data persistence Remote data storage and communication

**CO6.** Learn in details with examples Code signing

#### **Unit - 1**

**(15 Lectures)**

**Event Driven Programming:** UI event loop, Threading for background tasks, Outlets / actions, delegation, notification, Model View Controller (MVC) design pattern.

**Mobile application issues:** limited resources (memory, display, network, file system), input / output (multi-touch and gestures), sensors (camera, compass, accelerometer, GPS)

#### **Unit - 2**

**(15 Lectures)**

**Development tools:** Apple iOS toolchain: Objective-C, Xcode IDE, Interface Builder, Device simulator.

**Frameworks:** Objective-C and Foundation Frameworks, Cocoa Touch, UIKit, Others: Core Graphics, Core Animation, Core Location and Maps, Basic Interaction.

## **UG-Computer Science - CBCS Scheme**

### **Unit - 3**

**(15 Lectures)**

**Common UI's for mobile devices:** Navigation Controllers, Tab Bars, Table Views, Modal views, UI Layout.

**Data Persistence:** Maintaining state between application invocations, File system, Property Lists, SQLite, Core Data.

### **Unit - 4**

**(15 Lectures)**

**Remote Data-Storage and Communication:** "Back End" / server side of application, RESTful programming, HTTP get, post, put, delete, database design, server side JavaScript / JSON.

**Code signing:** security, Keychain, Developers and App Store License Agreement (6L)

#### **Reference:**

1. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley, 2011.
2. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
3. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009. Maximiliano
4. Firtman, Programming the Mobile Web, O'Reilly Media, 2010.
5. Christian Crumlish and Erin Malone, Designing Social Interfaces, O'Reilly Media, 2009.
6. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.

## **Mobile Applications Lab**

### **Software Lab based on Mobile Applications:**

1. Installing Android Environment
2. Create Hello World Application
3. Sample Application about Android Resources
4. Sample Application about Layouts

## **UG-Computer Science - CBCS Scheme**

5. Sample Application about Intents
6. Sample Application I about user interfaces
7. Sample Application about Animations
8. Make a Project based on above labs
9. Sample Application about Android Data
10. Sample Application about SQLite I
11. Sample Application about SQLite II
12. Project Presentation

## **SEMESTER VI**

**Course code: CMF25402**

**DSE6C: Elective:Computer Science - VI  
Cloud Computing**

**Credits: Theory - 04, Practical - 01**

**Theory: 60 Lectures**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn in depth Fundamentals of Cloud Computing
- CO2. Understand the details of Cloud Services and File System
- CO3. Learn in depth Concept of Collaborating with Cloud
- CO4. Understand the details of Virtualization in cloud
- CO5. Learn the classification and characteristics of Security challenges in Cloud Computing
- CO6. Specify the classification and characteristics of Security challenges in Cloud Computing
- CO7. Understand the details of Security challenges in Cloud Computing
- CO8. Understand the Common standards of Cloud Computing
- CO9. Deliberate in details with examples Various Application of Cloud Computing

**Unit - 1**

**(15 Lectures)**

**Cloud Introduction:** Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing, usage scenarios and Applications, Business models around Cloud– Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus - Open Nebula, CloudSim.

**Cloud Services And File System:** Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services.

## **UG-Computer Science - CBCS Scheme**

### **Unit - 2**

**(15 Lectures)**

Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force.

**Collaborating With Cloud:**Collaborating on Calendars, Schedules and Task Management –Collaborating on Event Management, Contact Management, Project Management –Collaborating on Word Processing , Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis. 185 CS-Engg&Tech-SRM-2013

### **Unit - 3**

**(15 Lectures)**

**Virtualization For Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.

### **Unit - 4**

**(15 Lectures)**

**Security, Standards, And Applications:** Security in Clouds: Cloud security challenges - Software as a Service Security, Common Standards: The Open Cloud Consortium - The Distributed management Task Force - Standards for application Developers - Standards for Messaging - Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud.

#### **Reference:**

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz “Cloud Computing ” Wiley India Edition,2010
2. John Rittinghouse& James Ransome, “Cloud Computing Implementation Management and Strategy”, CRC Press, 2010
3. Antohy T Velte ,Cloud Computing : “A Practical Approach”, McGraw Hill,2009
4. Michael Miller, Cloud Computing: “Web-Based Applications That Change the Way You Work and Collaborate Online”, Que Publishing, August 2008.

## **UG-Computer Science - CBCS Scheme**

5. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.

### **Online Reading/Supporting Material**

1. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing", Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008
2. [webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.ppt](http://webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.ppt) ennebula.org,
3. [www.cloudbus.org/cloudsim/](http://www.cloudbus.org/cloudsim/), <http://www.eucalyptus.com/>
4. [hadoop.apache.org](http://hadoop.apache.org)
5. [http://hadoop.apache.org/docs/stable/hdfs\\_design.html](http://hadoop.apache.org/docs/stable/hdfs_design.html)
6. [http://static.googleusercontent.com/external\\_content/untrusted\\_dlcp/research.google.com/en//archive/mapreduce-osdi04.pdf](http://static.googleusercontent.com/external_content/untrusted_dlcp/research.google.com/en//archive/mapreduce-osdi04.pdf)

## **Cloud Computing Lab**

### **Software Lab based on Cloud Computing:**

1. Create virtual machines that access different programs on same platform.
2. Create virtual machines that access different programs on different platforms.
3. Exploring Google cloud for the following
  - a) Storage
  - b) Sharing of data
  - c) Manage your calendar, to-do lists,
  - d) A document editing tool
4. Exploring Open source cloud (Any two)

## **SEMESTER VI**

**Course code:** CMF38002

**SEC4A: Elective:Computer Science - VII**  
**Android Programming**

**Credits: Theory - 01, Practical - 01**

**Theory: 15 Lectures**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn the details of Overview of Android
- CO2. Understand in details with examples Concepts of OOP's Using JAVA
- CO3. Learn in depth Development Tools
- CO4. Understand in depth User Interface Architecture
- CO5. Learn the details of User Interface Design
- CO6. Understand in depth SQLite Database Connectivity

**Unit - 1**

**(15 Lectures)**

**Introduction:** History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture.

**Overview of object oriented programming using Java:** OOPs Concepts: Inheritance, Polymorphism, Interfaces, Abstract class, Threads, Overloading and Overriding, Java Virtual Machine.

**Development Tools:** Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating a android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.

**User Interface Architecture:** Application context, intents, Activity life cycle, multiple screen sizes.

**User Interface Design:** Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners (Combo boxes), Images, Menu, and Dialog.

**Database:** Understanding of SQLite database, connecting with the database.

## UG-Computer Science - CBCS Scheme

### Reference:

1. Android application development for java programmers. By James C. Sheusi. Publisher: Cengage Learning, 2013.

#### ONLINE READING / SUPPORTING MATERIAL:

1. <http://www.developer.android.com>
2. <http://developer.android.com/about/versions/index.html>
3. <http://developer.android.com/training/basics/firstapp/index.html>
4. <http://docs.oracle.com/javase/tutorial/index.htm> (Available in the form of free downloadable ebooks also).
5. <http://developer.android.com/guide/components/activities.html>
6. <http://developer.android.com/guide/components/fundamentals.html>
7. <http://developer.android.com/guide/components/intents-filters.html>.
8. <http://developer.android.com/training/multiscreen/screensizes.html>
9. <http://developer.android.com/guide/topics/ui/controls.html>
10. <http://developer.android.com/guide/topics/ui/declaring-layout.html>
11. <http://developer.android.com/training/basics/data-storage/databases.html>

## Android Programming Lab

### Software Lab Based on Android Programming:

1. Create “Hello World” application. That will display “Hello World” in the middle of the screen in the emulator. Also display “Hello World” in the middle of the screen in the Android Phone.
2. Create an application with login module. (Check username and password).
3. Create spinner with strings taken from resource folder (res >> value folder) and on changing the spinner value, Image will change.
4. Create a menu with 5 options and selected option should appear in text box.
5. Create a list of all courses in your college and on selecting a particular course teacher-in-charge of that course should appear at the bottom of the screen.
6. Create an application with three option buttons, on selecting a button colour of the screen will change.
7. Create and Login application as above. On successful login, pop up the message.
8. Create an application to Create, Insert, update, Delete and retrieve operation on the database.



## **SEMESTER VI**

**Course code:** CMF38202

**SEC4B: Elective:Computer Science - VII**

**PHP Programming**

**Credits: Theory - 01, Practical - 01**

**Theory: 15 Lectures**

### **Course Outcome:**

After successful completion of the course, the student is able to

- CO1. Learn in depth Elements of PHP
- CO2. Learn in depth Interaction Methods Between HTML and PHP
- CO3. Understand in depth PHP function
- CO4. Understand in depth String Manipulation
- CO5. Learn the characteristics of Regular Expression
- CO6. Learn the details of Developing PHP Web Application

### **Unit - 1**

**(15 Lectures)**

**Introduction to PHP:** PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.), PHP with other technologies, scope of PHP, Basic Syntax, PHP variables and constants, Types of data in PHP , Expressions, scopes of a variable (local, global),, PHP Operators : Arithmetic, Assignment, Relational , Logical operators, Bitwise , ternary and MOD operator.

PHP operator Precedence and associativity

**Handling HTML form with PHP:** Capturing Form Data, GET and POST form methods Dealing with multi value fields, Redirecting a form after submission, PHP conditional events and Loops: PHP IF Else conditional statements ( Nested IF and Else) Switch case, while ,For and Do While Loop, Goto , Break ,Continue and exit

**PHP Functions:** Function, Need of Function , declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference, Scope of Function Global and Local

## **UG-Computer Science - CBCS Scheme**

**String Manipulation and Regular Expression:** Creating and accessing String , Searching & Replacing String, Formatting, joining and splitting String , String Related Library functions, Use and advantage of regular expression over inbuilt function, Use of preg\_match(), preg\_replace(), preg\_split()

**functions in regular expression Array:** Anatomy of an Array ,Creating index based and Associative array ,Accessing array, Looping with Index based array, with associative array using each() and foreach(),Some useful Library function

### **Reference:**

1. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley, 2011.
2. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
3. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009. Maximiliano
4. Firtman, Programming the Mobile Web, O'Reilly Media, 2010.
5. Christian Crumlish and Erin Malone, Designing Social Interfaces, O'Reilly Media, 2009.

## **PHP Programming Lab**

### **Software Lab Based on PHP:**

1. Create a PHP page using functions for comparing three integers and print the largest number.
2. Write a function to calculate the factorial of a number (non-negative integer). The function accept the number as an argument.
3. WAP to check whether the given number is prime or not.
4. Create a PHP page which accepts string from user. After submission that page displays the reverse of provided string.
5. Write a PHP function that checks if a string is all lower case.
6. Write a PHP script that checks whether a passed string is palindrome or not? ( A palindrome is word, phrase, or sequence that reads the same backward as forward, e.g., madam or nurses run)

## UG-Computer Science - CBCS Scheme

7. WAP to sort an array.
8. Write a PHP script that removes the whitespaces from a string.  
Sample string : 'The quick " " brown fox'  
Expected Output :Thequick""brownfox
9. Write a PHP script that finds out the sum of first n odd numbers.
10. Create a login page having user name and password. On clicking submit, a welcome message should be displayed if the user is already registered (i.e.name is present in the database) otherwise error message should be displayed.
11. Write a PHP script that checks if a string contains another string.
12. Create a simple 'birthday countdown' script, the script will count the number of days between current day and birth day.
13. Create a script to construct the following pattern, using nested for loop.

```
*  
* *  
* * *  
* * * *  
* * * * *
```

14. Write a simple PHP program to check that emails are valid.
15. WAP to print first n even numbers.
16. \$color = array('white', 'green', 'red')

Write a PHP script which will display the colors in the following way :

Output :

white, green, red,

- green
- red
- white

## **UG-Computer Science - CBCS Scheme**

17. Using switch case and dropdown list display a “Hello” message depending on the language selected in drop down list.
18. Write a PHP program to print Fibonacci series using recursion.
19. Write a PHP script to replace the first 'the' of the following string with 'That'.

Sample : 'the quick brown fox jumps over the lazy dog.'

Expected Result : That quick brown fox jumps over the lazy dog.

## **SEMESTER VI**

**Course code: CMF38402**

**SEC4C: Elective:Computer Science - VII  
System Administration and Maintenance**

**Credits: Theory - 01, Practical - 01**

**Theory: 15 Lectures**

**Course Outcome:**

After successful completion of the course, the student is able to

- CO1. System Administration & Maintenance
- CO2. Understand in details of Networking OS Environment
- CO3. Deliberate in depth Basic LINUX Commands
- CO4. Deliberate in details with examples Basic Windows Commands
- CO5. Learn the details of Server Configuration and Maintenance

**Unit - 1**

**(15 Lectures)**

**Part I - Linux/Unix:**Basics of operating system, services,Installation and configuration, maintenance. What is linux/unix Operating systems?, Kernel, API, cli, gui,Difference between linux/unix and other operating systems, Features and Architecture, Linux features, advantages, disadvantages

**Part II - Windows:**Windows as operating system, history, versions. PC hardware, BIOS, Devices and drivers, Kernal Configuration and building, Application installation, configuration and maintenance, Server services and Client services, Difference between WindowsXP/windows7 and windows server 2003/2008.

**Reference:**

1. Evi Nemeth, Garth Snyder and others,Unix and Linux System Administration Handbook, 4th Ed,Pearson Education, 2016.
2. PDaniel J. Barrett, Linux Pocket Guide: Essential Commands, 3rd Edition,Shroff/O'Reilly; Second edition 4 June 2012
3. Woody Leonhard,Windows 7 All-in-One For Dummies,2009

**System Administration and Maintenance Lab**

## **UG-Computer Science - CBCS Scheme**

### **Linux:**

Linux Desktop tour. Configuring desktop environment and desktop settings.

Basic Commands : Terminal, shell, Cat, ls, cd, date, cal, man, echo, pwd, Mkdir, rm, rmdir Ps, kill

Package Installation

Synaptic package manager

### **Windows:**

Creating users – Admin and regular.

Path of their personal files. Adding and changing passwords.

Difference between workgroup and domain. Concept of roles.

user profiles – creating and roaming Concept of Active Directory. Creating active directory in windows 2003/2008.

Process and Disk management

Windows Task manager. File systems – NTFS, FAT.

Services

Control Panel

C:/program Files, C:/system C:/windows

Add /remove new hardware (like printer ), Add/remove new programmes.

Network Administration

Ipconfig, Ping, tracert, route, hostname, net, netstat, whoami

Set manual IP address, check connectivity – ipv4, ipv6

Administrator Tools

Control Panel -> Administrative Tools

Computer Management, Local security Policy, Performance Monitor, Task Scheduler, Antivirus and firewall.

Misc

Start->Accessories->System tools ->All options (Remote desktop, backup/restore etc.)

LAN - sharing printer, files and folder over the network.

**Question Paper Pattern  
Theory (4 Credits)**

Time: 3 Hours

Max. Marks: 70

**Part – A**

**I. Answer any Eleven Question out of given Twelve Questions. 11 X 2 = 22**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**Note: Three Questions each from the Units 1, 2, 3, and 4**

**Part - B**

**II. Answer any Two SubQuestions from each main Question.**

- |        |            |
|--------|------------|
| 13. A) | 2 X 6 = 12 |
| B)     |            |
| C)     |            |
| 14. A) | 2 X 6 = 12 |
| B)     |            |
| C)     |            |
| 15. A) | 2 X 6 = 12 |
| B)     |            |
| C)     |            |
| 16. A) | 2 X 6 = 12 |
| B)     |            |
| C)     |            |

## **UG-Computer Science - CBCS Scheme**

**Note: Each Main questions contains 3 sub questions carries 06 Marks (may have internal Split-ups) and from Units 1, 2, 3 and 4 respectively**

### **Question Paper Pattern**

#### **Theory (1 Credit)**

Time: 2 Hours

Max. Marks: 50

#### **Part – A**

#### **I. Answer all Questions.**

**05 X 02 = 10**

- 1.
- 2.
- 3.
- 4.
- 5.

#### **Part - B**

#### **II. Answer any Four Questions out of given Five Questions.**

**4 X 10 = 40**

- 1.
- 2.
- 3.
- 4.
- 5.

**Note: Each Main questions contains 3 sub questions carries 06 Marks (may have internal Split-ups) and from Units 1, 2, 3 and 4 respectively**



## **UG-Computer Science - CBCS Scheme**

### **Question Paper Pattern**

#### **Practical / Project (1 or 1.5 or 2 Credits)**

Time: 3 Hours

Max. Marks: 70

#### **Practicals**

1. Two Experiments/ Programs 20 Marks Each 2 x 20 = 40 Marks
  - a. Write-ups 10 Marks
  - b. Conducting & Results 10 Marks ( Any One for 2 Hours of Practical's)
2. Viva – Voice 10 Marks
3. Record 10 Marks

#### **Project**

1. Project Presentation 15 Marks
2. Project Demo 20 Marks
3. Viva – Voice 10 Marks
4. Record 25 Marks

### **Question Paper Pattern**

#### **Practical (1 Credit)**

Time: 2 Hours

Max. Marks: 50

- a. Experiment/ Programs 30 Marks Each 30 Marks
- b. Conducting & Results 10 Marks
2. Viva – Voice 10 Marks
3. Record 10 Marks

## Structure of B.A. (Basic/Honours) In Economics

<b>Acronyms Expanded</b>	
<b>AECC</b>	Ability Enhancement Compulsory Course
<b>DSCC</b>	Discipline Specific Core Course
<b>SEC/SB/VB</b>	Skill Enhancement Course- Skill Based/ValueBased
<b>OEC</b>	Open Elective Course
<b>DSE</b>	Discipline Specific Elective

**B.A. PROGRAM**  
**Proposed Scheme of Teaching and Evaluation for B.A. (Basic/Honours) with**  
**Economics as Major EG -2022-2023**  
**(I, II, III and IV Semester)**

Sem	Course No C1/C2	Course Code	Title of the course	Course Type	Credit Pattern (L+T+P)	Total Credit	Teaching hrs/week	Evaluation Pattern			
								C1	C2	C3	Total Marks
I	Course1	FHA410	Basic Economics –I	DSC-1.1	3+0+0	3	3	20	20	60	100
I	Course2	FHA420	Contemporary Indian Economy	DSC-1.2	3+0+0	3	3	20	20	60	100
I	Open Elective Course-1A	---	Kautilya's Arthshastra	OE-1.1	3+0+0	3	3	20	20	60	100
I	Open Elective Course-1B	FHA810	Pre-reforms Indian Economy	OE-1.2	3+0+0	3	3	20	20	60	100
I	Open Elective Course-1C	FHA800	Development Studies	OE-1.3	3+0+0	3	3	20	20	60	100
II	Course1	FHB410	Basic Economics -II	DSC-2.1	3+0+0	3	3	20	20	60	100
II	Course2	FHB420	Karnataka Economy	DSC-2.2	3+0+0	3	3	20	20	60	100
II	Open Elective Course-2A	--	Contemporary Indian Economy	OE-2.1	3+0+0	3	3	20	20	60	100
II	Open Elective Course-2B	FHB810	Sustainable Development	OE-2.2	3+0+0	3	3	20	20	60	100
II	Open Elective Course-2C	FHB800	Economics of Business Environment	OE-2.3	3+0+0	3	3	20	20	60	100

Sem	Course No C1/C2	Course Code	Title of the course	Course Type	Credit Pattern (L+T+P)	Total Credit	Teaching hrs/week	Evaluation Pattern			
								C1	C2	C3	Total Marks
III	Course1	FHC410	Micro Economics	DSC-3.1	3+0+0	3	3	20	20	60	100
III	Course2	FHC420	Mathematics for Economics	DSC-3.2	3+0+0	3	3	20	20	60	100
III	Open Elective Course-3A	FHC800	Rural Economics	OE-3.1	3+0+0	3	3	20	20	60	100
III	Open Elective Course-3B	FHC810	Economics of Insurance	OE-3.2	3+0+0	3	3	20	20	60	100
III	Open Elective Course-3C	---	Economics of Human Development	OE-3.3	3+0+0	3	3	20	20	60	100
IV	Course1	FHD410	Macro Economics	DSC-4.1	3+0+0	3	3	20	20	60	100
IV	Course2	FHD420	Statistics for Economics	DSC-4.2	3+0+0	3	3	20	20	60	100
IV	Open Elective Course-4A	FHD810	Karnataka Economy	OE-4.1	3+0+0	3	3	20	20	60	100
IV	Open Elective Course-4B	FHD800	Entrepreneurial Economics	OE-4.2	3+0+0	3	3	20	20	60	100
IV	Open Elective Course-4C	---	Economics and Law	OE-4.3	3+0+0	3	3	20	20	60	100
IV	Open Elective Course-4D	---	Economics of GST	OE-4.4	3+0+0	3	3	20	20	60	100

**Note:**

1. In lieu of the research project, two additional elective papers/ Internship may be offered.
2. One Hour of Lecture is equal to 1Credit
3. Two Hours of Practical is equal to 1Credit
4. One Hour of Tutorial is equal to 1 Credit (Except Languages)

## EXECUTIVE SUMMARY

Economics is the study to understand the ways to make accurate choices. By studying economics one can make the efficient choices in managing scarce resources such as money and time. It is not only helpful to increase the standard of living of the individual and their households and also in the policy decisions for the economic development of the Nation. Overall, the objective of Economics is to improve well-being of Indians and thereby developing Indian Economy, since it serves as a centre for developing ideas and innovations.

The economic graduates will be trained to make the best choices among these seemingly infinite possibilities. These rigourously trained economists will play a vital role in the Economic Development of the Nation.

The implementation of NEP 2020 has given the great opportunity to make the structure and syllabus of Economics more dynamic and rigorous. Hence the Curriculum committee in Economics has prepared the model structure and syllabus for the first two semesters as the first step towards it.

The committee though has taken the confidence and suggestions of the BOS chairperson so fall the state Universities, it is reiterated that the complete autonomy to the respective BOS of the Universities/Institutes remains intact even as per HEC. The committee has identified different category of courses to be studied by the **Economics Students namely Discipline Specific Core Course (DSCC), Ability Enhancement Courses (AECC), Skill Enhancement Courses (SEC), (Generic Electives), Discipline Specific Electives (DSE) etc., by keeping wide choices by considering the present context.**

The members of the committee strongly felt that rigorous training, continuous assessment is the key to improve the quality of the economics students and the fellow fraternity members should leave no stone unturned to ensure it in total.

## **Introduction**

Economics is a popular and much sought-after course owing to its policy relevance and application to business as well as real life situations. However, in the conventional graduate programmes, Economics education was more class-room based with very less practical orientation. Further, with changing technology, emergence of newer issues like uncertainty, pandemics, climate change and business data analytics; the skill requirements are changing. New business models demand newer skills to successfully manage the change. Therefore, keeping in mind the aspirations of the NEP, the emerging skill matrix and the progression of the student at various levels, the Curriculum Committee of Economics finalized the following programme structure to be taught for BA (Basic and Honours).

### **Program Outcome**

The four-year Bachelor of Arts (B.A. Basic/Honours) in Economics programme and MA in economics is designed with option for multiple entry and exit. The students will be taught theory as well as the practical aspects of Economic Science. They would begin with fundamental concepts and then as they progress to higher semesters they would be introduced to more sophisticated and intricate concepts.

The main focus would be on conceptual clarity and practical usage of the knowledge gained. To make the students to ‘think like an economist’ is the main motto of the curriculum. They will also be exposed to quantitative approaches and tools to understand the economic relationships and also to analyse the data for framing as well as evaluating socio-economic policies. With varied electives and approaches to study socio-economic problems and policies, the graduates will be prepared to review and evaluate policies. The whole process aims at making them more inquisitive about the economic phenomena. After graduation, the students can apply their knowledge, skills and competencies across a broad range of occupations. They enjoy a rewarding career in academic, business, corporate, science, health care, government, or any field that uses the information to answer critical questions and inform decision-making.

### **Learning Objectives**

The Graduates will demonstrate:

- ✓ Knowledge of the principles, methodologies, value systems, and thought processes employed in understanding economic behaviour of human beings;
- ✓ Ability to solve problems in microeconomics and macroeconomics;

- ✓ Understanding of contemporary economic issues and the impact of public and social policies to resolve them;
- ✓ Understanding of markets and how they function;
- ✓ Ability to identify, formulate and solve problems related to global, national and local socio-economic development.
- ✓ Ability to design and conduct social and behavioural experiments.
- ✓ Ability to design Questionnaires and other Survey tools.
- ✓ Ability to structure and analyse economic data with statistical tools, software and equipment;
- ✓ Ability to critically evaluate academic and policy research in economics;
- ✓ Ability to visualize and work on multidisciplinary tasks;
- ✓ knowledge of professional and ethical responsibilities;
- ✓ Ability to communicate effectively in both verbal and written form;
- ✓ Confidence for self-education and ability for life-long learning.
- ✓ Participation and success in competitive examinations like UPSC/KPSC Civil Services, Indian Economic Services etc.;
- ✓ Ability to prepare and understand simple financial statements

### **Program Outcomes**

The Programme outcomes (POs) are expected to be as under:

- Students will be able to understand economic vocabulary, methodologies, tools and analysis procedures.
- Students will be familiar with the knowledge and application of micro economics for the formulation of policies and planning.
- Students will learn to apply economic theories and concepts to contemporary social issues, as well as analysis of policies.
- Students will be able to understand the impact of government policies and will be able to assess the consequences of the policies on the parties involved.
- As the programme along with economics contains like statistics, mathematics, it enhances them to compute and assess the real situation of the economy including the size and changes of population, income pattern, and rate of development with pattern of savings and investments and social security measures adopted in the country.
- Understand the basics of Quantitative techniques their applications

- Critically evaluate the ongoing economic developments in India and abroad
- Understand research methods in economics
- Student develops an awareness of career choices and the option for higher studies.

### **NEED FOR CURRICULUM DEVELOPMENT**

As per the NEP 2020 initiatives, it is intended to formulate Curriculum to eliminate the disparities among the students studying in different Universities/Institutes. The need for the curriculum development in Economics emerges due to the following reasons

1. **Changing Economic Scenario;** The Indian Economy is witnessing a radical amount of the changes in the economic policies since the introduction of the New Economic policy in 1991, followed by second and third generation reforms. India is not only inviting the FDI but at the same time also promoting Atmanirbhar Abhiyaan (A Self-reliant India). Market economy has expanded creating new opportunities and hence a new economics curriculum is prepared which helps the student to utilize the emerging.
2. **Credit transfer:** Credit transfer is approved by the UGC and the Government that allows the students to transfer course from their existing university to a new UGC approved university. The same number of credits in all the Universities in Karnataka is the first step to towards the credit transfer from University to University.
3. **Skill Enhancement:** The new curriculum focuses more on hands on training, internship and thereby enhancing the skills of the students. The papers like data **analytics etc further helps to develop the skills in the students.**



## **PEDAGOGY**

The goal of economics pedagogy is to awaken a student's critical consciousness and empower them with economic tools that help them in taking the crucial decision which helps them with economic tools through which they can make the efficient choices in managing scarce resources such as resources, money and time.

2. **Importance to theory as well as application:** All these years economics curriculum was concentrating more on teaching theoretical aspects, but the new curriculum gives importance to application through many hands-on training, case studies, empirical studies etc.
3. **Utilization of ICT:** in order to make the Critical and creative thinking among the students better the ICT tools will be used. It includes case studies of research-led teaching, via presentations, websites and other media
4. **Research-based and research-led teaching:** The theories will be explained with application. In order to give more hands-on training, the Projects and internships are introduced in the economics curriculum. The students will do the research project of their choice under the supervision of the research guide.
5. **Exposure to mathematics and statistics:** in today's world, economics is using more of statistics and mathematics in economic analysis. Hence the curriculum is designed in such a way which gives more exposure to mathematics and statistic straining.
6. **Brain Storming Approach:** Students will be deliberately involved either in groups or as individuals to deliberately discuss the possible implications or solutions to the Indian economic problems. The teacher will guide the process and help the students to think in right perspective and direction. This will help the teachers understand the extent of the student understanding and take corrective steps, but also helps in student involvement in the curriculum.
7. **Prominence to Indian economic contribution and Indian examples;** The western economic theories were taught ignoring the contribution of Indian economists. The new curriculum also emphasis on the Indian economist contribution, their theories and application. The teachers may highlight the Indian economic contribution and Indian examples in the pedagogy.

**Exit Options and Credit Requirements:**

A Certificate / Diploma/ Bachelor Degree or Bachelor Degree with Honours in Economics (BA in Economics) is awarded at the completion of every progressive year.

<b>Exit Option with</b>	<b>Certificate/ Diploma/ Degree/ Honors</b>
Successful completion of First year (two semesters) of the four years multidisciplinary undergraduate degree programme.	Certificate in Economics (Arts)
Successful completion of second year (four semesters) of the four years multidisciplinary undergraduate degree programme	Diploma in Economics (Arts)
Successful completion of three year (six semesters) of the four years multidisciplinary undergraduate degree Programme	Bachelor of Arts Degree in Economics
Successful completion of four years (eight semesters) of the four years multidisciplinary undergraduate degree Programme	Bachelor of Arts Degree with Honours in Economics
Successful completion of Five years (Ten semesters) of the five years multidisciplinary degree programme	Master of Arts Degree with Honours in Economics

A student will be allowed to enter/re-enter only after the odd semester and they can only exit after even semester. Re-entry at various as lateral academic programmes based on the above mentioned earned proficiency test records.

The validity of the earned credit will be for a maximum period year or as specified by the academic bank of credits (ABC).

## CONTINUOUS INTERNAL EVALUATION AND SEMESTER EXAMINATION

Total marks for each course shall be based on continuous assessments and term end examinations. As per the decision of the Karnataka State Higher Education Council, it is necessary to have uniform pattern of 40:60 for CIA and Semester End examinations respectively, among all the Universities, their affiliated and autonomous colleges.

The committee deliberated on the same and suggested the following pattern for the CIEMarks.

Sl. No.	Parameters for the Evaluation	Marks
	<b>Continuous Internal Evaluation (CIE)</b>	
A	<b>Continuous &amp; Comprehensive Evaluation (CCE)</b>	<b>20</b>
B	<b>Internal Assessment Tests (IAT)</b>	<b>20</b>
	<b>Total of CIE (A+B)</b>	<b>40</b>
C	<b>Semester End Examination (SEE)</b>	<b>60</b>
	<b>Total of CIE and SEE (A+B+C)</b>	<b>100</b>

### Evaluation process of IA marks may be as follows:

- The first component (C1), of assessment is for 20 marks. This shall be based on test, assignment, seminar, case study, field work, project work etc. This assessment and score process should be completed after completing 50% of syllabus of the course/s and within the first half of the semester.
- The second component (C2), of assessment is for 20 marks. This shall be based on test, assignment, seminar, case study, field work, internship / industrial practicum / project work etc. This assessment and score process should be based on completion of the remaining 50 percent of syllabus of the courses of the semester.
- During the 17<sup>th</sup> – 20<sup>th</sup> week of the semester, a semester end examination of Two and Half hours (2.30) duration shall be conducted by the University for each Course. This forms the third and final component of assessment (C3) and the maximum marks for the final component will be 60%.
- In case of a student who has failed to attend the C1 or C2 on a scheduled date, it shall be deemed that the student has dropped the test. However, in case of a student who could not take the test on scheduled date due to genuine reasons, such a candidate may appeal to the concerned teacher/ Program Coordinator / HOD and suitable decision taken accordingly.

- For assignments, tests, case study analysis etc., of C1 and C2, the students should bring their own answer scripts (of A4 size), graph sheets etc., required for such tests / assignments and these be stamped by the concerned department using their department seal at the time of conducting tests / assignment / work etc.

The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) of a course shall be as under:

**Outline for continuous assessment activities for C1 and C2**

<b>Activities</b>	<b>C1</b>	<b>C2</b>	<b>Total Marks</b>
Session Test	10 marks	10 marks	20
Case study / Assignment / Field work / Project work/ Academic Quiz/ Review of the Book/ etc.	10 marks	---	10
Case study / Assignment / Field work / Project work/ Academic Economics Quiz/ Review of the Book/ etc	---	10 marks	10
<b>Total</b>	20 marks	20 marks	40

**Suggestive Template for IAT**

**Internal Assessment Test BA  
In  
Economics**

Course Code:  
Duration: 60 Minutes

Name of the Paper:  
Total Marks: 10

**OPTION-A**

Answer any two of the following questions. (Questions for testing conceptual clarity)  
(5 X 2= 10)

- 1.
- 2.
- 3.

**OPTION- B**

Answer any one of the following questions. (Questions for testing the knowledge of theories and application)  
(10X1=10)

- 1.
- 2.

Note: 1. After the completion of 50% of the syllabus, C1 test has to be conducted followed by this C2 test has to be conducted after completion of the syllabus.

## BA (Honours) and MA (Economics) List of Open Electives

Semester	Open Elective Papers	Semester	Open Elective Papers
<b>I</b>	<ol style="list-style-type: none"> <li>1. Kautilya's Arthshastra</li> <li>2. Pre-reforms Indian Economy</li> <li>3. Development Studies</li> </ol>	<b>II</b>	<ol style="list-style-type: none"> <li>1. Contemporary Indian Economy</li> <li>2. Sustainable Development</li> <li>3. Economics of Business Environment</li> </ol>
<b>III</b>	<ol style="list-style-type: none"> <li>1. Rural Economics</li> <li>2. Economics of Insurance</li> <li>3. Economics of Human Development</li> </ol>	<b>IV</b>	<ol style="list-style-type: none"> <li>1. Karnataka Economy</li> <li>2. Entrepreneurial Economics</li> <li>3. Economics and Law</li> <li>4. Economics of GST</li> </ol>
<b>V</b>	<ol style="list-style-type: none"> <li>1. Agricultural Economics</li> <li>2. Industrial Economics</li> <li>3. Financial Economics</li> </ol> (Choose any one)	<b>VI</b>	<ol style="list-style-type: none"> <li>1. Labour Economics</li> <li>2. Economics of Non-Farm Sector</li> <li>3. Tertiary Economics</li> </ol> (Choose any one)
	Vocational Course – 1 <ol style="list-style-type: none"> <li>1. Entrepreneurial Economics</li> <li>2. Digital Economics</li> </ol> (Choose any one)		Vocational Course – 2 <ol style="list-style-type: none"> <li>1. Micro Entrepreneurs Development</li> <li>2. Project Planning &amp; Management (choose any one)</li> </ol>
<b>VII</b>	<ol style="list-style-type: none"> <li>1. Population Studies</li> <li>2. Urban Economics</li> <li>3. Economics of Infrastructure</li> </ol> (choose any one)	<b>VIII</b>	<ol style="list-style-type: none"> <li>1. Institutional Economics</li> <li>2. International Finance</li> <li>3. Co-operative Economics</li> </ol>
	<ol style="list-style-type: none"> <li>1. Economics of Governance</li> <li>2. Gender Economics</li> <li>3. Economics of Health &amp; Education</li> </ol> (choose any one)		
<b>IX</b>	<ol style="list-style-type: none"> <li>1. Economics and Law</li> <li>2. Global Economic Environment</li> <li>3. Managerial Economics</li> </ol>	<b>X</b>	<ol style="list-style-type: none"> <li>1. Economics of Financial Statement Analysis</li> <li>2. Stock Market Analysis</li> <li>3. Economics of Information Communication and Technology</li> </ol>

**SYLLABUS FOR TWO YEARS OR FOUR SEMESTERS OF  
B.A.(Basic/Honours)  
IN  
ECONOMICS**

**BA (Basic/Honours)**  
**Economics**  
**Semester - 1**

**DSC 1.1: Basic Economics – I (Economic Analysis -I) 3 credits**

**Course Outcomes:**

By the end of the course the student will be able to:

1. Identify the facets of an economic problem.
2. Learn basic economic concepts and terms.
3. Explain the operation of a market system;
4. Analyse the production and cost relationships of a business firm;
5. Evaluate the pricing decisions under different market structures; and
6. Use basic cost-benefit calculations as a means of decision making (i.e., thinking like an economist)

Content of Basic Economics 1	42 Hrs
<b>Unit– 1 Basic Concepts in Economics:</b>	14
<b>Chapter No. 1 Nature and Scope of Economics:</b> <ul style="list-style-type: none"> <li>• Meaning of Economics</li> <li>• Nature of Economics</li> <li>• Scope of Economics</li> <li>• Methods of Economics</li> <li>• Why Study Economics?</li> </ul>	5
<b>Chapter No. 2 Thinking Like an Economist:</b> <ul style="list-style-type: none"> <li>• Thinking Like an Economist</li> <li>• The Economist as Scientist</li> <li>• The Economist as Policy Adviser</li> <li>• Economic Policy</li> </ul>	4
<b>Chapter No. 3 Economic System:</b> <ul style="list-style-type: none"> <li>• Types of Economic Activities</li> <li>• Organisation of Economic Activities</li> <li>• Circular Flow of Economic Activities</li> <li>• Evolution of the Present Economic System</li> </ul>	5
<b>Practicum:</b> 1. Group Discussions on Choice Problem 2. Assignment on Types of Economic Systems	
<b>Unit – 2 Demand, Supply and Markets:</b>	14
<b>Chapter No. 4. Firms and Households:</b> <ul style="list-style-type: none"> <li>• Meaning of Firms and Household</li> <li>• Relationship Between Firms and Household</li> <li>• Input Markets</li> <li>• Output Markets</li> </ul>	4
<b>Chapter No. 5. Demand and Supply:</b> <ul style="list-style-type: none"> <li>• Individual Demand</li> <li>• Market Demand</li> <li>• Demand Determinants</li> <li>• Supply and its Determinants</li> <li>• Market Equilibrium</li> </ul>	5

<p><b>Chapter No. 6. Elasticity and its Measurement:</b></p> <ul style="list-style-type: none"> <li>• Types of Elasticity of Demand</li> <li>• Price, Income and Cross Elasticities</li> <li>• Measurement of Elasticity of Demand</li> <li>• Determinants of Elasticity of Demand</li> </ul> <p><b>Practicum:</b> 1. Estimation of Demand and Supply Elasticities 2. Solving an Equilibrium Problem</p>	5
<p><b>Unit – 3 Cost and Market Structures:</b></p>	14
<p><b>Chapter No. 7 Production and Production Function:</b></p> <ul style="list-style-type: none"> <li>• Meaning and features of production</li> <li>• Production function: Cobb-Douglas Production function</li> <li>• Total Product</li> <li>• Average Product</li> <li>• Marginal Product</li> </ul>	4
<p><b>Chapter No. 8. Production Cost and Revenue:</b></p> <ul style="list-style-type: none"> <li>• TC, AC and MC</li> <li>• Cost in the Short-run</li> <li>• Fixed Costs and Variable Costs</li> <li>• Long run AC and MC</li> <li>• TR, MR and AR</li> </ul>	5
<p><b>Chapter No. 9. Market Structure:</b></p> <ul style="list-style-type: none"> <li>• Markets : Meaning and Features of Perfect and Imperfect/Monopolistic Competition</li> <li>• Meaning and Features of Monopoly, Duopoly and Oligopoly</li> </ul> <p><b>Practicum:</b> 1. Calculation of various costs and comparing them with production concepts; a mini-project can be taken up wherever possible 2. Studying the real-life pricing mechanism through a project/ case studies</p>	5
<p><b>References (indicative):</b></p> <ol style="list-style-type: none"> <li>1. Cohen, A.J. (2020). <i>Macroeconomics for Life: Smart Choices for All? + MyLab Economics with Pearson eText</i> (updated 2<sup>nd</sup> ed.). Toronto, ON: Pearson Canada Inc. Type: Textbook: ISBN:9780136716532</li> <li>2. Cohen, A.J. (2015). <i>Microeconomics for Life: Smart Choices for You + MyLab Economics with Pearson eText</i> (2<sup>nd</sup> ed.). Toronto, ON: Pearson Canada Inc. Type: Textbook: ISBN:9780133899368</li> <li>3. Case Karl E. and Fair Ray C. Principles of Economics, Pearson Education Asia, 2014.</li> <li>4. Mankiw N. Gregory. Principles of Economics, Thomson, 2013.</li> <li>5. Stiglitz J.E. and Walsh C.E. Principles of Economics, W.W. Norton &amp; Co, New York, 2011.</li> </ol>	



## Semester I

<b>Course Title: DSC 1.2: Contemporary Indian Economy:</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

### Course Pre-requisite(s):

### Course Outcomes (COs):

At the end of the course the student should be able to:

- i. Understand the current problems of Indian Economy
- ii. Identify the factors contributing to the recent growth of the Indian Economy
- iii. Evaluate impact of LPG policies on economic growth in India
- iv. Analyze the sector specific policies adopted for achieving the as rational goals
- v. Review various economic policies adopted

<b>Content of Course 1</b>	<b>42 Hrs</b>
<b>Unit – 1 LPG POLICIES, ECONOMIC REFORMS AND AGRICULTURE:</b>	14
<b>Chapter No. 1 Recent Issues:</b> <ul style="list-style-type: none"> <li>• Genesis and Impact of LPG</li> <li>• India’s population policy</li> <li>• Demographic Dividend</li> <li>• India’s human development in global perspective</li> </ul>	4
<b>Chapter No. 2 Urbanization and governance:</b> <ul style="list-style-type: none"> <li>• Urbanization and Smart City Mission</li> <li>• Impact of COVID-19 Pandemic</li> <li>• Atma Nirbhara Bharat Abhiyan</li> <li>• Non-farm Sector</li> </ul>	4
<b>Chapter No. 3 Economic Reforms and Agriculture:</b> <ul style="list-style-type: none"> <li>• Agriculture and WTO</li> <li>• Commercialization and Diversification</li> <li>• Price Policy and Subsidies</li> <li>• Public Distribution System : TPDS</li> <li>• Impact of Public Expenditure on Agricultural Growth (1991 onwards)</li> <li>• Doubling Farm Incomes -MGNREGS (brief introduction)</li> </ul>	6
<b>Practicum</b> <ol style="list-style-type: none"> <li>1. Mini-project to ascertain the impact of pandemic on lives of different sections of population</li> <li>2. Field visits to understand the agrarian situation</li> </ol>	
<b>Unit – 2 INDUSTRY, BUSINESS, FISCAL POLICY:</b>	14
<b>Chapter No. 4. Industrial Policy:</b> <ul style="list-style-type: none"> <li>• New Industrial Policy and Changes</li> <li>• Public Sector Reforms</li> <li>• Privatisation and Disinvestment</li> </ul>	4

<ul style="list-style-type: none"> <li>• Competition Policy</li> </ul>	
<p><b>Chapter No. 5. Business:</b></p> <ul style="list-style-type: none"> <li>• Ease of Doing Business</li> <li>• Performance of MSMEs</li> <li>• Role of MNC's in Industrial Development</li> <li>• Make in India, Infrastructure Development : Health, Education, Transportation and Power (in brief)</li> <li>• National Monetization Pipeline</li> </ul> <p>(The teacher should include the latest policy of the government)</p> <p><b>Chapter No. 6. Fiscal Policy:</b></p> <ul style="list-style-type: none"> <li>• Tax, Expenditure, Budgetary Deficits</li> <li>• Fiscal Reforms - Public Debt Management</li> <li>• Fiscal Responsibility and Budget Management (FRBM) Act</li> <li>• GST (meaning and features), Fiscal Federalism and Fiscal Consolidation (in brief)</li> </ul> <ul style="list-style-type: none"> <li>• Recommendations of the Current Finance Commission</li> </ul> <p><b>Practicum:</b> Mini-projects to assess the business climate</p>	5
<p><b>Unit – 3 MONETARY POLICY, FOREIGN TRADE AND INVESTMENT:</b></p>	14
<p><b>Chapter No. 7 Monetary Policy:</b></p> <ul style="list-style-type: none"> <li>• Organisation of India's Money Market</li> <li>• Financial Sector Reforms</li> <li>• Review of Monetary Policy of RBI</li> </ul>	3
<p><b>Chapter No. 8. Money and Capital Markets:</b></p> <ul style="list-style-type: none"> <li>• Working of SEBI in India</li> <li>• Changing roles of the Reserve Bank of India</li> <li>• Commercial banks : Credit Creation</li> <li>• Foreign Banks and Non-Banking Financial Institutions</li> <li>• Demonetization and its impact</li> </ul>	5
<p><b>Chapter No. 9. Foreign Trade and Investment:</b></p> <ul style="list-style-type: none"> <li>• Direction of India's foreign trade</li> <li>• Balance of payments since 1991 (trends)</li> <li>• New Exchange Rate Regime: Partial and full convertibility</li> <li>• Capital account convertibility</li> <li>• FDI – Trends and Patterns</li> <li>• New EXIM policy</li> <li>• Bilateral and Multilateral Trade Agreements (in brief)</li> </ul> <p><b>Practicum:</b></p> <ol style="list-style-type: none"> <li>1. Computation and analysis of Wholesale Price Index, Consumer Price Index: components and trends.</li> <li>2. Group Discussions on India's trade policies and trade agreements</li> </ol> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>• Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.</li> <li>• Bhaduri Amit, (2015), A Model of Development By Dispossession, Fourth Foundation</li> <li>• Byres Terence J. (ed.), (1998), The State, Development Planning and Liberalisation in India, Delhi, OUP</li> </ul>	6

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| <ul style="list-style-type: none"> <li>• Dutt Ruddar and K.P.M Sundaram (2001): Indian Economy, S Chand &amp; Co. Ltd. New Delhi.</li> <li>• Frankel Francine R., (2004), India's Political Economy, Delhi. OUP Jenkins Rob, 2000, Economic Reform in India, Cambridge,CUP</li> <li>• Jalan, B. (1996), India's Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi.</li> <li>• Joshi Vijaya and L.M.D. Little, (1998), India's Economic Reform 1991-2001, Delhi,OUP.</li> <li>• Kapila Uma: Indian Economy: Policies and Performances, Academic Foundation</li> <li>• Mishra S.K &amp; V.K Puri (2001) "Indian Economy and –Its development experience", Himalaya Publishing House.</li> <li>• Mukharji Rahul (ed.) (2007), India's Economic Transition: The Politics of Reforms, edited by Rahul Mukherji, Oxford University Press , New Delhi.</li> <li>• Stuart and John Harris, (2000), Reinventing India, Cambridge Polity</li> </ul> |  |
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## Semester I

<b>Course Title: OEC 1.3.1: Kautilya's Arthashastra (OEC):</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

**Course Pre-requisite(s):** 12<sup>th</sup> Standard Pass

**Course Outcomes (COs):**

At the end of the course the student should be able to:

1. This course will enlighten the students about the ancient fundamentals about political and economic constituents, which will frame out a basic land of understanding the modern trends. This will help them to understand the upcoming needs in the area of policy making for states at national and international level.
2. This treatise deals with the science of Governance, so it projects out all the dimensions needed to be understood by students about the present socio-economic and political rules and regulations of the state.

Unit	Description	Hours
I	<b>Chapter 1:</b> Introduction to Arthashastra <b>Chapter 2:</b> Various disciplines of Indian Education System <b>Chapter 3:</b> Place of Kautilya's Arthashastra among them	2 2 2
II	<b>Chapter 4:</b> Importance of science dealing with governance - Introduction to Tantrayuktis – The methods of preparing a compendium, tools and techniques of writing a compendium. <b>Chapter 5:</b> Governance Procedure- Appointment of the ministers, duties of Government superintendents, treasury, spies, royal writ, punishment- Vakparushya and Dandaparushya; <b>Chapter 6:</b> Laws of Inheritance – Determination of forms of Agreements, determination of legal disputes, Division of inheritance, Special shares in inheritance, Distinction between sons	5 5 5
III	<b>Chapter 7:</b> Economic Dimension- Body of income of the state, collection of revenue, duties of a Chamberlin (Koshadhyksha), Forty ways of embezzlement of the revenue, Punishment for the embezzlement of revenue, Expenditure, Loss and Profit, Keeping up the Accounts, Recovery of Debts, Deposits of the state, Resumption of the gifts, Remission of Taxes <b>Chapter 8:</b> Political Dimension- Six-fold Policy- War, Combination of Powers, Agreement of Peace with or without definite terms, Double Policy, Circle of States, Conduct of Corporations, Secret means, Plan of treatise,	9 9 3
<b>Suggested readings:</b> 1. Arthashastra of Kautilya by T. Ganapati Shastri, Chaukhambha Surbharti Prakashana, Varanasi,		

India, 2005.

2. Arthashastra of Kautilya by Sri. Vacaspati Gairola, Chaukhambha Vidyabahavan, Varanasi, India, 2013.

3. Kautilya, The Arthashastra by L.N. Rangarajan, Penguin Books Ltd, London.

4. Kautilya's Arthashastra: The Way of Financial Management and Economic Governance, Jaico Publishing House, Mumbai, India.

## Semester 1

<b>Course Title: OEC 1.3.2: Pre-Reforms Indian Economy (OEC)</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

**Course Pre-requisite(s):** 12<sup>th</sup> Standard Pass

**Course Outcomes (COs):**

At the end of the course the student should be able to:

- i. Trace the evolution of Indian Economy
- ii. Identify the structural features and constraints of the Indian Economy
- iii. Evaluate planning models and strategy adopted in India
- iv. Analyze the sector specific problems and contributions towards overall economic growth
- v. Review various economic policies adopted

Unit	Description	Hours
<b>Unit-I</b>	<b>Features and problems of Indian Economy:</b>	<b>15</b>
	<b>Chapter 1: Features of Indian Economy:</b> <ul style="list-style-type: none"> <li>• India as a Developing Economy</li> <li>• Demographic Features</li> <li>• Human Development Index(HDI),</li> <li>• Problems of Poverty: Unemployment and Income Inequality</li> </ul>	4
	<b>Chapter 2: Issues in Agriculture sector in India:</b> <ul style="list-style-type: none"> <li>• Land reforms (in brief)</li> <li>• Green Revolution</li> <li>• Agriculture Marketing in India</li> <li>• Agricultural Price Policy</li> </ul>	6
	<b>Chapter 3: Industrial and Service Sectors:</b> <ul style="list-style-type: none"> <li>• Industrial Policy</li> <li>• Industrial Development</li> <li>• Micro, Small and Medium Enterprises</li> <li>• Performance of Public Sector in India</li> <li>• Service Sector in India.</li> </ul>	5
	<b>Practicum:</b> 1. Identifying economic problems and their causes; 2. Mini-project on any aspect of Indian Agriculture, Industry, Service and Public Sectors	
<b>Unit-II</b>	<b>Economic Policies:</b>	<b>13</b>
	<b>Chapter 4: Planning:</b> <ul style="list-style-type: none"> <li>• Mixed Economy</li> <li>• Bombay Plan</li> <li>• Gandhian Model</li> <li>• Nehru-Mahalanobis Model</li> <li>• Objectives and Achievements Of Economic Planning in India (before 1991)</li> </ul>	5
	<b>Chapter 5: Monetary policy in India</b> <ul style="list-style-type: none"> <li>• Instruments of Monetary Policy</li> </ul>	2

	<ul style="list-style-type: none"> <li>• Black money in India – Magnitude and Impact</li> </ul> <p><b>Chapter-6: Fiscal Policy in India:</b></p> <ul style="list-style-type: none"> <li>• Tax Revenue</li> <li>• Public Expenditure</li> <li>• Budgetary Deficits</li> <li>• Fiscal Reforms</li> <li>• Public Debt Management and Reforms</li> <li>• Centre State Finance Relations (before 1991)</li> </ul> <p><b>Practicum:</b> Assignment on successes and failures of India’s planning; Monetary and Fiscal Policy instruments</p>	6
<b>III</b>	<b>External sector and Nature of Reforms in India</b>	<b>14</b>
	<p><b>Chapter-7: India’s Foreign Trade:</b></p> <ul style="list-style-type: none"> <li>• Salient Features</li> <li>• Volume, Composition And Direction of Trade</li> <li>• Balance of Payments</li> <li>• Import Substitution and Protection</li> </ul> <p><b>Chapter-8: Pre-reforms Strategies:</b></p> <ul style="list-style-type: none"> <li>• Stabilization Strategies/Measures in all the three sectors of the economy</li> <li>• Tariff Policy: Types and Impact</li> <li>• Exchange Rate Dynamics</li> </ul> <p><b>Chapter 9: Planning Commission:</b></p> <ul style="list-style-type: none"> <li>• Organization and Objectives</li> <li>• Functions</li> </ul> <p><b>Practicum:</b> Calculation of BoP and evaluating trade policies; Assignment and group discussion on the planning commission.</p>	6  6  2
<p><b>Suggested Readings:</b></p> <ol style="list-style-type: none"> <li>1. Dutt Ruddar and K.P.M Sundaram (2001): Indian Economy, S Chand &amp; Co. Ltd. New Delhi.</li> <li>2. Mishra S.K &amp; V.K Puri (2001) “Indian Economy and –Its development experience”, Himalaya Publishing House.</li> <li>3. Kapila Uma: Indian Economy: Policies and Performances, Academic Foundation</li> <li>4. Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.</li> <li>5. Jalan, B. (1996), India’s Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi.</li> </ol>		

## Semester I

<b>Course Title: OEC 1.3.3: Development Studies (OEC)</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

**Course Pre-requisite(s):** 12<sup>th</sup> Standard Pass

**Course Outcomes (COs):**

At the end of the course the student should be able to:

- i. Graduates will be able to excel in higher studies and/or to succeed in profession.
- ii. Graduates will get a solid foundation of fundamentals required to solve socioeconomic problems and also to pursue higher studies.
- iii. Graduates will demonstrate knowledge to appreciate of the dimensions of contemporary development issues, to generate sensitivity to problems concerning ethics and human values to develop orientation towards effective communication and critical analysis, and to appreciate the interrelationships among disciplines as they relate to everyday realities.
- iv. Graduates will cultivate professional and ethical attitude, effective Communication skills, teamwork skills, multidisciplinary approach, and to facilitate an advanced understanding and appreciation of the principles, methodologies, value systems, and thought processes employed in human inquiries.

Unit	Description	Hrs
I	<b>Development: Meaning and Current Challenges</b>	<b>9</b>
	<b>Chapter-1: Meaning of Development:</b>	3
	<ul style="list-style-type: none"> <li>• The Concept of Development,</li> <li>• Growth and Development</li> <li>• Transition from quantitative to qualitative indices</li> </ul>	
	<b>Chapter-2: Modern economic growth:</b>	3
	<ul style="list-style-type: none"> <li>• Characteristics of Modern Economic Growth</li> <li>• Regional and Global Disparities</li> <li>• Common Characteristics and Dissimilarities among Developing Countries.</li> </ul>	
	<b>Chapter-3: Current Development Challenges:</b>	3
	<ul style="list-style-type: none"> <li>• Inequality</li> <li>• Migration</li> <li>• Conflicts</li> </ul>	
	Practicum: Group discussion on migration	
II	<b>Approaches to Development:</b>	12
	<b>Chapter-4: Development Ethics</b>	2
	<ul style="list-style-type: none"> <li>• Concept and Meaning</li> <li>• Principles and Importance of Development Ethics</li> </ul>	
	<b>Chapter-5: Assessing Development:</b>	4
	<ul style="list-style-type: none"> <li>• Per Capita Income</li> </ul>	



	<ul style="list-style-type: none"> <li>• Physical Quality of Life Index (PQLI)</li> <li>• Gender Empowerment Index</li> <li>• HDI</li> </ul> <p><b>Chapter-6: Approaches of Development:</b></p> <ul style="list-style-type: none"> <li>• Adam Smith</li> </ul>	6
	<ul style="list-style-type: none"> <li>• Marx</li> <li>• Schumpeter</li> <li>• Structuralist Approach</li> <li>• Neo-liberalism, IMF and Structural Adjustment</li> <li>• Capabilities Approach</li> </ul> <p>Practicum: Calculation of different Human Development Indices</p>	
III	<b>Theories and Current Issues in Development:</b>	21
	<p><b>Chapter-7: Theories of Development</b></p> <ul style="list-style-type: none"> <li>• Theorizing Development - Modernization Theory, Dependency Theory</li> <li>• Capitalist World System</li> <li>• The Evolution of Thought on Poverty Reduction</li> <li>• Colonial Regimes and Their Legacies</li> </ul> <p><b>Chapter-8: The Industrial Revolution</b></p> <ul style="list-style-type: none"> <li>• Genesis and Spread</li> <li>• International specialization of Labour/Industry</li> <li>• Industrial Labour</li> <li>• ILO and its activities to promote labour standards</li> </ul> <p><b>Chapter-9: Environment and Development</b></p> <ul style="list-style-type: none"> <li>• Increasing degradation of natural environment – Water and Air pollution and Deforestation</li> <li>• Depletion of Global Commons</li> <li>• Sustainable development - Concept and Measures</li> <li>• Sustainable Development Goals (SDGs)</li> <li>• Climate Change – Causes, Impact, Measures of Mitigation and Adaptations</li> </ul> <p>Practicum: Identify the different pollution sources</p>	6 5 10
<p><b>Suggested Readings:</b></p> <ol style="list-style-type: none"> <li>1. Crocker, D. (2008). Ethics and development theory-practice, Ethics of Global Development Agency, Capability, and Deliberative Democracy,67-106</li> <li>2. Des Gasper (2008), ‘Denis Goulet and the Project of Development Ethics: Development, 8, 99. 481-9, Elsevier Science, 1,pp.10-26.</li> <li>3. Drèze, Jean and Amartya Sen( 2002), India: Development and Participation, second edition. Oxford: Oxford University Press.</li> <li>4. Gasper, D. (2004). The ethics of development: From Economism to human development. Edinburgh: Edinburgh University Press</li> <li>5. Huntington, Samuel (1971), The change to change: Modernization, development and politics. Comparative Politics,3.</li> <li>6. Myrdal, Gunnar. (1974), “What is Development?” Journal of Economic Issues8(4):729-736.</li> <li>7. Peet, Richard with Elaine Hartwick (2009), Theories of Development: Contentions, Arguments, Alternatives (2nd edition). New York: Guilford.</li> <li>8. Sen, Amartya (1999) Development as Freedom. New York: Anchor Books.</li> </ol>		

## Semester - II

Course Title: <b>DSC 2.1: Basic Economics - II:</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

**Course Pre-requisite(s):** *Basic Economics I*

**Course Outcomes (COs):**

At the end of the course the student should be able to:

1. Understand the operation of the overall economic system;
2. Calculate national income and related aggregates
3. Explain the relationship between macroeconomic aggregates;
4. Analyse the nature of business cycles and policies towards controlling them;
5. Evaluate the macroeconomic policies for solving major problems like poverty and unemployment

Unit	Description	Hrs
<b>I</b>	<b>Macro Economic Concepts and Relationships:</b>	<b>12</b>
	<b>Chapter-1: Macroeconomy;</b> <ul style="list-style-type: none"> <li>• Introduction to National Income Accounting</li> <li>• Concepts of GDP, GNP and National Income</li> <li>• Approaches to calculating GDP, Personal Income, Nominal and Real GDP</li> <li>• Limitations of the GDP Concept</li> </ul>	5
	<b>Chapter-2: Monetary Economy</b> <ul style="list-style-type: none"> <li>• Characteristics of Money</li> <li>• The Demand for Money</li> <li>• The Supply Of Money and Overall Liquidity Position</li> <li>• Credit Creation</li> </ul>	4
	<b>Chapter-3: Inflation</b> <ul style="list-style-type: none"> <li>• Meaning and Causes of Inflation</li> <li>• Calculating Inflation Rate</li> <li>• Impact of Inflation</li> </ul>	3
	<b>Practicum:</b> 1. Understanding the relationships between various NI concepts used in India's NI accounting; 2. Estimating the components of money supply and interpreting the various price indices.	
<b>II</b>	<b>Macroeconomic Challenges and Policies:</b>	<b>12</b>
	<b>Chapter-4: Macroeconomic Challenges:</b> <ul style="list-style-type: none"> <li>• Unemployment</li> <li>• Business Cycles</li> <li>• Economic Growth</li> </ul>	3
	<b>Chapter-5: Monetary Policy:</b> <ul style="list-style-type: none"> <li>• Objectives</li> <li>• Instruments</li> </ul>	3
	<b>Chapter-6: Fiscal Policy:</b> <ul style="list-style-type: none"> <li>• Public Finance vs. Private Finance</li> <li>• Fiscal policy - Role of Government: Allocation, Distribution and Stabilisation</li> <li>• Characteristics of Public Goods,</li> </ul>	6

	<ul style="list-style-type: none"> <li>Rationale in the Provision of Public Goods</li> </ul> Practicum: 1. Reviewing the Monetary Policy of RBI; 2.A project to identify the nature and causes of poverty and the latest central budget	
III	<b>Public Policy and Globalization:</b>	18
	<b>Chapter 7: Poverty and Public Policy:</b>	6
	<ul style="list-style-type: none"> <li>Meaning, Types and Measurement of Poverty</li> <li>Poverty Alleviation Strategies in India</li> </ul>	
	<b>Chapter 8: International Trade:</b>	9
	<ul style="list-style-type: none"> <li>The Economic basis for trade—Absolute Advantage and Comparative Advantage.</li> <li>Terms of Trade: Meaning and Types</li> <li>Exchange Rates: Meaning, Types And Determinants</li> <li>Trade Barriers: Tariffs, Subsidies and Quotas</li> <li>Balance of Payments: The Current and Capital Account</li> </ul>	
	<b>Chapter 9: Globalization:</b>	3
	<ul style="list-style-type: none"> <li>Meaning</li> <li>Importance</li> <li>Pros and cons of Globalization</li> </ul> Practicum: Survey on identification of poor; Calculating the components of BoP of India	
<b>References (indicative)</b>		
<ol style="list-style-type: none"> <li>Cohen, A.J. (2020). <i>Macroeconomics for Life: Smart Choices for All? + MyLab Economics with Pearson eText</i> (updated 2<sup>nd</sup> ed.). Toronto, ON: Pearson Canada Inc. Type: Textbook: ISBN: 9780136716532</li> <li>Cohen, A.J. (2015). <i>Microeconomics for Life: Smart Choices for You + MyLab Economics with Pearson eText</i> (2<sup>nd</sup> ed.). Toronto, ON: Pearson Canada Inc. Type: Textbook: ISBN: 9780133899368</li> <li>Case Karl E. and Fair Ray C. <i>Principles of Economics</i>, Pearson Education Asia, 2014.</li> <li>Mankiw N. Gregory. <i>Principles of Economics</i>, Thomson, 2013.</li> <li>Stiglitz J.E. and Walsh C.E. <i>Principles of Economics</i>, W.W. Norton &amp; Co, New York, 2011.</li> </ol>		

## Semester II

Course Title: <b>DSC 2.2: Karnataka Economy</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

### Course Pre-requisite(s):

### Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand the nature of economic growth and problems of Karnataka state.
2. Explain the process of structural growth in Karnataka Economy;
3. Evaluate the policies and programmes undertaken by the Govt. of Karnataka for bringing about socio-economic development

Units	Description	Hours
Unit - I	<b>Characteristics of Karnataka Economy:</b>	<b>12</b>
	<b>Chapter-1: State Income</b> <ul style="list-style-type: none"> <li>• State Domestic Product and PCI</li> <li>• Measures to redress economic inequality.</li> </ul>	2
	<b>Chapter-2: Human and Natural Resources</b> <ul style="list-style-type: none"> <li>• Population</li> <li>• Human Development Index</li> <li>• Poverty and Unemployment– Anti-Poverty and Employment generation Programmes</li> <li>• Functioning of Panchayat Raj Institutions</li> </ul>	6
	<b>Chapter-3: Natural Resources in Karnataka:</b> <ul style="list-style-type: none"> <li>• Land, Water, Forest and Mineral Resources in Karnataka</li> <li>• Sustainable Development Goals in Karnataka</li> <li>• Karnataka Environmental Policy</li> </ul> Practicum: conduct field visit to Forest/Reservoir/Mining and prepare the report	4
II	<b>Agriculture and Industries in Karnataka:</b>	18
	<b>Chapter-4: Agriculture in Karnataka:</b> <ul style="list-style-type: none"> <li>• Importance of Agriculture</li> <li>• Problems in Agriculture</li> <li>• Land Reforms</li> <li>• Cropping Pattern</li> <li>• Irrigation</li> <li>• Watershed Development Programme</li> <li>• Dry Land Farming</li> <li>• Farmers Suicide – Causes And Solutions</li> </ul>	9
	<b>Chapter-5: Rural Development:</b> <ul style="list-style-type: none"> <li>• Regional Imbalance: Prof. D. M. Nanjundappa report</li> <li>• Public Distribution System</li> <li>• Rural Development Programmes.</li> </ul>	3

	<p><b>Chapter 6: Industrial Development in Karnataka:</b></p> <ul style="list-style-type: none"> <li>• Major Industries in Karnataka - Problems and Prospects</li> <li>• MSMEs - Problems and Measures</li> <li>• IT Industries in Karnataka</li> <li>• Industrial Finance in Karnataka</li> <li>• Industrial Policy of Karnataka</li> </ul> <p>Practicum: visit to industrial units in local area and prepare the report/Trace-out the impact of Prof. D. M. Nanjundappa Committee report</p>	6
III	<b>Infrastructure and Finances:</b>	12
	<p><b>Chapter 7: Economic Infrastructure in Karnataka:</b></p> <ul style="list-style-type: none"> <li>• Transportation: Road, Rail, Water and Air Transport</li> <li>• Information and Communication Technology Facilities;</li> </ul> <p><b>Chapter 8: Social Infrastructure:</b></p> <ul style="list-style-type: none"> <li>• Drinking Water, Sanitation</li> <li>• Housing</li> <li>• Health and Education</li> <li>• Rural Electrification</li> </ul> <p><b>Chapter 9: State Finance:</b></p> <ul style="list-style-type: none"> <li>• Sources of Revenue: Direct and Indirect Taxes</li> <li>• GST : Impact of GST</li> <li>• State Expenditure</li> <li>• States Indebtedness</li> <li>• State Finance Commission</li> <li>• Current State Budget</li> </ul> <p>Practicum: Discussion on State budget</p>	3 4 5
<p><b>References (Indicative):</b></p> <ol style="list-style-type: none"> <li>1. Government of Karnataka, Economic Survey [Various Issues]</li> <li>2. Planning Department, Annual Publication, Government of Karnataka.</li> <li>3. Karnataka at Glance, Annual Publication Government of Karnataka.</li> <li>4. Madaiah M &amp; Ramapriya. Karnataka Economy Growth: Issues and Development, Himalaya Pub., House, NewDelhi.</li> <li>5. Adul Aziz and K.G. Vasanti. (Eds) Karnataka Economy.</li> <li>6. Government District Development Reports</li> <li>7. Hanumantha Rao. Regional Disparities and Development in Karnataka.</li> <li>8. Krishnaiiah Gowda H.R. Karnataka Economy, Spandana Publications, Bangalore</li> <li>9. Nanjundappa D.M. Some Aspects of Karnataka Economy.</li> <li>10. Puttaswamiah K. Karnataka Economy, Two Volumes</li> </ol>		

## Semester II

<b>Course Title: OEC 2.3.1: Contemporary Indian Economy</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

**Course Pre-requisite(s):**

**Course Outcomes (COs):**

At the end of the course the student should be able to:

- vi. Understand the current problems of Indian Economy
- vii. Identify the factors contributing to the recent growth of the Indian Economy
- viii. Evaluate impact of LPG policies on economic growth in India
- ix. Analyze the sector specific policies adopted for achieving the aspirational goals
- x. Review various economic policies adopted

<b>Content of Course 1</b>	<b>42 Hrs</b>
<b>Unit – 1 LPG POLICIES, ECONOMIC REFORMS AND AGRICULTURE:</b>	14
<b>Chapter No. 1 Recent Issues:</b> <ul style="list-style-type: none"> <li>• Genesis and Impact of LPG</li> <li>• India’s population policy</li> <li>• Demographic Dividend</li> <li>• India’s human development in global perspective</li> </ul>	4
<b>Chapter No. 2 Urbanization and governance:</b> <ul style="list-style-type: none"> <li>• Urbanization and Smart City Mission</li> <li>• Impact of COVID-19 Pandemic</li> <li>• Atma Nirbhara Bharat Abhiyan</li> <li>• Non-farm sector</li> </ul>	4
<b>Chapter No. 3 Economic Reforms and Agriculture:</b> <ul style="list-style-type: none"> <li>• Agriculture and WTO</li> <li>• Commercialization and Diversification</li> <li>• Price policy and Subsidies</li> <li>• Public Distribution System : TPDS</li> <li>• Impact of public expenditure on agricultural growth (1991 onwards)</li> <li>• Doubling Farm Incomes -MGNREGS (brief introduction)</li> </ul>	6
<b>Practicum</b> <ol style="list-style-type: none"> <li>3. Mini-project to ascertain the impact of pandemic on lives of different sections of population</li> <li>4. Field visits to understand the agrarian situation</li> </ol>	
<b>Unit – 2 INDUSTRY, BUSINESS, FISCAL POLICY:</b>	14
<b>Chapter No. 4. Industrial Policy:</b> <ul style="list-style-type: none"> <li>• New Industrial Policy and changes</li> <li>• Public sector reforms</li> <li>• Privatisation and Disinvestment</li> </ul>	4

<ul style="list-style-type: none"> <li>• Competition Policy</li> </ul>	
<p><b>Chapter No. 5. Business:</b></p> <ul style="list-style-type: none"> <li>• Ease of Doing Business</li> <li>• Performance of MSMEs</li> <li>• Role of MNC's in Industrial Development</li> <li>• Make in India, infrastructure development : Health, Education, Transportation and Power (in brief)</li> <li>• National Monetization Pipeline</li> </ul> <p>(The teacher should include the latest policy of the government)</p> <p><b>Chapter No. 6. Fiscal Policy;</b></p> <ul style="list-style-type: none"> <li>• Tax, Expenditure, Budgetary Deficits</li> <li>• Fiscal Reforms - Public Debt Management</li> <li>• Fiscal Responsibility and Budget Management (FRBM) Act</li> <li>• GST (meaning and features), Fiscal Federalism and Fiscal Consolidation (in brief)</li> </ul> <ul style="list-style-type: none"> <li>• Recommendations of the Current Finance Commission</li> </ul> <p><b>Practicum:</b> Mini-projects to assess the business climate</p>	5
<p><b>Unit – 3 MONETARY POLICY, FOREIGN TRADE AND INVESTMENT:</b></p>	14
<p><b>Chapter No. 7. Monetary Policy:</b></p> <ul style="list-style-type: none"> <li>• Organisation of India's Money Market</li> <li>• Financial Sector Reforms</li> <li>• Review of Monetary Policy of RBI</li> </ul>	3
<p><b>Chapter No. 8. Money and Capital Markets:</b></p> <ul style="list-style-type: none"> <li>• Working of SEBI in India</li> <li>• Changing roles of the Reserve Bank of India</li> <li>• Commercial banks : Credit Creation</li> <li>• Foreign banks and Non-banking Financial Institutions</li> <li>• Analysis of Price Behaviour in India</li> <li>• Demonetization and its impact</li> </ul>	5
<p><b>Chapter No. 9. Foreign Trade and Investment:</b></p> <ul style="list-style-type: none"> <li>• Direction of India's Foreign Trade</li> <li>• Balance of Payments since 1991 (trends)</li> <li>• New Exchange Rate Regime: Partial and Full Convertibility</li> <li>• Capital Account Convertibility</li> <li>• FDI – Trends and Patterns</li> <li>• New EXIM Policy</li> <li>• Bilateral and Multilateral Trade Agreements (in brief)</li> </ul> <p><b>Practicum:</b></p> <ol style="list-style-type: none"> <li>1. Computation and analysis of Wholesale Price Index, Consumer Price Index: Components and Trends.</li> <li>2. Group Discussions on India's trade policies and trade agreements</li> </ol> <p><b>References</b></p> <ul style="list-style-type: none"> <li>• Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.</li> <li>• Bhaduri Amit, (2015), A Model of Development By Dispossession, Fourth Foundation</li> <li>• Byres Terence J. (ed.), (1998), The State, Development Planning and Liberalisation' in India, Delhi, OUP</li> <li>• Dutt Ruddar and K.P.M Sundaram (2001): Indian Economy, S Chand &amp; Co. Ltd. New</li> </ul>	6

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- Frankel Francine R., (2004), India's Political Economy, Delhi. OUP Jenkins Rob, 2000, Economic Reform in India, Cambridge, CUP
- Jalan, B. (1996), India's Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi.
- Joshi Vijaya and L.M.D. Little, (1998), India's Economic Reform 1991-2001, Delhi,
- Kapila Uma: Indian Economy: Policies and Performances, Academic Foundation
- Mishra S.K & V.K Puri (2001) "Indian Economy and –Its development experience", Himalaya Publishing House.
- Mukharji Rahul (ed.) (2007), India's Economic Transition: The Politics of Reforms, edited by Rahul Mukherji, Oxford University Press , New Delhi.
- Stuart and John Harris, (2000), Reinventing India, Cambridge Polity



## Semester II

<b>Course Title: OEC 2.3. 2: Sustainable Development Goals</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

**Course Pre-requisite(s):**

**Course Outcomes (COs):**

At the end of the course the student should be able to:

- i. Understand the basic concept of Sustainable Development (SD), the environmental, social and economic dimensions.
- ii. Know the history of the SD idea.
- iii. Be able to discuss the conflicts which are involved in the SD concept on the national as well as on the global scale.
- iv. Be able to discuss the (dis-)advantages of instruments for SD;
- v. Evaluate the sustainable development goals and their attainments

Unit	Description	Hrs
<b>I</b>	<b>Development, Environment and Pollution</b>	<b>15</b>
	<b>Chapter-1: Environmental Goods and Services:</b> <ul style="list-style-type: none"> <li>• Relationship between Environment and Development</li> <li>• Environmental Kuznets Curve – Meaning and Evidence</li> </ul>	3
	<b>Chapter-2: Resource Use and Management:</b> <ul style="list-style-type: none"> <li>• Resource Taxonomy – Renewable and Non-renewable Resources</li> <li>• Economic Theory of Depletable Resources</li> <li>• Optimal Use of Renewable Resources</li> <li>• Resource Scarcity and Economic Growth – Limits to Growth Model</li> <li>• Tragedy of Commons and Common Property Resources</li> <li>• Resource Pricing and Resource Conservation</li> </ul>	6
	<b>Chapter-3: Sustainable Development</b> <ul style="list-style-type: none"> <li>• Sustainable Development – Meaning and Indicators</li> <li>• Objectives and Principles</li> <li>• Approaches and Strategies for Sustainable Development</li> <li>• Environmental Accounting Measures</li> </ul>	6
	<b>Practicum:</b> Mini project on the impact of local environment	
<b>II</b>	<b>Sustainable Development Goals</b>	<b>10</b>
	<b>Chapter-4: Introduction and History</b> <ul style="list-style-type: none"> <li>• Brundtland Committee Recommendations</li> <li>• Rio Summit and Agenda21</li> <li>• SDGs: Targets and Indicators</li> </ul>	3
	<b>Chapter-5: Government and the SDGs</b> <ul style="list-style-type: none"> <li>• Planning</li> </ul>	4

	<ul style="list-style-type: none"> <li>Localizing the SDGs</li> <li>SDG Policy Instruments</li> <li>Industrial Policies and the SDGs</li> </ul> <b>Chapter-6: Financing the SDGs</b>	3
	<ul style="list-style-type: none"> <li>Types of Financing</li> <li>New Financing Mechanisms and Global Funds</li> </ul> <b>Practicum:</b> Assignments on Progress in attainment of various SDGs in India and their states	
<b>III</b>	<b>SDGs and their Achievement:</b>	17
	<b>Chapter-7: Realizing the SDGs:</b> <ul style="list-style-type: none"> <li>De-growth and Circular Economy</li> <li>Sustainable Production and Consumption</li> <li>Sustainable Cities and Transportation</li> <li>Sustainable Designs, Technology, Digital Revolution and Innovation</li> <li>Renewable Energy</li> </ul> <b>Chapter-8: Tools for SDGs Achievement:</b> <ul style="list-style-type: none"> <li>Governance and Policy Tools</li> <li>Openness, Participation and Accountability</li> <li>Effectiveness and Coherence</li> <li>India's framework for Sustainable Development</li> </ul>	8
	<b>Chapter-9: Other Issues in SDGs:</b> <ul style="list-style-type: none"> <li>Social business, Civil Society Organizations (CSOs) and Operations</li> <li>Development Assistance</li> <li>Cross-Border Cooperation</li> </ul> <b>Practicum:</b> Group Discussion on sustainable practices – other agriculture	5
		4
<b>Suggested Readings:</b>		
<ul style="list-style-type: none"> <li>Baumol, W.J. and W.E. Oates (1988): <i>The Theory of Environmental Policy</i> (2e), CUP, Cambridge.</li> <li>Bhattacharya, R.N. (Ed): <i>Environmental Economics: An Indian Perspective</i>, OUP, New Delhi.</li> <li>Dalby, Simon, et al. <i>Achieving the Sustainable Development Goals: Global Governance Challenges</i>. Routledge,2019.</li> <li>Day, G.S., and P.J.H. Schoemaker (2011), <i>Innovating in uncertain markets: 10 lessons for green technologies</i>, MIT Sloan Management Review, 52.4:37-45.</li> <li>Elliott, Jennifer. <i>An introduction to sustainable development</i>. Routledge,2012.</li> <li>Gagnon, B., Leduc, R., and Savard, L., <i>Sustainable development in engineering: a review of principles and definition of a conceptual framework</i>. Working Paper 08-18,2008.</li> <li>Hanley, Shogren and White (1997): <i>Environmental Economics in Theory and Practice</i>, Macmillan.</li> <li>Kolstad, C.D. (1999): <i>Environmental Economics</i>, OUP,ND.</li> <li>Pearce, D.W. and R. Turner (1991): <i>Economics of Natural Resource Use and Environment</i>, John Hopkins Press, Baltimore.</li> <li>Sachs, Jeffrey D. <i>The age of sustainable development</i>. Columbia University Press,2015</li> <li>Tietenberg, T. (1994): <i>Environmental Economics and Policy</i>, Harper Collins,NY.</li> </ul>		

## Semester II

<b>Course Title: OEC 2.3. 3: Business Environment:</b>	
Total Contact Hours: 42	Course Credits: 3
Formative Assessment Marks:40	Duration of ESA/Exam: 2½ hrs
Model Syllabus Authors:	Summative Assessment Marks: 60

**Course Pre-requisite(s):**

**Course Outcomes (COs):**

At the end of the course the student should be able to:

- i. Explain the elements of Business Environment.
- ii. Identify the environmental constraints in the growth of a business firm.
- iii. Analyze the ways to utilize the current environmental conditions to achieve higher business growth.

Unit	Content of Course:	42 Hrs
<b>I</b>	<b>Introduction to Business Environment:</b>	12
	<b>Chapter-1: Introduction:</b> <ul style="list-style-type: none"> <li>• Definition, Objectives, Importance of Business Environment.</li> <li>• Strategies of Business Environment</li> <li>• Business Environment Determinants</li> <li>• The Micro Environment of Business and The Macro Environment of Business.</li> </ul>	3
	<b>Chapter-2: Economic Environment:</b> <ul style="list-style-type: none"> <li>• Meaning of Economic Environment</li> <li>• Impact of Liberalization Privatization &amp; Globalization (LPG) on Indian Business Environment.</li> <li>• Monetary policy – Meaning and Objectives</li> <li>• Fiscal policy – Meaning and Objectives</li> <li>• EXIM policy – Meaning and Objectives</li> <li>• Industrial policy – Meaning and Objectives (Latest Policy Measures).</li> </ul>	6
	<b>Chapter-3: Global Business Environment:</b> <ul style="list-style-type: none"> <li>• Meaning</li> <li>• Globalization: Nature and Impact of Globalization</li> <li>• Challenges of International Business</li> <li>• WTO and its Implications on Indian Economy.</li> </ul>	3
	<b>Practicum</b> <ol style="list-style-type: none"> <li>1. Group discussion on WTO and its impact on Indian business</li> </ol>	
<b>II</b>	<b>Non-Economic Environment:</b>	10
	<b>Chapter-4: Social and Cultural Environment:</b> <ul style="list-style-type: none"> <li>• Business and Society</li> <li>• Social Objectives of Business</li> <li>• Corporate Social Responsibility</li> <li>• Consumer Rights &amp; Corporate Governance</li> <li>• Business Ethics</li> </ul>	4
	<b>Chapter-5: Technological Environment:</b> <ul style="list-style-type: none"> <li>• Meaning</li> </ul>	2

	<ul style="list-style-type: none"> <li>• Technological Changes – R &amp; D in India</li> <li>• Public and Private Investment in R and D.</li> </ul> <p><b>Chapter-6: Financial Environment:</b></p> <ul style="list-style-type: none"> <li>• Introduction and Meaning</li> <li>• An Overview of Indian Financial System</li> <li>• Financial Institutions and their Roles</li> <li>• Role of Foreign Direct Investment and its impact on Indian Business</li> </ul> <p><b>Practicum:</b> Students are expected to analyze the major economic and financial indicators such as GDP/BSE/NSE and submit the report .</p>	4
<b>III</b>	<b>Governance and Business in India:</b>	22
	<p><b>Chapter-7: Political Environment:</b></p> <ul style="list-style-type: none"> <li>• Introduction and Meaning</li> <li>• Political Environment and the Economic System</li> <li>• Provisions of Indian Constitution for Business</li> </ul> <p><b>Chapter-8: Legal Environment of Business:</b></p> <ul style="list-style-type: none"> <li>• Indian Company Law</li> <li>• Competition policy and law</li> <li>• Patents &amp; Trademarks</li> <li>• Industrial Policy- an overview</li> <li>• Labour Laws &amp; Social Security,</li> <li>• Environmental Laws.</li> </ul> <p><b>Chapter-9: Current Issues in Environmental Business:</b></p> <ul style="list-style-type: none"> <li>• Ease of Doing Business</li> <li>• Performance of MSMEs</li> <li>• Make in India</li> <li>• Development of Economic and Social Infrastructure</li> <li>• National Monetization Pipeline</li> </ul> <p>(The teacher should include the latest policy of the government)</p> <p><b>Practicum:</b> Students are expected to give a report on how the economic environment has affected the performance of any one of the large Indian Business Houses.</p>	4  8  10
	<p><b>REFERENCES:</b> Francis Cherunilam: Business Environment, Himalaya Publishing House, Mumbai. K. V. Sivayya and VBM Das: Indian Industrial Economy, Sulthan Chand Publications, Delhi. M. Adhikari: Economic Environment of Business, Sulthan Chand and Sons, New Delhi. Raj Agarwal: Business Environment, Excel Publications, New Delhi.</p>	



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Third Semester</b>
Course Title	<b>Microeconomics</b>		
Course Code:	<b>DSC-3.1</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<p><b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:</p> <p>CO1. Understand introductory economic concepts.          CO2. Recognize basic supply and demand analysis.          CO3. Recognize the structure and the role of costs in the economy.          CO4. Describe, using graphs, the various market models: perfect competition, monopoly, monopolistic competition, and oligopoly.          CO5. Explain how equilibrium is achieved in the various market models.          CO6. Identify problem areas in the economy, and possible solutions, using the analytical tools developed in the course.</p>	
<b>Contents</b>	<b>42 Hrs</b>
<b>Unit-1: Basics of Microeconomics</b>	
<p><b>Chapter:1 Exploring Microeconomics:</b> Nature and scope of economics – opportunity cost, scarcity, production possibility frontier - Market system as a way to organise economic activities, welfare state</p>	3
<p><b>Chapter:2 Supply and Demand:</b> Determinants of demand and supply; demand and supply schedules and; individual and market demand and supply; shifts in the demand and supply curves; Interaction of demand and supply; Equilibrium price and quantity</p>	3
<p><b>Practicum:</b></p> <ul style="list-style-type: none"> <li>➤ Reading and working with graphs</li> <li>➤ Estimation of elasticity and discussing its applications; solving problems to estimate the equilibrium price and quantity</li> </ul>	
<b>Unit -2: Consumption Decisions</b>	
<p><b>Chapter 3</b></p> <p><b>The Households:</b> Diminishing Marginal Utility; Indifference curves – Meaning and Properties; budget constraint; Satisfaction Maximization; income and substitution effects; choice between leisure and consumption.</p>	5
<p><b>Practicum:</b> Conducting a consumer survey to understand their tastes and preferences</p>	
<b>Unit -3: Production and Costs</b>	
<p><b>Chapter 4: The Firms:</b> Concept of firm and Industry; Production Function; Law of Variable Proportions; isoquant and isocost lines, cost minimizing equilibrium condition; Returns to Scale; Features of Cobb-Douglas Production Function</p>	5
<p><b>Chapter 5: Cost of Production:</b> Short run and long run costs; Returns to Scale.</p>	3
<p><b>Practicum:</b></p> <ul style="list-style-type: none"> <li>➤ Analysing reasons for diminishing marginal returns</li> </ul>	

➤ Examining the relationship between cost and output/ Deriving cost functions from output functions	
<b>Unit -4: Pricing</b>	
<b>Chapter 6: The Markets:</b> Meaning of Market Structure and Types; Pricing under perfect competition; Monopoly pricing and price discrimination; Monopolistic Competition – Features and Pricing; Oligopoly – Interdependence, Collusive and non-collusive oligopoly; Elements of Game theory	7
<b>Chapter 7: The Inputs (Factors):</b> Functional and Personal Income; Demand for and supply of factors; Marginal Productivity Theory of Distribution; Meaning and determinants of Rent, Wages, Interest and Profits	6
<b>Practicum:</b>	
<ul style="list-style-type: none"> <li>➤ Conducting Market Survey to identify the nature and features of markets for different goods/services</li> <li>➤ Understanding distribution of national income as factor incomes</li> </ul>	
<b>Unit -5: Welfare Economics</b>	
<b>Chapter 8: Welfare Economics:</b> Meaning of Welfare; Pigou’s Welfare Economics; Compensation principle; Impediments to attain Maximum Social Welfare; Externalities, Market Failure	6
<b>Practicum:</b> Examining day to day externalities and proposing solutions to them	
<b>Unit -6: Economics in Action</b>	
<b>Chapter 9: Economic Theory and Policy:</b> Pricing Practices; Basics of Monetary and Fiscal Policies; Controls and Regulations; Incentives and Penalties; Labour policies	4
<b>Practicum:</b> Analysis of latest budget of the Central Government; Review of terminology used in the latest Monetary Policy of the RBI	

<b>References</b>	
1	Ahuja, H.L. (2008): <i>Principles of Microeconomics</i> , S. Chand and Co., New Delhi
2	Mankiw, N. Gregory (2020). <i>Principles of Economics</i> (Ninth ed.). Boston, MA.
3	Jhingan, M.L. (2016): <i>Microeconomics</i> , Vrinda Publications, New Delhi
4	Koutsoyianis, A (1979): <i>Modern Microeconomics</i> , London, Macmillan
5	Omkarnath, G. (2012): <i>Economics: A Primer for India</i> , Orient Blackswan, Hyderabad
6	Samuelson, Paul (2004): <i>Economics</i> , McGraw-Hill, New Delhi
7	Krishnaiahgouda H.R. (2020): Sapna Book House, Bengaluru
8	<a href="https://www.core-econ.org/the-economy/book/text/0-3-contents.html">https://www.core-econ.org/the-economy/book/text/0-3-contents.html</a>
9	Somashekhar Ne. Thi., Sidhlingeshwara Prakashana, Kalburgi.



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Third Semester</b>
Course Title	<b>Mathematics for Economics</b>		
Course Code:	<b>DSC-3.2</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:	
CO1.	Perform basic operations in Sets and functions and Matrix algebra.
CO2.	Calculate limits, derivatives of Economic functions and identify the nature of relationship.
CO3.	Calculate maxima and minima of function
<b>Contents</b>	
<b>Unit-1: Preliminaries</b>	
<b>Chapter:1 - Introduction to Mathematical Economics:</b> Nature and scope of mathematical economics- Role of mathematics in economic theory	4
<b>Chapter:2 - Number system and Set theory:</b> Types of Numbers: Natural Number, Real number, integers, Irrational Number, Complex Number. Concepts of sets- meaning –types- union of sets – interaction of sets.	4
<b>Chapter:3 - Functions:</b> Meaning of function- Types of functions: Linear and Non-linear Functions; Quadratic, Polynomial, Logarithmic and Exponential functions-	4
<b>Unit -2: Economic Functions, their Application and Matrices</b>	
<b>Chapter 4 Economic Functions:</b> Demand Function, Supply function, Production function, Cost, Revenue and Profit function, Consumption function	4
<b>Chapter-5: Applications of Functions:</b> Graph of Economic Functions, Market equilibrium; Equilibrium price and Quantity, Impact of specific tax and subsidy on market equilibrium	5
<b>Chapter-6: Matrices:</b> Definition and Types of Matrices- Matrix Operations: Addition, Subtraction and Multiplication, Transpose of a Matrix, Determinants of Matrix- Cramer’s Rule	5
<b>Unit -3: Differential Calculus and Its Applications</b>	
<b>Chapter 7- Limits:</b> Limits of functions, differentiation, rules of differentiation.	4
<b>Chapter 8 Derivatives of Economic functions:</b> Derivation of Marginal functions from total function-Marginal Production, Marginal cost, Marginal Revenue, Marginal Profit.	6
<b>Chapter 9 - Applications of Derivatives and Higher order derivatives:</b> Elasticity of Demand- Second order derivatives- Maxima and Minima of Economic function.	6

References	
1	Chiang, A. C. and Wainwright, K., “Fundamental Methods of Mathematical Economics”, McGraw-Hill/Irwin, 4th Edition, 2005.
2	Sydsaeter, K and Hammond, P., Mathematics for Economic Analysis, Pearson Educational Asia, 4th Edition, 2002.
3	Allen R.G.D., (2015) Mathematical Analysis for Economists, Macmillan.
4	Bose D., (2003) An Introduction of Mathematical Economics, Himalaya Publishing House, Mumbai.
5	Dowling, E. T., “Introduction to Mathematical Economics”, McGraw-Hill, 2001.
6	Hoy, M., Livernois, J. McKenna, C, Rees, R. and Stengos, T., “Mathematics for Economics”, MIT Press, 3rd Edition, 2011



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Third Semester</b>
Course Title	<b>Rural Economics</b>		
Course Code:	<b>OE-3.1</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:	
CO1. To Understand the basics of rural development,	
CO2. To study the characteristics, problems, and programmes of rural redevelopment	
CO3. To study the trends and patterns of economic activities in rural areas	
CO4. To study the role of infrastructural facilities and governance in rural development	
CO5. To enable the students to know about significance of rural enterprises and agricultural allied activities.	
<b>Contents</b>	<b>42 Hrs</b>
<b>Unit-1:</b>	<b>12 Hrs</b>
<b>Chapter:1 - Introduction to Rural Economy</b> Meaning and Objectives of Rural economy Characteristics of Rural Economy Indicators of Rural Development Concepts of inclusive and sustainable development	5
<b>Chapter:2 - Approaches to Rural Development</b> Gandhian Model Community Development Approach, Minimum Needs Approach, Integrated Rural Development and Inclusive Growth Approach.	4
<b>Chapter:3 - Poverty and Unemployment in Rural India</b> Meaning and Measurement of Poverty Causes of Poverty Farm and Non-farm employment Measurement and Types employment Review of Poverty Alleviation and Employment Generation Programmes in India.	5
<b>Practicum:</b>	
<ul style="list-style-type: none"> <li>• Field visit to nearby village and study the poverty situation</li> <li>• Field visit to village and study the employment pattern</li> <li>• Undertake evaluation study on employment generation programmes and prepare an assignment.</li> </ul>	
<b>Unit -2:</b>	<b>14 Hrs</b>
<b>Chapter 4- Rural Enterprises</b> Meaning and Importance, Classification of MSME Progress and Problems of MSME Khadi and Village Industries	5
<b>Chapter-5: Rural Banking and Finance</b> Credit Co-operative Societies Regional Rural Banks Role of NABARD Microfinance Institutions	4
<b>Chapter-6: Rural Infrastructure</b>	5



Educational and Health Infrastructure Housing and Sanitation Drinking Water Supply Rural Transport and Communication Rural Electrification	
<b>Practicum:</b>	
<ul style="list-style-type: none"> <li>• Write an assignment on Rural infrastructure</li> <li>• Write a small report on Rural Industry</li> </ul>	
<b>Unit -3:</b>	<b>14 Hrs</b>
<b>Chapter 7- Rural Development Programmes</b> Wage Employment Programmes Self-employment and Entrepreneurship Development Programmes Rural Housing Programmes Rural Sanitation Programmes	4
<b>Chapter 8 - Rural Markets</b> Meaning and Types of Rural Markets Defects and Government Measures for Removal of Defects in rural markets Co-operative Marketing Societies Meaning and Importance of Regulated Markets Digital Marketing(e-NAM)	5
<b>Chapter 9 - Rural Governance</b> Legislations powers, Functions, and sources of revenue of Panchayat Raj Institutions Role of NGOs in rural development People's participation in rural development	5
<b>Practicum:</b>	
<ul style="list-style-type: none"> <li>• Group Discussion on Rural Governance</li> <li>• Interview Gram Panchayat members and prepare brief note on their participation in rural development.</li> <li>• Undertake evaluation study on rural development programmes and prepare an assignment.</li> </ul>	

References	
1	Chambers, R. (1983): Rural Development: Putting the Last First, Longman, Harlow.
2	Dandekar, V.M. and N. Rath (1971): Poverty in India, GIPE, Pune.
3	Dantwala, M. L. (1973): Poverty in India: Then and Now, 1870-1970, Macmillan, Bombay.
4	Gupta. K .R. (Ed) (2003): Rural Development in India, Atlantic Publishers and Distributors, New Delhi.
5	Jain, Gopal Lal (1997): Rural Development, Mangal Deep Publications, Jaipur,
6	Singh, Katar (1986): Rural Development: Principles, Polices and Management, Sage Publications, New Delhi, (Second Edition).
7	Karalay, G. N. (2005): Integrated Approach to Rural Development: Polices, Programmes and Strategies, Concept Publishing Company, New Delhi.
8	Maheshwari, S. R. (1985): Rural Development in India, Sage, Publications New Delhi.
9	Satya Sundaram, I. (1997): Rural Development, Himalaya Publishing House, Delhi.
10	Mehta, Shiv R. (1984): Rural Development Policies and Programmes, Sage Publications, New Delhi.
11	Tyagi, B. P. (1998): Agricultural Economics and Rural Development, Jai Prakash Math and Co., Meerut.
12	Somashekar Ne. Thi. (2022) Siddalingeswara publication, Kalburgi.
13	H. R. Krishnaiah Gowda (2022) Mysore book house publication, Mysore.



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***Model Curriculum***

Program Name	<b>BA in Economics</b>	Semester	<b>Third Semester</b>
Course Title	<b>Economics of Insurance</b>		
Course Code:	<b>OE-3.2</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to: CO1. Gain knowledge relating to the importance of the insurance in the life of human beings.	
<b>Contents</b>	<b>42 Hrs</b>
<b>Unit-1: Introduction to Economics of Insurance</b>	
<b>Chapter:1 - Fundamentals of Economics of insurance</b>	
<ul style="list-style-type: none"> <li>➤ Definition of insurance</li> <li>➤ Scope of economic of insurance</li> <li>➤ Importance of insurance</li> </ul>	
<b>Chapter:2 - The conceptual framework</b>	
<ul style="list-style-type: none"> <li>➤ Brief history of insurance</li> <li>➤ Perils and risks in insurance, Classification of risks hazards</li> <li>➤ How insurance works</li> <li>➤ Classes of insurance and assumptions</li> </ul>	
<b>Chapter:3 - Type of Insurance</b>	
<ul style="list-style-type: none"> <li>➤ Risk pooling and risk transfer in insurance</li> <li>➤ Social vs private insurance</li> <li>➤ Life vs non-life insurance</li> </ul>	
<b>Unit -2: Insurance Planning</b>	
<b>Chapter 4- Types of Insurance Planning</b>	
<ul style="list-style-type: none"> <li>➤ Wealth accumulation plan lifecycle planning</li> <li>➤ Planning for wealth accumulation</li> <li>➤ Tax advantage and tax non-advantage</li> </ul>	
<b>Chapter-5: Retirement Planning</b>	
<ul style="list-style-type: none"> <li>➤ Essential of individual retirement planning</li> <li>➤ Investing pension plan, basic principles of pension plans</li> <li>➤ Pension plans in India</li> </ul>	
<b>Chapter-6: General Insurance Structure</b>	
<ul style="list-style-type: none"> <li>➤ General Insurance, concept of General Insurance</li> <li>➤ Types of General Insurance, Marine Insurance, Motors Insurance, Agricultural Insurance</li> <li>➤ Fire Insurance, Personal Accident Insurance</li> </ul>	
<b>Unit -3: personal insurance / Health Insurance</b>	
<b>Chapter 7- Essential of Life and Health Insurance</b>	
<ul style="list-style-type: none"> <li>➤ Fundamentals of Life and Health Insurance, functions of Life and Health Insurance</li> <li>➤ Health Insurance and Economic Development, Insurance and Farmer Security</li> </ul>	
<b>Chapter 8 - Insurance Documentation</b>	
<ul style="list-style-type: none"> <li>➤ Health Insurance products, Health Insurance underwriting</li> <li>➤ Health Insurance claims</li> </ul>	
<b>Chapter 9 - Insurance Legislation</b>	
<ul style="list-style-type: none"> <li>➤ The insurance act, 1938- Registration- Accounts and Returns</li> </ul>	

- Investments -Limitation on expense of Management
- Regulation of Insurance, Insurance regulation in India, role and need of regulation, history of insurance regulation in India
- Insurance Reforms Development Authority (IRDA), performance of IRDA
- Indian Insurance in global platform, future potential in Indian Insurance Business

## References

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2	Dandekar, V.M. and N. Rath (1971): Poverty in India, GIPE, Pune.
3	Dantwala, M. L. (1973): Poverty in India: Then and Now, 1870-1970, Macmillan, Bombay.
4	Gupta. K .R. (Ed) (2003): Rural Development in India, Atlantic Publishers and Distributors, New Delhi.
5	Jain, Gopal Lal (1997): Rural Development, Mangal Deep Publications, Jaipur,
6	Singh, Katar (1986): Rural Development: Principles, Polices and Management, Sage Publications, New Delhi, (Second Edition).
7	Karalay, G. N. (2005): Integrated Approach to Rural Development: Polices, Programmes and Strategies, Concept Publishing Company, New Delhi.
8	Maheshwari, S. R. (1985): Rural Development in India, Sage, Publications New Delhi.
9	Satya Sundaram, I. (1997): Rural Development, Himalaya Publishing House, Delhi.
10	Mehta, Shiv R. (1984): Rural Development Polices and Programmes, Sage Publications, New Delhi.
11	Tyagi, B. P. (1998): Agricultural Economics and Rural Development, Jai Prakash Math and Co., Meerut.



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Third Semester</b>
Course Title	<b>Economics of Human Development</b>		
Course Code:	<b>OE-3.3</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to: CO1. Differentiate between Human Resource Development (HRD), Human Development (HD) and HRM CO2. Understand the concepts of Human security, describe dimensions of human development, and appreciate various practices and policies of human development, HDI and India.	
<b>Contents</b>	<b>42 Hrs</b>
<b>Unit-1: Introduction to Human Development</b>	<b>12 Hrs</b>
<b>Chapter 1:</b> Human Growth and Human Development - Basic Needs Approach - Quality of Life Approach - Capability Approach <b>Chapter 2:</b> Human Resource Development (HRD), Human Resource Management (HRM). <b>Chapter 3:</b> Human Development: meaning and definition, importance, and objectives.	
<b>Unit -2: Human Security, SDGs and Approaches to Human Development.</b>	<b>12Hrs</b>
<b>Chapter 4:</b> Human Security: Economic security - Food security - Health security - Environmental security - Personal security - Community security - Political security. <b>Chapter 5:</b> Sustainable Development Goals (SDGs): Understanding the SDGs - Linkages between human development and the SDGs. <b>Chapter 6:</b> Indian Perspectives and Experience with Human Development: Approach to human development in national plans	
<b>Unit -3: Dimensions and Measurement of Human Development</b>	<b>18 Hrs</b>
<b>Chapter 7:</b> Dimensions of Human Development: Empowerment - meaning and usage, Cooperation - definition and brief introduction, Equity - concept and usage, Sustainability – meaning and importance, Participation - concept, different forms of participation, Human development & Productivity - factors determining productivity. <b>Chapter 8:</b> Measuring Human Development: Need for indices - limitations of per capita GDP as an indicator. Earlier indices (meaning): - Physical Quality of Life Index (PQLI), - Disability Adjusted Life Years (DALYs), - Social Capability Index. Human Development Index - HDI as compared to per capita GDP - Method of computing HDI - Critique of HDI. Other indices (meaning): Human Poverty Index (HPI)- Gender-related Development Index (GDI) - Gender Empowerment Measure (GEM). <b>Chapter 9:</b> Selected Issues in Human Development: Impact of Globalisation on Human Development - Trade and Human Development. - Technology and Human Development	

<b>References</b>	
1	Chelliah, Raja J. and R. Sudarshan (eds.), 1999, Income Poverty and Beyond: Human Development in India, UNDP, Social Science Press, New Delhi
2	Dev, S. Mahendra, Piush Antony, V. Gayathri, and R.P. Mangain, 2001, Social and Economic Security in India, Institute for Human Development, New Delhi
3	Government of India, National Human Development Report 2002, Planning Commission, New Delhi
4	Jaya Gopakl, R: Human Resource Development: Conceptual analysis and Strategies, Sterling Publishing Pvt. Ltd., New Delhi
5	Naresh Gupta (2019), Human Development in India Emerald Publishers.
6	Nadler, Leonard (2004). Corporate Human Resource Development, Van Nostrand Reinhold, ASTD, New York
7	Padmanabhan Nair(2007) Human Development Index: An Introduction (Economy Series), ICFAI UNIVERSITY PRESS
8	Papalia, D.E. , Olds, S.W. and Feldman, R.D. (2006). Human development.9th Ed. New Delhi: Tata McGraw- Hill.
9	Rao, T.V and Pareek, Udai (2005) Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi.
10	Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi,
11	Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.
12	Rao, T.V. (et.al)( 2003) HRD in the New Economic Environment, Tata McGraw-Hill Pub.Pvt, Ltd., New Delhi ,.
13	Rao, T.V: Human Resource Development, Sage Publications, New Delhi.
14	Viramani, B.R and Rao, Kala: Economic Restructuring, Technology Transfer and Human Resource Development, Response Books, New Delhi
15	United Nations Development Programme (2005); ‘Course Curriculum on Human Development-An Outline’, New Delhi

<b>Websites:</b>	
1	<a href="https://www.undp.org/sustainable-development-goals?c_src=CENTRAL&amp;c_src2=GSR">https://www.undp.org/sustainable-development-goals?c_src=CENTRAL&amp;c_src2=GSR</a>
2	<a href="https://hdr.undp.org/en/2020-report">https://hdr.undp.org/en/2020-report</a>
3	<a href="https://www.un.org/millenniumgoals/">https://www.un.org/millenniumgoals/</a>
4	<a href="https://www.undp.org/india/publications/national-human-development-report-india">https://www.undp.org/india/publications/national-human-development-report-india</a>
5	<a href="https://www.sdgfund.org/mdgs-sdgs">https://www.sdgfund.org/mdgs-sdgs</a>

<b>Journals</b>	
1	Indian Journal of Training and Development
2	HRD Newsletter (NHRD Network)
3	American Journal of Training and Development
4	Personnel Today



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Macroeconomics</b>		
Course Code:	<b>DSC-4.1</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:	
CO1.	Understand the Theories of National Income Accounting
CO2.	Explain the process of Consumption and Investment Functions
CO3.	Evaluate the Concept of Multiplier and Inflation
<b>Content of Theory</b>	
<b>42 Hrs</b>	
<b>Unit-1: Theory of National Income Determination</b>	
<b>14 Hrs</b>	
<b>Chapter:1 Classical Framework:</b>	
1. Typical Features of classical theory of employment; Assumptions	
2. Basis of Classical theory:	
➤ Say’s Law	
➤ Pigou’s wage price flexibility	
➤ Fisher’s Quantity theory of money	
➤ Knut Wicksell’s loanable funds theory	
➤ Classical dichotomy and neutrality of money	
3. Criticism of classical theory	
<b>7</b>	
<b>Chapter-2: The Keynesian Framework</b>	
1. Introductory: connecting growth of national income to development; why incomes of all fall or rise? Are income, output, and employment related?	
2. Some Basic concepts: The idea of equilibrium and identity; ex- ante and ex-post concepts.	
3. Aggregate Demand and its components	
<b>a.</b> Consumption function: Algebraic and Graphical explanation; Marginal and Average propensity to consume	
<b>b.</b> Investment function; savings and investment relationship.	
4. Aggregate Supply: Meaning and graphical explanation; Effective demand	
5. Determination of national income in Keynes’ two sector economy with Aggregate Demand and Aggregate Supply with fixed prices: Analytical /Graphical and algebraic explanation; numerical problems	
6. Determination of national income in Keynes’ two sector economy with investment and savings with fixed prices: Analytical / Graphical and algebraic explanation; numerical problems	
<b>7</b>	
<b>Unit -2: Aggregate Consumption and Investment</b>	
<b>15Hrs</b>	
<b>Chapter-3: Theories of Determinants of Consumption:</b>	
<b>5</b>	
1. Keynesian Psychological Law of consumption; determinants	
2. Permanent Income hypothesis of Milton Friedman	
<b>Chapter-4: Investment:</b>	
<b>5</b>	
1. Types of investment	
2. Determinants of investment:	
<b>a.</b> rate of interest	

<b>b.</b> marginal efficiency of capital: meaning and determinants;	
<b>Chapter-5: Concepts of Multiplier and Accelerator</b>	5
1. Investment Multiplier: Meaning and assumptions.	
2. multiplier; leakages;	
<b>Unit -3: Monetary Economics</b>	<b>13 Hrs</b>
<b>Chapter-6: Money Supply:</b>	5
1. Concept of Money Supply; recent measures of money supply as suggested by RBI	
2. Determinants of money supply:	
<b>a.</b> High powered money	
<b>b.</b> Money multiplier	
3. The reserve ratio and deposit multiplier	
<b>Chapter-7: Money demand:</b>	4
1. Cash transactions approach (only meaning) and	
2. Cambridge approach (Only Marshall's equation)	
3. The liquidity preference approach of Keynes	
<b>Chapter-8: Inflation and Unemployment:</b>	4
1. Phillips Curve	
2. Wage cut theory and employment	

<b>References</b>	
1	Ackley, G. (1976), Macroeconomics: Theory and Policy, Macmillan Publishing Company, New York.
2	Ahuja H (2016), Macro Economics- theory and policy, S Chand and Co
3	Dwivedi DN (2016) Macro Economics: Theory and Policy, Tata McGraw-Hill
4	Heijidra, B.J. and F.V. Ploeg (2001), Foundations of Modern macroeconomics, Oxford University Press, Oxford.
5	Keynes, J.M. (1936), The General theory of Employment, Interest and Money, Machmillan, London.
6	Lucas, R. (1981), Studies in Business Cycle Theory, MIT Press, Cambridge, Massachusetts
7	Somashekar Ne. Thi., Principles of Macroeconomics, Scientific International Pvt. Ltd., Publications New Delhi
8	Somashekar Ne. Thi., - Siddalingeshwara prakashana, Kalburgi.
9	H. R. Krishnaiah Gowda - Mysore book house prakashna, Mysore.



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Statistics for Economics</b>		
Course Code:	<b>DSC-4.2</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:	
CO1.	Understand the nature of Data and their presentation
CO2.	Calculate Descriptive statistics like measures of central tendency and dispersion
CO3.	Apply statistical techniques like correlation and regression in Economic analysis
<b>Content of Theory</b>	
	<b>42 Hrs</b>
<b>Unit-1: Preliminaries</b>	
	<b>12 Hrs</b>
<b>Chapter:1 Introduction to Statistics:</b> Meaning and Importance of Statistics, Functions of Statistics, Types of Statistics: Descriptive Statistics and Inferential Statistics-Variables; Qualitative Variable and Quantitative Variable	4
<b>Chapter-2:</b> Datatypes, Sources and Collection of Data: Qualitative and Quantitative Data - Cross Section Data, Time Series Data and Panel Data - Primary and Secondary sources of Data – Methods of Collecting Primary Data	4
<b>Chapter-3:</b> Tabulation and Presentation of Data: Classification and tabulation of data - Frequency distributions – Continuous and Discrete frequency distribution. Graphical presentation- Histogram- frequency polygon - Ogive Curves -Bar Diagram, Pie Chart	4
<b>Unit -2: Measures of Central Tendency and Dispersion</b>	
	<b>14 Hrs</b>
<b>Chapter-4: Arithmetic Average:</b> Definition of Central Tendency, Types of Central Tendency: Arithmetic Mean: Meaning and Properties of Arithmetic Mean – Computation of Arithmetic Mean	5
<b>Chapter-5: Positional Averages-Median and Mode:</b> Definition and importance of Median- Calculation of Median- Definition and importance of Mode - Calculation of Mode.	4
<b>Chapter-6: Dispersion:</b> Meaning of Dispersion- Measures of Dispersion- Range- Quartile deviation- mean deviation - Standard deviation - Coefficient of Variation and Their Computation	5
<b>Unit -3: Correlation, Regression and Time Series Analysis</b>	
	<b>16 Hrs</b>
<b>Chapter-7: Correlation:</b> Meaning of Correlation - Types of correlation - Methods of measuring Correlation- Karl Pearson’s correlation coefficients	5
<b>Chapter-8: Regression:</b> Meaning and Importance of Regression - Regression Equation - Estimation of regression equation - Applications of regression equation in Economics	6
<b>Chapter-9: Time Series Analysis:</b> Definition of Time Series – Components of Time Series – Estimation and Forecasting of Trend	5

<b>References</b>	
1	Gupta S P. (2012) Statistical Methods, S. Chand and Company, New Delhi.
2	S. C. Gupta, (New edition) Fundamentals of Statistics, Himalaya publishing house, Mumbai.
3	S. N. Yogish, Statistical methods for Economists- Mangaldeep publications, Jaipur.
6	Medhi, J., Statistical Methods: An Introductory Text, Wiley, 1992
7	Morris H. Degroot and Mark J. Schervish, "Probability and Statistics", 4th edition, 2012.
8	Teresa Bradley, Essential Statistics for Economics, Business and Management,





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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Karnataka Economy</b>		
Course Code:	<b>OE 4.1</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:	
CO1.	Understand the nature of economic growth and problems of Karnataka state.
CO2.	Explain the process of structural growth in Karnataka Economy
CO3.	Evaluate the policies and programmes undertaken by the Govt. of Karnataka for bringing about socio-economic development
<b>Contents</b>	
<b>42 Hrs</b>	
<b>Unit-1: Karnataka Economy – An overview</b>	
<b>12 Hrs</b>	
<b>Chapter:1 Characteristics of Karnataka Economy</b>	
<ul style="list-style-type: none"> <li>○ Features of Karnataka Economy</li> <li>○ Trends and sectoral distribution of State Domestic Product and Per Capita Income</li> <li>○ Measures to redress regional imbalances – Dr. Nanjundappa Committee Report, Article 371J</li> </ul>	5
<b>Chapter-2: Human Resources</b>	
<ul style="list-style-type: none"> <li>○ Human Resources: importance, Size and Health indicators</li> <li>○ Human Development Index</li> <li>○ Poverty and Unemployment– Eradication Programmes</li> </ul>	4
<b>Chapter-3: Natural Resources Management</b>	
<ul style="list-style-type: none"> <li>○ Natural Resources: Importance and volume of different natural resources</li> <li>○ Karnataka Environmental Policy</li> </ul>	3
<b>Practicum:</b> conduct field visit to Forest/Reservoir/Mining and prepare the report	
<b>Unit -2: Agriculture, Rural development, and Industries in Karnataka</b>	
<b>18 Hrs</b>	
<b>Chapter-4: Agriculture</b>	
<ul style="list-style-type: none"> <li>○ Problems in Agriculture</li> <li>○ Land Reforms</li> <li>○ Cropping Pattern</li> <li>○ Irrigation: importance, important irrigation projects and watershed development projects.</li> <li>○ Farmers Suicide – Causes and Solutions</li> </ul>	7

<b>Chapter-5: Rural Development</b> <ul style="list-style-type: none"> <li>○ Public Distribution System</li> <li>○ Rural Development Programmes (brief)</li> <li>○ Government Schemes for Rural Women</li> </ul>	4
<b>Chapter-6: Industries in Karnataka</b> <ul style="list-style-type: none"> <li>○ Major Industries in Karnataka - Problems and Prospects</li> <li>○ MSMEs - Problems and Measures</li> <li>○ IT Industries in Karnataka</li> <li>○ Industrial Finance in Karnataka</li> <li>○ Industrial Policy of Karnataka</li> </ul>	7
<b>Practicum:</b> visit to industrial units in local area and prepare the report/Trace-out the impact of Prof. D. M. Nanjundappa Committee report	
<b>Unit -3: Infrastructure and Finance in Karnataka</b>	<b>12 Hrs</b>
<b>Chapter-7: Economic Infrastructure</b> <ul style="list-style-type: none"> <li>○ Transportation: Road, Rail, Water and Air Transport</li> <li>○ Information and Communication Technology Facilities</li> </ul>	3
<b>Chapter-8: Social Infrastructure</b> <ul style="list-style-type: none"> <li>○ Drinking Water</li> <li>○ Housing and Sanitation</li> <li>○ Health and Education</li> <li>○ Rural Electrification</li> </ul>	4
<b>Chapter-9: State Finance</b> <ul style="list-style-type: none"> <li>○ Sources of Revenue: Direct and Indirect Taxes</li> <li>○ Impact of GST on Karnataka economy</li> <li>○ State Expenditure</li> <li>○ State Finance Commission</li> <li>○ Current State Budget (Brief)</li> </ul>	5
<b>Practicum:</b> Discussion on State budget	

References	
1	Government of Karnataka, Economic Survey [Various Issues]
2	Planning Department, Annual Publication, Government of Karnataka.
3	Karnataka at Glance, Annual Publication Government of Karnataka.
4	Madaiah M & Ramapriya. Karnataka Economy Growth: Issues and Development, Himalaya Pub., House, NewDelhi.
5	Adul Aziz and K.G. Vasanti. (Eds) Karnataka Economy.
6	Government District Development Reports
7	Hanumantha Rao. Regional Disparities and Development in Karnataka.
8	Krishnaiah Gowda H.R. Karnataka Economy, Spandana Publications, Bangalore
9	Somashekar Ne. Thi., Siddalingshwara publications, Kalburgi.
10	Nanjundappa D.M. Some Aspects of Karnataka Economy.
11	Puttaswamiah K. Karnataka Economy, Two Volume



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Entrepreneurial Economics</b>		
Course Code:	<b>OE 4.2</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to: CO1. Start own business as Entrepreneur CO2. Enabling the students to find career opportunities in business. CO3. To enable the students to gain knowledge and skills needed to run a business successfully.	
<b>Contents</b>	<b>42 Hrs</b>
<b>Unit-1: Entrepreneur and Entrepreneurship</b>	<b>12 Hrs</b>
<p><b>Chapter 1:</b> Entrepreneur and Entrepreneurship – Meaning, Definitions, Evolution, types- Characteristics, qualities, functions of entrepreneur- Distinction between entrepreneur and manager, Distinction between entrepreneur and intrapreneur,</p> <p><b>Chapter 2:</b> Role and importance of Entrepreneurship in economic development: Role and importance- Factors influencing entrepreneurship’- Psychological, social, Economic and Environmental.</p> <p><b>Chapter 3:</b> New generations of entrepreneurship viz. social, Health, Tourism and Women entrepreneurship; Barriers to entrepreneurship.</p>	
<b>Unit -2: Launching Entrepreneurial Ventures</b>	<b>18 Hrs</b>
<p><b>Chapter 4:</b> Generation of ideas: Methods and process - sources of ideas - screening process- Assessing Opportunities-Challenges, pitfalls and critical factors of new venture;</p> <p><b>Chapter 5:</b> Business Plan- New Ventures: Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno-Economic Feasibility Assessment.</p> <p><b>Chapter 6:</b> Role of Innovation &amp; Creativity: Innovation- Meaning and importance of innovation; Types of innovation; Sources of innovation; Conditions for effective innovation at Organization level;</p> <p><b>Chapter 7:</b> Creativity: Concept and process of creativity; role and importance of creativity and mental blocks to creativity; branding, trademarks, patents, copyrights, and registered design protection-Methods of protecting innovation and creativity.</p>	
<b>Unit -3: Business and Entrepreneurial development</b>	<b>12 Hrs</b>
<p><b>Chapter 8:</b> Entrepreneur Assistance: Assistance to an entrepreneur-Industrial Park (Meaning, features, &amp; examples)-Special Economic Zone (Meaning, features &amp; examples)-Financial assistance by different agencies-License, Environmental Clearance, e-tender process, Excise exemptions and concession, Exemption from income tax -Quality Standards with special reference to ISO.</p> <p><b>Chapter 9:</b> Business and Entrepreneurial development - Determining and acquiring required resources (Financial, Physical and Human): Search for entrepreneurial capital- Debt vs. Equity; Venture Capital Market; Angel Financing and Alternative sources of finance for Entrepreneurs. Entrepreneurship development programme (EDP) in India– Objectives, Phases, and inputs of EDP; - Government initiatives for entrepreneurship – Make in India, Start-up India, MUDRA etc.</p>	



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**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Economics and Law</b>		
Course Code:	<b>OE 4.3</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

**Course Outcomes (COs):** After the successful completion of the course, the student will be able to:

CO1. Comprehend the basic economic issues affecting the economy along with the related legal provisions

CO2. Acquire knowledge on the basic provisions of law relating to consumer activities, business organizations, environment

CO3. To appreciate the understanding the law framework in order to frame the economics model closer to reality.

CO4. To enable the students to understand the consequences of legal rules, primarily as an exercise in applied microeconomics, macroeconomics, industrial and international economics.

<b>Contents</b>	<b>42 Hrs</b>
<b>Unit-1: Economic analysis of law</b>	<b>14 Hrs</b>
<b>Chapter 1: Introduction to legal reasoning</b>	5
<ul style="list-style-type: none"> <li>• Efficiency.</li> <li>• Markets and efficiency.</li> <li>• Market failure.</li> <li>• Coase theorem and related ideas,</li> </ul>	
<b>Chapter 2: welfare economics</b>	4
<ul style="list-style-type: none"> <li>• Compensation principles.</li> <li>• Social welfare function.</li> <li>• Maximization problem;</li> </ul>	
<b>Chapter 3: Economic Reasoning</b>	5
<ul style="list-style-type: none"> <li>• Nature of economic reasoning.</li> <li>• Economic approach to law</li> <li>• History</li> <li>• Criticism.</li> </ul>	
<b>Practicum:</b>	
<ol style="list-style-type: none"> <li>1. Group Discussions on Economic reasoning</li> <li>2. Assignment on Coase theorem and related issues</li> </ol>	
<b>Unit -2: An Introduction to Law and Legal Institutions</b>	<b>12 Hrs</b>
<b>Chapter 4: Law</b>	4
<ul style="list-style-type: none"> <li>• Definition</li> <li>• Territorial Nature of Law</li> <li>• Kinds of Law</li> <li>• General Law and Special Law</li> <li>• Kinds of Special Law</li> </ul>	
<b>Chapter 5: Civil law and the and the Common Law Traditions</b>	4
<ul style="list-style-type: none"> <li>• The institutions of the federal and State Court systems;</li> <li>• The nature of legal dispute,</li> <li>• How legal rules evolve.</li> </ul>	
<b>Practicum:</b>	
<ol style="list-style-type: none"> <li>1. Group Discussions on Civil law and the and the Common Law Traditions</li> </ol>	

2.	Assignment on the different kinds of Law	
<b>Unit -3: Economic Laws</b>		<b>16 Hrs</b>
<b>Chapter 6: Law Relating to Consumer Activities</b>	<ul style="list-style-type: none"> <li>• Bargaining theory.</li> <li>• Economic theory of contract.</li> <li>• Defining tort law,</li> <li>• Economics of tort liability.</li> <li>• Definition of Consumer</li> </ul>	5
	<ul style="list-style-type: none"> <li>• Consumer protection; The Consumer Protection Act, 2019</li> <li>• Consumer courts.</li> </ul>	
<b>Chapter 7: Law of Business Organizations</b>	<ul style="list-style-type: none"> <li>• Structure of firm — Kinds, Corporations,</li> <li>• Capital, Shares, Debentures, Insiders' trading,</li> <li>• RBI, IRDA, MRTP, Role of SEBI,</li> </ul>	5
<b>Chapter 8: Macroeconomics and Law</b>	<ul style="list-style-type: none"> <li>• Inequality; Contract theory of Distributive justice</li> <li>• Economic and social costs of poverty</li> <li>• Wealth distribution by Liability Rules</li> <li>• Taxation and efficiency</li> <li>• National and global environmental problems and international environmental agreements</li> </ul>	6
<b>— their legal and economic implications</b>		
<b>Practicum</b>		
<ol style="list-style-type: none"> <li>1. Hold the moot court in the classroom and let there be discussion consisting of at least two or more different views on National and Global environment problems and acts</li> <li>2. Discuss the case studies on Economic and social costs of poverty and consumer court judgements protecting the consumers</li> </ol>		

<b>References</b>	
1	Bouckaert, B. and G. De Geest (Ed.) (1999), Encyclopaedia of Law and Economics, (Volume I to V), Edward Elgar Publishing Ltd., U.K.
2	Cooter, R.D. and T.S. Ulen, (2000), Law and Economics, (3rd Edition), Addison Wesley, New York.
3	Dan-Schmidt, K.G. and T.S. Ulen (Ed.) (2000), Law and Economic Anthology, Addison Wesley, New York.
4	Newman, P. (Ed.) (1998), The New Palgrave Dictionary of Economics and Law, Stockton Press, New York.
5	Oliver, J.M. (1979), Law and Economics, George Allen and Unwin, London.
6	Posner, R.A. (1998), Economic Analysis of Law, (5th Edition), Little Brown, Boston.
7	Posner, R.A. and F. Parisi (Eds.) (1997), Law and Economics, Edward Elgar Publishing Ltd., U.K.
8	Massey, I.P. (1995), Administrative Law, Eastern Book Company, Lucknow.
9	Indian Law Institute, Annual Survey of Indian Law, Indian Law Institute, New Delhi.



**Government of Karnataka**

**Model Curriculum**

Program Name	<b>BA in Economics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Economics of GST</b>		
Course Code:	<b>OE 4.4</b>	No. of Credits	<b>3</b>
Contact hours	<b>42 Hours</b>	Duration of SEA/Exam	<b>2 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

**Course Outcomes (COs):** After the successful completion of the course, the student will be able to:

CO1. Acquire knowledge on indirect taxes with special reference to GST  
 CO2. Acquire the theoretical and application knowledge of GST and its Evolution in India  
 CO3. To enable the students to understand the GST Law, ITC, Valuation of supply and returns  
 CO4. Simple calculation of GST and Input Tax Credit, Valuation of Supply (Numerical on valuation and calculation of tax)

<b>Contents</b>	<b>42 Hrs</b>
<b>Unit-1: Introduction to Economics of GST</b>	<b>14 Hrs</b>
<b>Chapter 1: Indirect taxes before GST</b>	5
<ul style="list-style-type: none"> <li>• Indirect Taxes-Meaning, Types with examples</li> <li>• Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union &amp; State Government)</li> <li>• Concept of VAT: Meaning, Variants and Methods;</li> </ul>	
<b>Chapter 2: Reforms in Indirect Taxes</b>	4
<ul style="list-style-type: none"> <li>• Major Defects in the structure of Indirect Taxes prior to GST; Need for Tax reforms</li> <li>• Kelkar committee on Tax Reforms</li> </ul>	
<b>Chapter 3: Introduction to GST</b>	5
<ul style="list-style-type: none"> <li>• Rationale for GST;</li> <li>• Constitution [101st Amendment] Act, 2016;</li> <li>• GST- Meaning, Overview of GST</li> <li>• Taxes subsumed under GST</li> <li>• Territorial Jurisdiction of GST</li> </ul>	
<ul style="list-style-type: none"> <li>• Multiple rates of GST</li> <li>• Recent reforms in GST</li> </ul>	
<b>Practicum:</b>	
<ol style="list-style-type: none"> <li>1. Group Discussions on Indirect Taxes defects prior to GST</li> <li>2. Assignment on Types of Indirect Taxes prior to GST and After introduction of GST</li> </ol>	
<b>Unit – 2 Fundamentals of GST</b>	<b>12 Hrs</b>
<b>Chapter 4: GST Structure in India,</b>	4
<ul style="list-style-type: none"> <li>• GST: Advantages and Disadvantages</li> <li>• One Nation-One Tax,</li> <li>• Structure of GST;</li> <li>• Features of Single and Dual GST Model</li> </ul>	
<b>Chapter 5: Dual GST Mode and GST Council</b>	4
<ul style="list-style-type: none"> <li>• Dual GST Mode in India: 1 SGST, CGST, UTGST &amp; IGST);</li> </ul>	

<ul style="list-style-type: none"> <li>• Goods and Services Tax Network [GSTN],</li> <li>• GST Council; Creation, Members, Decisions, Compensation to states.</li> <li>• GST Network,</li> <li>• Registration,</li> </ul>	
<b>Practicum:</b> 1. Group Discussions on advantages and disadvantages of GST 2. Hold the moot of GST Council in the class room and decide the different slabs of GST	4
<b>Unit -3: Taxes and Duties</b>	<b>16 Hrs</b>
<b>Chapter 6: Transactions and taxes covered and not covered</b> <ul style="list-style-type: none"> <li>• Transactions and taxes covered under GST</li> <li>• Taxes and duties outside the purview of GST</li> <li>• Tax structure Computation</li> <li>• Administration of Tax on items containing alcohol, petroleum products, tobacco products</li> <li>• Taxation on services</li> </ul>	4
<b>Chapter 7: Levy and Collection of Tax</b> <ul style="list-style-type: none"> <li>• Taxable event- “Supply” of Goods and Services</li> <li>• Place of Supply: Within state, Interstate Levy and Collection</li> <li>• Import and Export; Time of supply</li> <li>• Valuation for GST- Valuation rules,</li> <li>• Taxability of reimbursement of expenses;</li> <li>• Exemption from GST: Small supplies and Composition Scheme Classification of Goods and Services: Composite and Mixed Supplies.</li> </ul>	6
<b>Chapter 8: Input Tax Credit</b> <ul style="list-style-type: none"> <li>• Eligible and Ineligible Input Tax Credit</li> <li>• Apportionments of Credit and Blocked Credits</li> <li>• Tax Credit in respect of Capital Goods</li> <li>• Recovery of Excess Tax Credit</li> <li>• Availability of Tax Credit in special circumstances</li> <li>• Transfer of Input Credit (Input Service Distribution)</li> <li>• Payment of Taxes; Refund; Doctrine of unjust enrichment</li> </ul>	6
<b>Practicum</b> 1. Simple illustrations on calculation of GST and Input Tax Credit, 2. Valuation of Supply (Numerical on valuation and calculation of tax) 3. Simple calculation Adjustment of Input tax credit against output CGST, SGST, IGST.	

References	
1	The Central Goods and Services Tax, 2017
2	The Integrated Goods and Services Tax, 2017
3	The Union Territory Goods and Services Tax, 2017
4	The Goods and Services Tax (Compensation to States), 2017
5	The Constitution (One hundred and First Amendment) Act, 2016
6	Gupta, S.S. , <i>GST- How to meet your obligations (April 2017)</i> , Taxmann Publications
7	Datey, V.S. (2019) . <i>Indirect Taxation</i> . New Delhi <i>Vastu and Sevakar Vidhan</i> by Government of India
8	Mehrotra, H.C. & Goyal, S.P.(2019), <i>Indirect Taxes</i> , Agra: Bhawan Publications.

**Pedagogy:** Classroom lecture, tutorials, Problem solving exercise

<b>Formative Assessment for C1 &amp; C2</b>		
<b>Assessment Occasion/ type</b>	<b>Marks</b>	
	<b>C1</b>	<b>C2</b>
Internal Test	10	10
Assignment/Seminar	05	
Quiz	05	
Case study / Field work / Project work/ Industrial Visit and Prepare a report	-	10
<b>Total</b>	<b>40 Marks</b>	
<i>Formative Assessment as per NEP guidelines are compulsory</i>		

*Note: Strictly follow the Practicum*



CBCS Question Paper Pattern for UG Semester

**DSC, DSEC & OEC**

Paper Code:		Paper Title:	
Duration of Exam	<b>2-30 Hours</b>	Max Marks	<b>60 Marks</b>
Instruction:	<b>Answer all the sections</b>		

**Part-A**

1. Answer <b><u>ALL</u></b> the following sub-questions, each sub-question carries <b>ONE</b> mark	(10X1=10)
A. B. C. D. . . J.	
<i>Note for Section-A: Three sub-questions from each unit and remaining one sub-question (J) from unit I to III.</i>	

**Part-B**

Answer any <b><u>FOUR</u></b> of the following questions, each question carries <b>FIVE</b> marks	(4X5=20)
2. 3. 4. 5. 6. 7.	
<i>Note for Section-B: Minimum Two question from each unit (Q No 2 to 6)</i>	

**Part-C**

Answer any <b><u>THREE</u></b> of the following questions, each question carries <b>TEN</b> marks	(3X10=30)
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8.

9.

10.

11.

12.

**Note for Section-C: Minimum Two question from each unit (Q No 8 to 12) Sub-questions such as 'a' and 'b' may be given for a question in section-C only.**

Date

Subject Committee Chairperson

**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE**  
(AUTONOMOUS)  
**B.N. ROAD, MYSURU**



**DEPARTMENT OF ECONOMICS**

**Revised Syllabus for Undergraduate (UG)  
CBCS Scheme - 2019-2020**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
(AUTONOMOUS)  
**B.N. ROAD, MYSURU-25**

**DEPARTMENT OF ECONOMICS**  
**Course BA: Syllabus**  
**Restructured and Revised Syllabus and Scheme for BA Economics under**  
**CBCS - 2019-2020**

**Note:**

Sem	CourseCode	Course	Teaching Hours / week	L T P	Credit	I.A Marks	Theory Exam	Total Marks
<b>Discipline Specific Core(DSC)</b>								
I	Core-IE LA21021/22/26/23/24	Principles of Micro Economics-I	5+1	5-1-0	6	30	70	100
II	Core - IIE LB21021/22/26/23/24	Principles of Micro Economics-II	5+1	5-1-0	6	30	70	100
III	Core – III E LC21021/22/26/23/24	Principles of Macro Economics-I	5+1	5-1-0	6	30	70	100
IV	Core – IV E ELD21021/22/26/23/24	Principles of Macro Economics-II	5+1	5-1-0	6	30	70	100
<b>Discipline Specific Elective (DSE) – Any one</b>								
V	DSE – 1AE LE21021/22/26/23/24	Economics of Development	5+1	5-1-0	6	30	70	100
V	DSE – 1BE LE21121/22/26/23/24	Money and Banking	5+1	5-1-0	6	30	70	100
V	DSE – 1CE LE21221/22/26/23/24	Environmental Economics	5+1	5-1-0	6	30	70	100
<b>Discipline Specific Elective (DSE) – Any one</b>								
VI	DSE - 1A LF21021/22/26/23/24	Indian Economy	5+1	5-1-0	6	30	70	100
VI	DSE - 1B LF21221/22/26/23/24	Economic History of India-1857-1947	5+1	5-1-0	6	30	70	100
VI	DSE – 1C LF21321/22/26/23/24	Public Finance	5+1	5-1-0	6	30	70	100

- 1. Credits Per Course/Paper per week in all the SIX Semesters =6 Credits [L:5 + T:1]**  
[Of which, it is 5 Credits for Lecture and 1 Credit for Tutorials]
- 2. Work Load Per Course/Paper per week in all the SIX Semesters = 07 Hours[L:5 + T:2]**  
[Of which, it is 5 Hours for Lecture and 2 Hours for Tutorials]

## Generic Elective

Sem	Course Code	Course	Teaching Hours / week	LT P	Credit	IA Marks	Theory Exam	Total Marks	Remarks
V	GE-I ELE 21321/ 22/26/23/24	Introduction To Economics	2	2-0-0	2	15	35	50	<i>To benefit those students interested to study Basic Economics and Indian Economy irrespective of his / her programme</i>
VI	GE-II ELF21422/22 /26/23/24	Indian Economy	2	2-0-0	2	15	35	50	

Year	SEM	COURSE CODE	TITLE OF THE PAPER	CONTINUOUS ASSESSMENT				MAX.MARKS			DURATI ON OF EXAM
				C1		C2		C3	TH	IA	TH
				TEST	AS/ GD	TEST	SE/ PD				
I	I	Core-1 ELA21021/22/26 /23/24	Principles of Micro Economics-I	10	5	10	5	70	70	30	3h
	II	Core - II ELB21021/22/26 /23/24	Principles of Micro Economics-II	10	5	10	5	70	70	30	3h
II	III	Core - III ELC21021/22/26 /23/24	Principles of Macro Economics-I	10	5	10	5	70	70	30	3h
	IV	Core - IV ELD21021/22/26 /23/24	Principles of Macro Economics-II	10	5	10	5	70	70	30	3h
III	V	DSE - 1A ELE21021/22/26/ 23/24	Economics of Development	10	5	10	5	70	70	30	3h
		DSE - 1B ELE21121/22/26/ 23/24	Money and Banking	10	5	10	5	70	70	30	3h
		DSE - 1C ELE21221/22/26 /23/24	Environmental Economics	10	5	10	5	70	70	30	3h
	VI	GE-I ELE21321/22/26 /23/24	Introduction to Economics	7.5	-	7.5	-	35	35	15	2h
		DSE - 1A ELF21021/22/26 /23/24	Indian Economy	10	5	10	5	70	70	30	3h
		DSE - 1B ELF21221/22/26 /23/24	Economic History of India-1857-1947	10	5	10	5	70	70	30	3h
		DSE - 1C ELF21321/22/26 /23/24	Public Finance	10	5	10	5	70	70	30	3h
GE-II ELF21422/22/26/ 23/24	Indian Economy	7.5	-	7.5	-	35	35	15	2h		

## **Scheme of assessment for B.A Economics under CBCS-2019-2020**

### **Core and Discipline Specific Elective(DSE)** **Courses in Economics**

Semester I	Semester II
Core Economics I: Principles of Microeconomics-I	Core Economics II: Principles of Microeconomics-II
Semester III	Semester IV
Core Economics III: Principles of Macroeconomics-I	Core Economics IV: Principles of Macroeconomics-II
Semester V	Semester VI
Discipline Specific Elective I	Discipline Specific Elective II

One of the following:	One of the following:
i. DSE-1A : Economics of Development ii. DSE-1B : Money and Banking iii. DSE-1C :Environmental Economics	iv. DSE-1A: Indian Economy v. DSE -1B: Economic History of India 1857-1947 vi. DSE- 1C: Public Finance

### Generic Electives

Semester	Course Title	Remarks
V	GE-I Introduction to Economics	Benefits those students interested to study <i>Basic Economics</i> and <i>Indian Economy</i> irrespective of his / her programme
VI	GE-II Indian Economy	

### TEMPLATE Subject: ECONOMICS

Sem	Core			DSE			GE		
	No. of Courses	Credits	Total Hours	No. of Courses	Credits	Total Hours	No. of Courses	Credits	Total Hours
I	1	6	75+15	-	-	-	-	-	-
II	1	6	75+15	-	-	-	-	-	-
III	1	6	75+15	-	-	-	-	-	-
IV	1	6	75+15	-	-	-	-	-	-
V	-	-	-	1	6	75+15	1	2	30
VI	-	-	-	1	6	75+15	1	2	30
<b>Total</b>	<b>4</b>	<b>24</b>	<b>360</b>	<b>2</b>	<b>12</b>	<b>180</b>	<b>2</b>	<b>4</b>	<b>60</b>

## **Programme Outcome**

### **After completing the graduation in B A(HEG) the students are able to:**

- PO1. Critically recognizes the social, political, economic and cultural aspects of History.
- PO2. Demonstrate thinking skills by analyzing, synthesizing, and evaluating them in relation to their cultural and historical context.
- PO3. Correctly extracts evidence from primary sources by analyzing and evaluating them in relation to their cultural and historical context.
- PO4. Develop an informed familiarity with multiple cultures.
- PO5. Demonstrate critical reading, writing and thinking skills.
- PO6. Explain, graph, and analyze key economics models.
- PO7. Understand current events and evaluate specific policy proposals.
- PO8. To address problem that do not have clear economic solutions.
- PO9. Develop critical and quantitative thinking skills.
- PO10. Communicate effectively in written, oral and graphical form about specific issues.
- PO11. Apply economic analysis to everyday problems in real world situations.
- PO12. Understand and appreciate relationship between man and Environment
- PO13. Read, interpret, and generate maps and other geographic representations
- PO14. To extract, analyze, and present information from a spatial perspective
- PO15. Understand physical-geographic processes, global distribution of landforms and ecosystems
- PO16. The role of physical environment on human population
- PO17. Develop the ethical aptitudes and dispositions necessary to acquire and hold leadership positions in industry, government, and professional organizations.

### **Programme Specific Outcomes**

#### **On Completion of BA (HEG) students will:**

- PSO1. This Programme exerts its influence on life and destiny of Human beings.
- PSO2. It is a stepping stone for one's success in competitive examinations.
- PSO3. Understand the background of our religion, customs and Institutions and so on.
- PSO4. Understand the present Social, political, religious and economic conditions of the people.
- PSO5. Understand theoretical and practical aspects of Economics and Geography
- PSO6. Evaluate Economic behavior inconsonance with Geographical factors
- PSO7. Suggest the policy makers about desirable changes to be made in Micro and Macro Economic



issues based on geographical factors

PSO8. Gain ability to understand the economic problems in Geographical indicators

PSO9. Able to offer palatable solutions for economic and geographical challenges

PSO10. Attain Proficiency to analyze the economic decision of Government and non-Govt. entities that correlate with Geographical factors

PSO11. Gain requisite knowledge to evaluate land use pattern and demographical profile

PSO12. Apply GIS for understanding Market situation, Transport problem change in Weather Condition, Cropping Pattern, and Natural Calamities and so on

### **Programme Outcome**

#### **After completing the graduation in B A(HEP) the students are able to:**

PO1. Critically recognizes the social, political, economic and cultural aspects of History.

PO2. Demonstrate thinking skills by analyzing, synthesizing, and evaluating them in relation to their cultural and historical context.

PO3. Correctly extracts evidence from primary sources by analyzing and evaluating them in relation to their cultural and historical context.

PO4. Develop an informed familiarity with multiple cultures.

PO5. Demonstrate critical reading, writing and thinking skills.

PO6. Explain, graph, and analyze key economics models.

PO7. Understand current events and evaluate specific policy proposals.

PO8. To address problem that do not have clear economic solutions.

PO9. Develop critical and quantitative thinking skills.

PO10. Apply economic analysis to everyday problems in real world situations.

PO11. To extract, analyze, and present information from a spatial perspective.

PO12. Spread the messages of equality, nationality, social harmony and other human values.

PO13. Comprehend the basic structures and processes of government systems and/or theoretical underpinnings.

PO14. Analyze political problems, arguments, information, and/or theories.

PO15. Apply methods appropriate for accumulating and interpreting data applicable to the discipline of Political Science.

### **Programme Specific Outcomes**

#### **On Completion of BA (HEP) students will:**

PSO1. Critically recognize the social, political, economic and cultural aspects of History.

PSO2. Demonstrate thinking skills by analyzing, synthesizing, and evaluating historical information from multiple sources.

PSO3. Correctly extract evidence from primary sources by analyzing and evaluating them in relation to their cultural and historical context.

PSO4. Develop an informed familiarity with multiple cultures.

PSO5. Demonstrate critical reading, writing, and thinking skills.

PSO6. Explain, graph, and analyze key economics models.

PSO7. Understand current events and evaluate specific policy proposals.

PSO8. To address problem that do not have clear economic solutions.

PSO9. Develop critical and quantitative thinking skills.

PSO10. Communicate effectively in written, oral and graphical form about specific issues.

PSO11. Apply economic analysis to everyday problems in real world situations.

PSO12. Develop the ethical aptitudes and dispositions necessary to acquire and hold leadership positions in industry, government, and professional organizations.

## **Programme Outcome**

### **After completing the graduation in B A(KEP) the students are able to:**

PO1. Develop human values and a sense of social service

PO2. Become a responsible and dutiful citizen.

PO3. Able to enhance critical temper and creative ability

PO4. Apply economic analysis to everyday problems in real world situations.

PO5. Explain, graph, and analyze key economics models.

PO6. Understand current events and evaluate specific policy proposals.

PO7. To address problem that do not have clear economic solutions.

PO8. Develop critical and quantitative thinking skills.

PO9. Apply economic analysis to everyday problems in real world situations.

PO10. To extract, analyze, and present information from a spatial perspective.

PO11. Spread the messages of equality, nationality, social harmony and other human values.

PO12. Comprehend the basic structures and processes of government systems and/or theoretical underpinnings.

PO13. Analyze political problems, arguments, information, and/or theories.

PO14. Apply methods appropriate for accumulating and interpreting data applicable to the discipline of Political Science.

## **Programme Specific Outcomes**

### **On Completion of BA (KEP) students will:**

PSO 1: Know more specific terminologies along with its etymology.

PSO2: Know the changes in the differences in formation of society and their culture

PSO3: Help to understand different races, Society, and culture.

PSO4. Understand theoretical and practical aspects of Economics and Geography

PSO5. Evaluate Economic behavior inconsonance with Geographical factors

PSO6. Suggest the policy makers about desirable changes to be made in Micro and Macro Economic issues based on geographical factors

PSO7. Act as a stepping stone for one's success in competitive examinations

PSO8. Create appropriate and efficient Historians, Political Leaders, administrators and

man

State's

PSO9. Educate about patriotism toleration and National Integration.

### **Programme Outcome**

### **After completing the graduation in B A(KEG) the students are able to:**

PO1. Develop human values and a sense of social service

PO2. Become a responsible and dutiful citizen.

PO3. Able to enhance critical temper and creative ability

PO4. Apply economic analysis to everyday problems in real world situations.

PO5. Explain, graph, and analyze key economics models.

PO6. Understand current events and evaluate specific policy proposals.

PO7. To address problem that do not have clear economic solutions.

PO8. Develop critical and quantitative thinking skills.

PO9. Apply economic analysis to everyday problems in real world situations.

PO12. Understand and appreciate relationship between man and Environment

PO13. Read, interpret, and generate maps and other geographic representations

PO14. To extract, analyze, and present information from a spatial perspective

PO15. Understand physical-geographic processes, global distribution of landforms and ecosystems

PO16. The role of physical environment on human population.

### **Programme Specific Outcomes**

### **On Completion of BA (KEG) students will:**

PSO 1: Know more specific terminologies along with its etymology.

PSO2: Know the changes in the differences in formation of society and their culture

PSO3: Help to understand different races, Society, and culture.

PSO4. Understand theoretical and practical aspects of Economics and Geography.

PSO5. Evaluate Economic behavior inconsonance with Geographical factors.

PSO6. Suggest the policy makers about desirable changes to be made in Micro and Macro Economic issues based on geographical factors.

PSO7. Act as a stepping stone for one's success in competitive examinations.

PSO8. Gain ability to understand the economic problems in Geographical indicators.

PSO9. Able to offer palatable solutions for economic and geographical challenges.

PSO10. Attain Proficiency to analyze the economic decision of Government and non- Govt. entities that correlate with Geographical factors.

PSO11. Gain requisite knowledge to evaluate land use pattern and demographical profile.

PSO12. Apply GIS for understanding Market situation, Transport problem change in Weather Condition, Cropping Pattern, and Natural Calamities and so on.

## **Programme Outcome**

### **After completing the graduation in B A(HEE) the students are able to:**

PO1. Critically recognize the social, political, economic and cultural aspects of History.

PO2. Demonstrate thinking skills by analyzing, synthesizing, and evaluating historical information from multiple sources.

PO3. Correctly extract evidence from primary sources by analyzing and evaluating them in relation to their cultural and historical context.

PO4. Develop an informed familiarity with multiple cultures.

PO5. Demonstrate critical reading, writing, and thinking skills.

PO6. Explain, graph, and analyze key economics models

PO7. Understand current events and evaluate specific policy proposals

PO8. To address problem that do not have clear economic solutions

PO9. Develop critical and quantitative thinking skills

PO10. Communicate effectively in written, oral and graphical form about specific issues

PO11. Apply economic analysis to everyday problems in real world situations

PO12. Write focused, organized, well-developed, and text-based essays using effective paragraphs.

PO13. Support a clear thesis statement, and demonstrate competence in Standard English Language and usage.

PO14. Write articles, novels, stories to spread the messages of equality, nationality, social harmony and other human values.

PO15. Acquire the ability to engage in independent and life-long learning in a broader context about socio-technological and demographic changes.

PO16. Develop and carry out research projects, and locate, evaluate, organize, and incorporate information effectively.

### **Programme Specific Outcomes**

#### **On Completion of BA (HEE) students will:**

PSO1. Demonstrate thinking skills by analyzing, synthesizing, and evaluating historical information from multiple sources.

PSO2. Correctly extract evidence from primary sources by analyzing and evaluating them in relation

to their cultural and historical context.

PSO3. Develop an informed familiarity with multiple cultures.

PSO4. Demonstrate critical reading, writing, and thinking skills.

PSO5. Explain, graph, and analyze key economics models.

PSO6. Understand current events and evaluate specific policy proposals.

PSO7. To address problem that do not have clear economic solutions.

PSO8. Develop critical and quantitative thinking skills.

PSO9. Communicate effectively in written, oral and graphical form about specific issues.

PSO10. Apply economic analysis to everyday problems in real world situations

PSO11. Write and edit clear, graceful, grammatically correct prose.

PSO12. Analyse numerical data and utilize database for multi-layered storytelling.

PSO13. Demonstrate preparation for an entry-level position in the profession through a portfolio exhibiting their work.

**ELE21021/22/26/23/24**

**V Semester**  
**DSE-1A: Economics of Development**

**Course outcomes**

On completion of the Course, students will:

CO1. Learn in depth Understand the concept of Economic development and factors affect Development.

CO2. Deliberate in details with examples Differentiate Economic development and growth.

CO3. Identify the characteristics of Demographic Trends.

CO4. Specify in depth Harrod -Domar Growth Model.

CO5. Understand the classification and characteristics of Endogenous Growth theory.

CO6. Identify the details of Poverty Eradication Measures.

CO7. Deliberate in depth Amartya Sen and Bhagavathi Debate.

**Course Description:**

This course reviews major trends in aggregate economic indicators of economic development, factors in economic development and theories of economic development and growth

**I Economic Development:**

**18**

Economic Development –Meaning-definition- Concept of Sustainable Development and

Inclusive Development-Economic Growth and Development-Factors affecting Development-Indicators of Economic Development-National Income, Per capita Income, Basic needs approach- PQLI-HDI-GEM-MDPI-Happiness Index.

- II Factors in Economic Development: 12**  
Capital Formation: Meaning and Importance-Capital Output Ratio- Physical Capital – Technology-Human Capital-Demographic Transition-Institutional factors.
- III. General Theories of Economic Growth 15**  
Adam Smith, Karl Marx and Schumpeter’s Theories of Economic Development. Harrod-Domor Growth Model-Rastow’s Growth Theory.
- IV. Partial Theories of Economic Growth and Development: 12**  
Arthur Lewis- Labour Surplus Model. Big push Theory-Theories of Dualistic Development-Balanced v/s Unbalanced Theories- Endogenous Growth Theory.
- V. Economic Growth and Distributive Justice: 18**  
Economic Growth and Social Justice: Poverty- Meaning, Types, Causes and Measures. Poverty Eradication Measures-Unemployment- Meaning, Types, Causes and Measures. Measures to reduce Unemployment. Occupational Structure-Organized and Unorganized Sector (with reference to India) Amartya Sen- Bhagavathi Debate.

**ELE21121/22/26/23/24**

**V Semester**  
**DSE-1B: Money and Banking**

**Course outcomes**

On completion of the Course, students will:

- CO1. Understand the characteristics of Demand for Money.
- CO2. Specify the classification and characteristics of Capital Market.
- CO3. Deliberate the details of Theories of Interest.
- CO4. Learn the classification and characteristics of Functions of Commercial bank.
- CO5. Understand the characteristics of Indian Banking System.
- CO6. Learn the characteristics of Evaluation and Functions of Central bank.
- CO7. Deliberate the details of Monetary Policy.

**Course Description:**

This course exposes students to the theory and functioning of the monetary and financial sectors of the economy. It highlights the organization, structure and role of financial markets and institutions. It also discusses interest rates, monetary management and instruments of monetary control, financial and banking sector reforms and monetary system with special reference to India.

- I. Money :** **12**  
Concept, Meaning and Definitions, Classifications of Money Functions and its Classification- Importance of Money. Demand for Money and determinants. Supply of money and determinants. Theories of Value of Money- Fisher's and Quantity Theory of Money.
- II. Money Market and Capital Market:** **15**  
Money Market-Meaning-Structure and Instruments-Characteristics of a Good Money Market. Capital Market- Meaning-Structure and Instruments. Difference between Money Market and Capital Market.
- III. Interest Rates:** **14**  
Rate of Interest-Meaning-Structure-Functions-short term and Long Term Interest. Theories of Interest rate Determination-Liquidity Theory of Interest- Don Pankin Theory-Interest rate in India.
- IV Commercial Banks & NBFCs:** **16**  
a) Commercial Banks-Functions-Role-Balance Sheet-*Credit Creation*.  
b) Indian Banking System-NBFCs: Concept-Structure-Functions-Banking sector reforms, Changing role and structure.
- v. Central Banking and Monetary Policy:** **18**  
a) Central Bank-Evolution and Functions of Central Bank.  
b) RBI and its role in the Development of Banking System in India- RBI and Monetary Policy. Credit control Instruments.

### **Reference:**

- F. S. Mishkin and S. G. Eakins, Financial Markets and Institutions, Pearson Education, 6<sup>th</sup> edition, 2009
- F. J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, Foundations of Financial markets and Institutions, Pearson Education, 3<sup>rd</sup> edition, 2009
- L. M. Bhole and J. Mahukud, Financial Institutions and Markets, Tata McGraw Hill, 5<sup>th</sup> edition, 2011
- M. Y. Khan, Indian Financial System, Tata McGraw Hill, 7<sup>th</sup> edition, 2011.
- RBI Bulletin, Various latest issues of Annual Reports, Reports on Currency and Finance and Reports of the Working Group, IMF Staff Papers.
- L. V. Chandler-Money & Banking (S. Chand & Company)
- D. M. Mithani- Money & Banking and Financial System(Himalaya Publishing house)
- R. R. Paul-Monetary Economics(Kalyani Publishers)
- B. Gupta-Monetary Economics(S. Chand & Company)

**ELE21221/22/26/23/24**

### **V Semester**

### **DSE-1C: Environmental Economics**

#### **Course outcomes**

On completion of the Course, students will:

- CO1. Deliberate in details with examples Pareto Optimality.
- CO2. Understand the details of Market failure and Externalities.
- CO3. Understand in details with examples Implementation of Environmental Policy
- CO4. Identify in details with examples Economics of climate change
- CO5. Specify the details of Cost- benefit analysis of Environmental policies.
- CO6. Deliberate the characteristics of Sustainable Development.
- CO7. Identify the details of Environmental Valuation Methods and Application.
- CO8. Specify in depth Perspectives from Indian experience.

#### **Course Description:**

This course introduces students to concepts, methods and policy options in managing the environment using tools of economic analysis. Since several environmental problems are caused by economic activity, for instance, carbon emissions, over-harvesting of renewable resources and air and water pollution as a by-product of industrial activity. This course examines different approaches to adjusting behavior through economic institution such as markets and incentives.

#### **I. Introduction:**

**15**

Key environmental issues and problems, economic way of thinking about these problem, basic concepts from economics; Pareto optimality and market failure in the presence of externalities; property rights and other approaches.

#### **II. Economics of Natural Resources:**

**14**

Economics of Natural Resources: Types-Importance: Traditional-Natural Resources-Renewable and Non-Renewable Resources: Property Resources; Economics of Climate Change-Meaning-Causes and Effects.



- III. The Design and Implementation of Environmental Policy: 16**  
 Overview, Pigouvian taxes and effluent fees, tradable permits, implementation of environmental policies in India and international experience; trans-boundary environmental problems:
- IV. Environmental Valuation Methods and Applications: 14**  
 Valuation of Environmental goods and services-theory and practice; measurement methods; Direct and Indirect Application: Travel Cost Method-Cost-benefit analysis: Contingent Method.
- V. Sustainable Development: 14**  
 Concepts: measurement; Agriculture Sustainable Development; Industrial Sustainable Development: Rural Sustainable Development; Perspectives from Indian experience.

**Reference:**

Roger Perman, Yue Ma, Michael Common, David Maddison and James McGilvray, "Natural Resource and Environmental Economics" Pearson Education/Addison.

Charles Kolstad," Intermediate Environmental Economics" Oxford University press 2<sup>nd</sup> edition,2010.

Robert N. Stavins (ed.),"Economics of the Environment: Selected Readings", W. W. Norton 6<sup>th</sup> edition,2012.

**ELE21321/22/26/23/24**

**V Semester**  
**GE-I Introduction to Economics**

**Course outcomes**

On completion of the Course, students will:

CO1. Analyze Micro Economic issues and Scarcity, Choice & Production Possibility Curve.

CO2. Understand Law of demand, determinants of demand.

CO3. Gain knowledge about Law of Supply, determinants of Supply and Equilibrium of demand & supply.

CO4. Have insight into Production function: Law of variable proportion.

CO5. Clarify the meaning & Types of various Cost Concepts and Revenue Concepts.

CO6. Understand to various classification of Market.

- I. Introduction: 08**

Economics-Meaning, Definitions-Need for the study: Micro and Macro Economics-Meaning-Importance and Limitations: Basic Problems of an Economy: Problem of Choice: Production Possibility Curve.

- II. Theories of Demand and Supply: 07**  
Demand: Meaning-Law of Demand: Exception of the Law of Demand: Factors determining Demand, Supply-Meaning-Law of Supply, Factors determining Supply.
- III. Production, Cost and Revenue Analysis: 08**  
Production Function-returns to scale-Law of Variable Proportions; Cost Concepts-Short run and Long run Cost Curves; Revenue Concept-TR,AR and MR.
- IV. Market Structure: 07**  
Market-Meaning and Types of Market: Perfect Competition Market-Meaning-Features, Monopoly and Oligopoly-Features.

**Reference:**

D.M.Mithani-Modern Economic Analysis-Himalayan Publishing House.  
H.L.Ahuja-Advanced Economic Theory  
J.K.Mithra-Principles of Economics  
K.K.Dewett-Modern Economic Theory  
G.Mankiw-Principles of Economics  
Mukhaerjee Sampat-Modern EconomTheory

**ELF21021/22/26/23/24**

**VI Semester**  
**DSE-1A : Indian Economy**

**Course outcomes**

On completion of the Course, students will:

- CO1. Understand the characteristics of Indian Agricultural policies.
- CO2. Identify the classification and characteristics of Regional variation.
- CO3. Write down the classification and characteristics of New Industrial Policy.
- CO4. Specify in depth Public and Private Sector.
- CO5. Identify in depth Monetary Policy.
- CO6. Understand in depth FDI and WTO.
- CO7. Learn in details with examples Public Debt.
- CO8. Identify the details of Effects of Parallel Economy.

**Course Description:**

This course examines sector-specific trends in key indicators and their implications in the post-Independence period.

- I. Indian Agriculture: Policies and Performance 14**

Introduction to Indian Economy-Role of Agriculture in India-Agriculture development-Agriculture-Production and Productivity-Agriculture Credit-Agriculture Labour-Agriculture Pricing and Marketing-Land Reforms-Regional Variation. National Agricultural Policy.

- II. Indian Industries: Policies and Performance** **15**  
Role of Industries in India-Importance and Problems of Large Scale and MSMEs in India. Private Sector and Public Sector Industries-Disinvestment Policy. New Industrial Policy. Development of IT Industries.
- III. Development of Service Sector In India** **16**  
a) Growth of Service Sector in India: Trends and Issues. Health and Education .  
b)Role of commercial banks in Indian economy; Reserve Bank of India and Monetary policy; Reforms in the Banking sector(Narasimmam committee only)
- IV. India's Foreign Trade: Trends and Policies** **13**  
Composition, directions, Trends in India's Foreign Trade. FDI and MNCs. WTO and India's Foreign Trade. Balance of Trade, Balance of Payments. Trade Liberalization. EXIM Policy
- V. Indian Public Finance** **17**  
Revenue and expenditure of central and state governments; India's public debt; deficit financing; financial relations between central and state; parallel economy-meaning, causes, extent and consequences; measures to control it. Concept of Demonetisation.GST-Current Year Union Budget

**Reference:**

- UmaKapila Indian Economy Since Independence, Academic Foundation, 19<sup>th</sup> edition(2009)  
Government of India, Economic Survey (latest).  
Government of India, Five Year Plan (latest).  
Michael P Todaro and Stephen Smith. Economic Development, Pearson, 11<sup>th</sup> edition (2011).  
United Nations Development Programme, Human Development Report 2010.palgrave Macmillan (2010).  
RBI-Handbook of Statistics on Indian Economy  
Government of India. Finance Commission Report (latest).  
Dutt Ruddar & Sundaram.K.P.M-Indian Economy  
Misra S.K & V.K.Puri-Indian Economy(Himalaya Publishing House)  
Agarwal A.N-Indian Economy(Wishva Publications)  
P.K.Dhar-Indian Economy(New Age International)

**VI Semester**  
**DSE-1B: Economic History of India 1857-1947**

**Course outcomes**

On completion of the Course, students will:

CO1. Learn in depth Indian Economy in the pre -British period.

CO2. Specify in depth Estimation of National Income in India.

CO3. Identify the characteristics of Agriculture markets and Institutions- credit.

CO4. Understand in details with examples Evaluation of Entrepreneurial and Industrial Structure.

CO5. Learn the details of Government and Fiscal policy.

**Course Description:**

This course analyses key aspects of Indian economic development during second half of British rule and investigates the place of Indian economy in the wider colonial context. This course links directly to the course on India's development after independent in 1947.

- I. Introduction: Colonial India: Background and Introduction** **15**  
Overview of colonial Economy: Meaning of Colonialism: British Rule and Exploitation of India-The British Rule and India's Underdevelopment-State Policies and Economic Underdevelopment: Colonial Exploitation: forms and Consequences: Colonialism and Modernization: Nature of Indian Economy.
- II. Macro Trends:** **16**  
National Income: Estimates in India-Trends, Limitations. Population: Size and Growth Rate: Demographic Transition: Causes and Measurement of Rapid Growth of Population Occupational Structure: Occupational distribution of Labour Force in India: Historical Experience of Structural Change.
- III. Agriculture:** **17**  
Agrarian structure: Productivity and Efficiency: land relations; Cropping Patten-Irrigation: Agricultural markets and institutions-Credit. Commerce and technology; trends in performance and productivity; famines.
- IV. Railway and Industry:** **13**  
Railways; the de-industrialization debate; evolution of entrepreneurial and industrial structure; Nature of industrialization in the interwar period; constraints to industrial breakthrough; labor relations.
- v. Economy and State in the Imperial Context:** **14**  
The imperial priorities and the Indian economy; drain of wealth; international trade, Capital, flows and the colonial economy- changes and continuities; government and fiscal policy.

**Reference:**

Lakshmi Subramaniam, History of India-1707-1857, Orient Blackswan (2010)  
Tirthankar Roy, The Economic History of India 1857-1947, Oxford University (2011)  
J.Krishnamurthy, Occupational Structure, The Cambridge  
Irfan Habib, Indian Economy 1858-1914,(2006)

**ELF21321/22/26/23/24**

**VI Semester**  
**DSE-1C: Public Finance**

**Course outcomes**

On completion of the Course, students will:

- CO1. Understand the classification and characteristics of Public Economics and Public Finance.
- CO2. Understand in details with examples Test of maximum social Advantage.
- CO3. Understand in depth Tax and non Tax Revenue.
- CO4. Identify the characteristics of Central and State financial Relations.
- CO5. Deliberate the classification and characteristics of Central and State financial Relations.

**Course Description:**

This course gives a non-technical overview of government finances with special reference to India. It will look into the efficiency and equity aspects of Taxation of the centre, states and the local governments and the issues of fiscal federalism and decentralization in India. The course will be useful for students aiming towards careers in the government sector, policy analysis, business and journalism.

- |  |           |
|--|-----------|
| <b>I. Introduction :</b>   | <b>13</b> |
| Meaning, Nature and Scope of Public Finance, differences between Public Economics and Public Finance. Importance of the study Public Economics-Role of Public Finance in Developing Countries.   |           |
| <b>II. Principles of Public Economics:</b>   | <b>15</b> |
| Principles of maximum social advantage, Principle of allocation of resources; Test of maximum social advantage; Pareto's welfare Theory; Social welfare functions of modern governments; Distinction between private and public goods; Market imperfection; Externalities. |           |
| <b>III. Public Revenue, Expenditure and Debt:</b>  | <b>17</b> |
| a) Public Revenue-Tax and Non-Tax Revenue-Cannon of Taxation.  |           |
| b) Public Expenditure-Principles of Public Expenditure and Wagner's Law of Increasing state Activities.  |           |
| c) Public Debt-Meaning-Causes-Burden and Redemption.   |           |
| <b>IV. Issues In Indian Public Finance:</b>  | <b>16</b> |
| a) Working of monetary and fiscal policies   |           |
| b) Current Issues of Indian Tax System.  |           |

- c) Central and State financial Relations.
- d) State and Local Finance.

**V. Budget:**

**14**

Classification of Budgets: Programme performance budget; Budgetary deficits-Revenue and fiscal deficits; Zero based budgeting; Fiscal policy-meaning, objectives and Instruments

**Reference:**

- Musgrave, R. A. and P. B. Musgrave, Public Finance in Theory and Practice, Mc-Graw Hill, 1989  
 Mahesh Purohit, " Value Added Tax: Experience of India and other Countries' Gayatri Publications, 2007  
 Kaushik Basu, and A. Maertens (ed).The Oxford Companion to Economics in India, Oxford University Press, 2007  
 M. M. Sury - Government Budgeting in India, Commonwealth publishers, 1990.  
 Shankar Acharya, ' Thirty Years of tax reform' in India, Economic and Political Weekly, May 2005.  
 Report of the 13<sup>th</sup> Finance Commission - Government of India  
 Economic survey - Government of India (latest)  
 State Finances: A Study of Budgets, Reserve Bank of India (latest).  
 H. L. Bhatia-Public Finance (Sulthan Chand & Sons)  
 S. K. Singh-Public Finance in Theory & Practice (Himalayan Publications)  
 K. P. M. Sundaram & K. K. Andley -Public Finance (Sulthan Chand & Sons)  
 B. P. Tyagi- Public Economics (Himalayan Publications)

**ELF21422/22/26/23/24**

**VI Semester**  
**GE-II Indian Economy**

**Course outcomes**

On completion of the Course, students will:

- CO1. Identify in details with examples Human Resource.
- CO2. Learn the characteristics of Population policy.
- CO3. Identify the details of Role of Agriculture.
- CO4. Understand the details of Rural Development.
- CO5. Understand in depth Disinvestment.
- CO6. Deliberate the classification and characteristics of Foreign Trade.

**I. Introduction :**

**10**

Features of Indian Economy; Concepts of National Income -GNP-NNP-GDP-NDP- Percapita Income-Disposable Income- Green GDP; of Population Explosion: India's Population Policy; Poverty: Definition; Poverty and Inequality; Poverty Alleviation Schemes; Unemployment: Definition and Types: Employment Guarantee Schemes(MGNREGA).

**II. Agriculture Sector:**

**08**

Role of Agriculture; Cropping Pattern-Land Reforms-Green Revolution- Food Security; Sources of Agricultural Credit-Co-Operatives Banks, Regional Rural Banks, NABARD, Commercial

Banks; Agricultural Marketing-Problems and remedies; Agriculture and WTO.

**III. Industry and Tertiary Sector:**

**12**

Role of Industries; Industrial Policy since 1991; MSMEs-Role and Problems; Large Scale Industries; Disinvestment in Public Sector undertakings: Emergence of IT Industry.

Role of Commercial Banks in Indian Economy; Reserve Bank of India: Functions and Credit Control Methods: Reforms in the Banking Sector (Narasimham Committee only): Foreign Trade- Trends, Composition, directions of Trade-India's Balance of Payments; Foreign Exchange Rate.

**Reference:**

Dutt Ruddar & Sundaram K.P.M-Indian Economy(S. Chand & Co, New Delhi)

Kapila Uma, Indian Economy since Independence, Academic Foundations, New Delhi

Misra S.K & V.K Puri - Indian Economy (Himalaya Publishing House)

S. Sankaran - Indian Economy(Margham Publications)

Mohan Rakesh (Edition), Facts of the Indian Economy, OUP, New Delhi

Vaidyanathan A. India's Economic Reforms and Development, Oxford University Press New Delhi

Agarwal A.N- Indian Economy (Vishva Publications)

M.C.Vaish-Indian Economy (New Age International)

P. K. Dhar- Indian Economy (New Age International)

Economic Survey (Recent) – Govt. of India and Karnataka

Data Sources: Hand Book of statistics of Indian Economy

Census Report & NSSO Report.

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
B.N. ROAD, MYSORE-25**

**DEPARTMENT OF ECONOMICS  
MODEL QUESTION PAPER FOR DSC & DSE  
B.A.ECONOMICS  
I, II, III, IV, V&VI Semester  
(CBCS Scheme)**

**Time: 3 Hours**

**Max. Marks – 70**

**PART-A**

**I. Answer any Five of the following questions.**

**5x2=10**

1)

- a) .....
- b) .....
- c) .....
- d) .....
- e) .....
- f) .....
- g) .....

**PART-B**

**II. Answer any four of the following questions.**

**4x5=20**

2. -----
3. -----
4. -----
5. -----
6. -----
7. -----

**PART-C**

**III. Answer any four of the following questions.**

**4x10=40**

8. -----
9. -----
10. -----
11. -----
12. -----

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
B.N. ROAD, MYSORE-25**

**DEPARTMENT OF ECONOMICS  
MODEL QUESTION PAPER FOR GENERIC ELECTIVE  
B.A.ECONOMICS  
V&VI Semester  
(CBCS Scheme)**

**Time: 2 Hours**

**Max. Marks – 35**

**PART-A**

**I. Answer any Five of the following questions.**

**5x2=10**

1. -----
2. -----
3. -----
4. -----
5. -----
6. -----
7. -----

**PART-B**



**II. Answer any Three of the following questions.**

**5x3=15**

- 8. -----
- 9. -----
- 10. -----
- 11. -----
- 12. -----

**PART-C**

**III. Answer any One of the following questions.**

**10x1=10**

- 13. -----
- 14. -----
- 15. -----



**JSS COLLEGE OF ARTS, COMMERCE AND  
SCIENCE**

**(Autonomous)**

**OOTY ROAD, MYSURU- 570 025**

**DEPARTMENT OF ELECTRONICS**

**Curriculum for  
I and II year BSc Degree under NEP  
and  
III year BSc Degree under CBCS**

**2022-23**

## Programme Structure

### a) NEP : Program Code: BScPhEI33

SEM	Course type	Course Code	Title of the Course	Credits	Teaching hrs/Week
I	DSC - Th	FSA 440	Electronic Devices and Circuits	4:0:0	04
	DSC - Lab	FSA 443	Electronic Devices and Circuits Lab	0:0:2	04
	OE 1.1	FSA 860	Fundamentals of Electronics and Domestic Wiring	3:0:0	03
	OE 1.2	FSA 870	Domestic Equipment Maintenance	3:0:0	03
II	DSC - Th	FSB 440	Analog and Digital Electronics	4:0:0	04
	DSC - Lab	FSB 443	Analog and Digital Electronics Lab	0:0:2	04
	OE 2.1	FSB 860	Fundamentals of Semiconductor Devices	3:0:0	03
	OE 2.2	FSB 870	Renewable Energy and Energy Harvesting	3:0:0	03
	OE 2.3	FSB 865	PCB Design and Fabrication	3:0:0	03
III	DSC - Th	FSC 440	Programming in C and Digital Design using Verilog	4:0:0	04
	DSC - Lab	FSC 440	Programming in C and Digital Design using Verilog - Lab	0:0:2	04
	OE 3.1	FSC 860	Fundamentals of Electronics	3:0:0	03
	OE 3.2	FSC 870	Robotics	3:0:0	03
	OE 3.3	FSC 875	Medical Electronics	3:0:0	03
IV	DSC - Th	FSD440	Electronic Communication-I	4:0:0	04
	DSC - Lab	FSD 440	Electronic Communication-I - Lab	0:0:2	04
	OE 4.1	FSD 860	IOT and Applications	3:0:0	03
	OE 4.2	FSD 870	Application of Electronics -II	3:0:0	03
	OE 4.3	FSD 865	Augmented and Virtual Reality	3:0:0	03
<b>b) CBCS: Program Code: BSc 04</b>					
V	DSC1A Th	DME260	Digital Signal Processing	4:0:0	04
	DSE1A: Pra-V	DME261	Practical 5: Digital Signal Processing	0:0:1	02
	DSC 1B Th	DME262	Electronic Instrumentation	4:0:0	04
	DSE1B: Pra-VI	DME263	Practical 6: Electronic Instrumentation	0:0:1	02
	SEC1A: Th	DME264	Electrical circuits and network skills	2:0:0	02
	SEC1B: Th	DME266	Computer networks	2:0:0	02
VI	DSC2A: Th	DMF260	VERILOG & VHDL	4:0:0	04
	DSC2A: Pract-VII	DMf261	VERILOG & VHDL	0:0:1	02
	DSC2B: Th	DMF262	Photonic Devices and Power Electronics	4:0:0	04
	DSC2B: Pract-VIII	DMF263	Photonic Devices and Power Electronics	0:0:1	02

## **Bachelor of Science with Electronics as one of the optional subject**

### **Eligibility Criteria:**

A candidate who has passed the two year Pre-University Examination with Science Subjects conducted by the Pre-University Board of Education, Government of Karnataka or any other examination considered equivalent by the University is eligible for admission to the first Semester of the UG program

### **Programme Outcome (Under NEP)**

After completing the graduation in the Bachelor of Science the students are able to:

PO1	Acquire the knowledge of Basic and Advanced topics related to the field of Electronics
PO2	Apply the knowledge of Logic thinking and basic Science for solving Electronics related problems.
PO3	Ability to perform Electronics Experiments and analyse and interpret data.
PO4	Ability to design and manage Electronic Systems or Processes that conforms to a given specification within ethical and economic constraints.
PO5	Ability to identify, formulate, solve and analyse the problems in various sub disciplines of Electronics.
PO6	Ability to use Modern Tools/Techniques in solving problems in the field of Electronics..

### **Programme Specific Outcome (Under NEP)**

## **Bachelor of Science with Electronics as one of the optional subject**

PSO1	Find career opportunities.
PSO2	Develop competence to write competitive examinations.
PSO3	Develop proficiency in the analysis of complex physical problems.
PSO4	Create a hypothesis and appreciate how it relates to broader theories.
PSO5	Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations.
PSO6	Apply appropriate troubleshooting techniques to Electronic circuits / systems and perform test procedures

## **Programme Outcome (Under CBCS)**

### **Bachelor of Science in Physics, Mathematics, Electronics**

PO1	Apply mathematical problems and solutions in aspects of science and technology.
PO2	Gain experience to investigate the real world problems.
PO3	Apply mathematical ideas and models to problems.
PO4	Apply appropriate troubleshooting techniques to electronic circuits / systems and perform test procedures.
PO5	Assist, Assemble, modify and test electronic circuits in accordance with job requirements.
PO6	Communicate effectively in technical and non-technical environments.

## **Programme Specific Outcome (Under NEP)**

### **Bachelor of Science in Physics, Mathematics, Electronics**

PSO1	Use mathematical or other appropriate techniques to solve complex physical problems
PSO2	Demonstrate skills in the use of Computers for control, data acquisition, and data analysis in experimental investigations.
PSO3	PSO7: Apply knowledge of Physics, Mathematics and Electronics fundamentals to the solve problems in Electronic circuits & communication systems.
PSO4	PSO8: Apply appropriate troubleshooting techniques to Electronic circuits / systems and perform test procedures

### Scheme of Evaluation:

- **The evaluation weightage for theory papers in DSC, DSE and OE courses**

Course	Theory			Total
	C1	C2	C3	
DSC	20	20	60	100
DSE	20	20	60	100
OE	20	20	60	100

- **Scheme for C1 and C2 Evaluation for Theory component of DSC/DSE/OE**

Sl. No.	Activity	C1	C 2
1	Test	10 marks	10 marks
2	Seminar/Book Review/Report on Data Sheets of Electronic Components, etc.		10 marks
3	Assignment/Mini Project Work/Case Study/ Report on Industry Visit, etc.,	10 marks	
<b>Total</b>		<b>20 marks</b>	<b>20 marks</b>

### **Scheme of Evaluation for Practicals**

- The evaluation weightage for Practicals in DSC, DSE courses:

Course	Practicals				Total
	C1	C2	Record	C3	
DSC	10	10	05	25	50
DSE	10	10	05	25	50

- The student will be evaluated on the basis of skill, comprehension, and recording the results
- The student has to compulsorily submit the practical record for evaluation during C1, C2, and C3.
- A candidate appearing for the first time should submit a duly signed and certified practical record.

- **Scheme of assessment of C3 component in Practical Examination**

Division	Marks
Experiment	17
Viva	03

**Scheme for Experiment Part assessment in Practical Examination**

Division	Marks
Write up of the experiment - Circuit diagram , Tabular column, formula & Nature of Graph	05
Circuit connections	05
Taking and Recording Readings	04
Calculations and Plotting of Graph	02
Accuracy of Result	01
<b>TOTAL</b>	<b>17</b>

## Scheme for Examination and Assessment

Course type	IA C1		IA C2		SEE C3		Exam duration	
	Th	Pr	Th	Pr	Th	Pr	Th	Pr
DSE	15	7.5	15	7.5	70	35	3h	3h
SEC	7.5	-	7.5	-	50	-	2h	

### **SCHEME OF VALUATION FOR PRACTICAL EXAMINATION**

- A candidate appearing for the first time should submit a duly signed and certified practical record
- Each candidate has to perform one experiment in the specified duration of two hours for **THIRY FIVE marks**
- Practical record has to be valued for **FIVE marks** by examiners at the time of examination
- IA for **FIFTEEN marks** in practical is awarded by two tests in the lab

Sl no	Component	Marks
1	Program Writing	10
2	Entering /Coding	10
3	Execution	05
4	Practical record	05
5	Viva	05
<b>TOTAL</b>		<b>35</b>



**JSS COLLEGE OF ARTS, COMMERCE & SCIENCE, MYSURU**

**Pattern of Question Paper for DSC/DSE/OE**

Time: 2.30 Hours

Max. Marks: 60

1. Answer any **TEN** of the following.

10 x 2 = 20

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)
- k)
- l) .

6 + 4 = 10

2. a) Long answer type question for 6 marks  
b) Short answer type question or Numericals for 4 marks

**OR**

- 3 a) Long answer type question for 6 marks  
b) Short answer type question or Numericals for 4 marks

6 + 4 = 10

- 4 a) Long answer type question for 6 marks  
b) Short answer type question or Numericals for 4 marks

**OR**

- 5 a) Long answer type question for 6 marks  
b) Short answer type question or Numericals for 4 marks

6 + 4 = 10

- 6 a) Long answer type question for 6 marks  
b) Short answer type question or Numericals for 4 marks

**OR**

- 7 a) Long answer type question for 6 marks  
b) Short answer type question or numerical for 4 marks

6 + 4 = 10

- 8 a) Long answer type question for 6 marks  
b) Short answer type question or Numericals for 4 marks

**OR**

- 9 a) Long answer type question for 6 marks  
b) Short answer type question or Numericals for 4 marks

6+4 =10

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## Curriculum Contents

### Semester- I - Electronic Devices and Circuits

Program Name	<b>BSc in Electronics</b>	Semester	<b>First Semester</b>
Course Title	<b>Electronic Devices &amp; Circuits (Theory)</b>		
Course Code:	<b>FSA 440</b>	No. of Credits	<b>4</b>
Contact hours	<b>60</b>	Duration of SEA/Exam	<b>2.30hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

#### Course Objectives:

The objectives of the Course are to enable the student to understand

1. Principle of operation of passive components
2. Basics principles of network theorems
3. Analysis of Electronic circuits
4. Construction, operation and applications of semiconductor diode, BJT and special Purpose devices
5. Number systems, Boolean laws and methods of simplifications of Boolean expressions

#### Course Outcomes:

At the end of this course, students will be able to-

1. Explain the principles and behaviour of basic semiconductor devices.
2. Analyse basic networks using network theorems.
3. Apply the concepts to realize the circuits. As per the requirement
4. Build simple electronic circuits used in various applications
5. Evaluate the critical internal parameters of semiconductor devices for the given standard device models.
6. Demonstrate the working of analog and digital circuits as per the specifications

#### Unit - 1

**Electronic Components:** Passive components – R, L, and C, and their properties, V-I relation, mutual and self-inductance, Transformer and its working, Definition and list of Active components, Concept of Voltage and Current Sources, Electric Energy and Power. (Qualitative only).

**Network Theorems:** KCL, KVL and node analysis of circuits, Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems, inter-conversion between Thevenin's and Norton equivalent circuits, (For Circuits with DC Source)

**Network Analysis:** DC and AC analysis of RC and RL circuits, RLC Series and Parallel Resonant Circuits.

**PN-junction Diode:** Ideal and practical diodes, Formation of Depletion Layer, mention of diode equation, I-V characteristics, DC load line, Static and Dynamic resistance, Zener diode and its IV Characteristics, Reverse saturation current, Zener and avalanche breakdown.

**Rectifiers:** Half-wave and Full-wave centre-tap and bridge rectifiers, expressions for output voltage, PIV, ripple factor and efficiency, Operation with and without shunt capacitor filter. (Relevant Numericals wherever applicable). **15 Hours**

## Unit - 2

**Applications of Diode:** Clippers, Clampers and Voltage Multipliers (Qualitative analysis only)

**Voltage Regulator:** Block diagram of regulated power supply, Zener diode as voltage regulator – circuit diagram, load and line regulation, Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317).

**Special Semiconductor Devices:** Construction, working principle, characteristics, symbol and applications of Varactor diode, Schottky diode, and Tunnel diode, Solar Cell.

**Display Devices:** Construction, working principles, characteristics, symbol, and applications of LED and LCD, operation of 7-segment display, common anode and common cathode type 7-segment display. ( Relevant Numericals wherever applicable) **15 Hours**

## Unit - 3

**Bipolar Junction Transistor:** Construction and working of NPN transistor, CE, CB and CC configurations (mention only), Input and Output characteristics of a transistor in CE mode - Regions of operation of BJT (active, cut off and saturation), leakage currents (mention only), Current gains  $\alpha$ ,  $\beta$  and their inter-relations, dc load line and Q point.

**Applications of Transistor:** Circuit and working principles of Transistor as an amplifier and switch.

**Transistor Biasing:** Fixed and Voltage Divider Bias. Thermal runaway, mention of stability and stability factor, Transistor as a two-port network, h-parameter equivalent circuit for CE configuration.

**Amplifier:** Small signal analysis of single-stage CE amplifier using h-parameters, Frequency Response, Input and Output impedances, Current and Voltage gain.

**Multi-stage Amplifiers:** Types of coupling of amplifiers, Two-stage RC Coupled Amplifier – circuit, working and its Frequency Response, loading effect, GBW product.

**Power Amplifiers:** Class A, B and C Power Amplifiers (qualitative). ( Relevant Numericals wherever applicable) **15 Hours**

## Unit - 4

**Number System:** Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned binary numbers, Binary arithmetic - addition, subtraction by 1's and 2's complement method, BCD code (8421, 2421, Excess-3), Gray code - Gray to binary interconversion, parity error checking, single-bit error correction codes.

**Boolean Algebra:** Constants, variables, operators, SOP and POS form, canonical form, conversion form SOP to POS and Vice-versa, Boolean laws, Duality Theorem, De Morgan's Theorem.

**Logic gates:** AND, OR, NOT, Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. Simplification and realization of Boolean expressions using gates. ( Relevant Numericals wherever applicable) **15 Hours**

### Reference Books:

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11th Edition, Pearson Education India, 2018.
2. Ravish R Singh, "Network Analysis and Synthesis," 1st Edition, MGH, 2018.
- B.Sc. Electronics Curriculum – NEP-2020, University of Mysore, Karnataka Page 10
3. Robert L Boylestad, "Introductory Circuit Analysis," 15th edition, Pearson, 2015.
4. R. S. Sedha, "A Text book of Applied Electronics," 7th edition., S. Chand and Company Ltd., 2011.
5. A. P. Malvino, and, David J Bates, "Electronics Principles," 7th Edition, TMH, 2011.
6. David A. Bell, "Electronic Devices and Circuits," 5th Edition, Oxford Uni. Press, 2015.
7. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.
8. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8th Edition, TMH, 2014.
9. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1st Edition, TMH, 2011.

## Electronic Devices and Circuits -Practicals

Program Name	<b>BSc in Electronics</b>	Semester	<b>First Semester</b>
Course Title	Electronic Devices & Circuits <b>(Practicals)</b>		
Course Code:	<b>FSA 443</b>	No. of Credits	<b>2</b>
Contact hours	<b>60</b>	Duration of SEA/Exam	<b>3 hours</b>
Formative Assessment Marks	<b>25</b>	Summative Assessment Marks	<b>25</b>

### PART - A

1. Verification of Thevenin's, Norton's, and Maximum Power Transfer Theorems
2. Study the I-V Characteristics of p-n junction and Zener diodes.
3. Study of Half and full wave rectifiers without and with shunt capacitor filter and to find the Ripple factor for different values of load resistance.
4. Study of Zener diode as a voltage regulator using bridge rectifier with shunt capacitor filter and to find the Load and Line regulation.
5. Study of clipping and clamping circuits.

### PART – B:

6. Study of Transistor characteristics in CE configuration – determination of h-parameters.
7. Study of Voltage divider bias circuits.
8. Study of single stage CE amplifier and to draw its frequency response and to determine the input and output impedances in mid-band.
9. Study of Series and Parallel Resonance circuits.
10. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using Respective ICs and Realization of basic gates using universal gates.
11. Binary to Gray and Gray to Binary code conversion and parity checker using XOR IC 7486.

## Open Electives Course – 1.1

### Fundamentals of Electronics and Domestic Wiring

Program Name	<b>BSc in Electronics</b>	Semester	<b>First Semester</b>
Course Title	Fundamentals of Electronics and Domestic Wiring		
Course Code:	<b>FSA 860</b>	No. of Credits	<b>3</b>
Contact hours	<b>48</b>	Duration of SEA/Exam	<b>3 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

#### Course Objectives

The objectives of the Course are to enable the student to understand

1. Ability to gain the knowledge of basic electronics and electronic components.
2. Ability to analyse various components behaviour in AC and DC circuits.
3. Ability to get the knowledge of electrical wiring and safety precautions.
4. Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electrical and electronics.
5. Provide students with skills that enable them to get employment in various organisations, industries, and turn as entrepreneurs.

#### Unit – 1:

**12 Hours**

**Introduction to Electronics:** Evolution of Electronics, Definition and expression for of Charge, Current, Voltage, Potential Difference, Power, Energy. Coulombs Law, Ohm's Law.

**Electronic Components:** Definition and list of passive and active components.

**Resistors:** Definition, application, and mention of types of resistors, colour coding of resistors, series and parallel combinations.

**Capacitors:** Definition, application and mention of types capacitors, series and parallel combinations, factors affecting capacitance, colour coding of capacitors.

**Inductors:** Definition, application, and mention of types of inductors, series and parallel combinations. Self and mutual inductance, factors affecting inductance.

#### Unit – 2:

**12 Hours**

**Kirchhoff's laws:** KCL and KVL, voltage divider rule and current divider rule, open and short circuits.

**Network Theorems (DC analysis only):** Thevenin's theorem, Norton's theorem and maximum

Power transfer theorem, Superposition Theorem (Qualitative Approach with statements and steps involved in solving) as applied to simple T-network.

**DC power supplies:** Block diagram and working, Applications.

**Cells and Batteries:** Primary and Secondary cells, Mention of types of batteries, series and parallel combination of batteries.

**Lead Acid Battery:** Construction, Internal resistance, Efficiency and capacity of a battery, condition of a fully charged and discharged lead acid battery.

### **Unit – 3:**

**12 Hours**

**A. C. Fundamentals:** Definition and waveform of ac signal. Definition of Amplitude, Frequency, Time period, RMS value, average value, Phase and phase angle difference of sinusoidal signal. Sinusoidal signal applied to resistor, capacitor and Inductor, waveforms and phasor diagram for each. Expression for capacitive and inductive reactance. Circuit diagram and working of series and parallel resonance circuits, expression for resonance frequency.

**Transformers:** Definition, construction, working principle and application, step-up and step-down transformers.

### **Unit – 4:**

**12 Hours**

**Domestic Wiring:** Introduction, Types of Domestic Wiring, Cleat Wiring, Wooden/PVC Casing and Capping Wiring, Toughened Rubber Sheath (TRS or CTS) or Batten Wiring, Conduit Wiring, Specifications of Wires, Size of Conductor, Distribution Board, Types of Cables, Lighting Control Circuits, Earthing System, Fuses and HRC Fuses, Calculation of Fuse Rating.

**Switches:** Definition and application of switch, Brief note on SPST, SPDT, DPST and DPDT, electromagnetic relay, MCB, ELCB, RCCB, Toggle switch, push button, joystick, selector, limit, proximity switches.

### **Reference Books:**

1. C L Wadhwa, "Basic Electrical Engineering," 4th Edition, New Age International Publisher, 2007.
2. Robert Boylestad, "Introductory circuit analysis," 5th edition, PHI, 2010.  
Robert Boylestad and Louis Nashelsky, "Electronic Devices and circuit theory," 9th Edition, PHI, 2013.
3. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand Publishers, New Delhi, 2014.
4. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering," Pearson Education India, 2012.
5. I. J. Nagrath, "Electronic Devices and Circuits," PHI Learning Pvt. Ltd., 2007.
6. V. Mittle and Arvind Mittle, "Basic Electrical Engineering," McGraw Hill Companies, 2005.
7. Mitchel E. Schultz, "Basic Electronics," 10th Edition, TMH, 2010.

## Open Electives Course -1.2

### Domestic Equipment Maintenance

Program Name	BSc in Electronics	Semester	First Semester
Course Title	Domestic Equipment Maintenance		
Course Code:	FSA 870	No. of Credits	3
Contact hours	48 Hours	Duration of Exam	2 ½ Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

*Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.*

#### Course Objectives:

The objectives of the course are

1. To enable the students to understand the working principle of domestic equipments.
2. Identify the common faults that occur in the domestic equipment.
3. Able to carry out minor repairs in the equipments.
4. Understand the technical specifications of the equipments.

#### Unit 1

12 Hrs

##### Unit-1

**Microwave Oven:** Working, parts, Common faults and their troubleshooting: Microwave does not heat, runs then stops, buttons do not work, plate do not spin, bulb does not turn ON during operation, sparking inside, shuts OFF after few seconds. Demonstrate the working of microwave oven.

**Geyser:** Construction and working, parts and types. Common faults and their trouble shooting: Dripping geyser overflow, overheating, steam or hot water escaping from overflow, water leaking through the ceiling, no hot water, water not hot enough, poor hot water pressure. Demonstrate the working of Geyer.

#### Unit 2

12 Hrs

**Induction Cooker:** Construction and working, parts and types. Common faults and their trouble shooting: Cooker fuse blown, cooker buttons not working, cook top shuts off while cooking, food not get cooked or heated properly, overheating and uneven heating, display keep flashing, weird noises, crackling, fan noise, humming sound, clicking. Demonstrate the working of induction cooker.

#### Unit 3

12 Hrs



**Refrigerator:** Working, electrical wiring diagram, types of refrigerator. Common faults and their troubleshooting: Fridge not cooling, fridge not defrosting, leaking water, freezing food light not working, freezer is cooled but fridge stays warm, dead refrigerator, not enough cooling, keeps running, leakage, makes noise. Replacement procedure for: seal (gasket), evaporator fanmotor, PTC relay, thermostat, compressor, bulb. Demonstrate the working of refrigerator.

**Unit 4**

12 Hrs

**Air Conditioner:** Working, electrical wiring diagram, types. Common Faults and their troubleshooting: Faults in following parts of AC: Filter, thermostat, refrigerant leaks, breakers, capacitors, compressor, evaporator coils, condenser coils, warm contactor. General faults : AC unit has an odour, shuts ON and OFF repeatedly, does not blow cold air, repeatedly tripping a circuit breaker, indoor unit is leaking water inside the room, outdoor unit is making an unusually loud sound, room is not getting cold enough, AC not turning ON. Demonstrate the working of air conditioner.

Reference Books:

1. R. G. Gupta, "Electronic instruments and systems: Principles, maintenance and Trouble shooting," TMH, 2001.
2. . R. S. Khandpur, "Troubleshooting Electronic Equipment: Includes Repair & Maintenance," TMH, 2013.
3. G. C. Loveday, "Electronic fault diagnosis," Pearson Education, 1994

## Semester- II - Analog and Digital Electronics

Program Name	<b>BSc in Electronics</b>	Semester	<b>Second Semester</b>
Course Title	Analog and Digital Electronics ( <b>Theory</b> )		
Course Code:	<b>FSB440</b>	No. of Credits	<b>4</b>
Contact hours	<b>60</b>	Duration of SEA/Exam	<b>2.30hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Objectives:

The objectives of the Course are to enable the student to understand

1. Principle of operation active devices like, BJT, FET, Op-Amp, UTJ, SCR, etc.,
2. Understand different applications of op-amp.
3. Analysis of Electronic circuits.
4. Construction, operation and applications oscillators.
5. Digital Logic Families and their comparison.
6. Understand, analyse and simply combinational and sequential digital logic circuits.

### Course Outcomes

At the end of this course, students will be able to

1. Explain the working principles of semiconductor devices like JFET, MOSFET, UJT, SCR, Diac and Triac.
2. Design and build the circuits to understand the applications of op-amp.
3. Demonstrate and understand the working of combinational and sequential logic circuits

### Unit – 1:

**15 Hours**

**JFET:** Construction, working, Symbol, and I-V characteristics of p-channel and n-channel JFET, mention of different parameters and their relation in JFET, Comparison of BJT and JFET.

**MOSFET:** Construction, working, Symbol, drain and transfer characteristics of E-MOSFET, D-MOSFET, VMOS, UMOS. MOS Logic and its switching action, NMOS Inverter, CMOS and its characteristics, CMOS logic, Circuit and working of CMOS inverter, Construction and working of IGBT. Comparison of MOSFET, CMOS, and IGBT.

**UJT:** Construction, working, Symbol, I-V characteristics, equivalent circuit and parameters of UJT. Mention of equivalent circuit and I-V characteristics, working principles of UJT based Relaxation Oscillator.

**SCR:** Construction, working, Symbol, I-V characteristics, and two-transistor equivalent circuit of SCR, working principles of half-wave and full-wave controlled rectifiers.

**Diac and Triac:** Construction, working, Symbol, I-V characteristics and applications of Diac and Triac. Working principle of Triac as an AC-voltage controller.

(Relevant Numericals wherever applicable)

## Unit – 2

15 Hours

**Operational Amplifier:** Basics of Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop inverting and non-inverting amplifiers, concept of virtual ground, Derivation for voltage gain, definition and expression for op-amp parameters – input/output impedance, offset voltage, CMRR, Slew Rate, Frequency Response.

**Applications of Op-amp:** Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative Study). Inverting and non-inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Comparator, and Zero-crossing detector.

**Filters:** Definition and types of filter, active versus passive filters, First and Second order active low pass, high pass and band pass Butterworth filters.

**Oscillators:** Definition and working principle of oscillator, concept of negative feedback, Barkhausen criterion for sustained oscillations, Colpitt's and crystal oscillators, RC-Phase Shift and Wien-bridge oscillator (no derivation for each)

**IC 555 Timer:** Introduction, Block diagram, Circuit diagram and working of Astable and Monostable multivibrator circuits. (Relevant Numericals wherever applicable)

## Unit – 3

15 Hours

**Logic Families:** Pulse characteristics, Logic Families- classification of digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology, CMOS NAND Logic, comparison of TTL and CMOS families.

**Combinational Logic Circuits:** Minimisation techniques using K-maps - SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables.

**Arithmetic Logic Circuits:** Half Adder, Full Adder, Half Subtractor, Full Subtractor, 4 – bit parallel binary adder, 2 – bit and 4 – bit magnitude comparator.

**Encoder and Decoder:** Decimal to BCD priority encoder. Decoders: - 2:4 decoder using AND gates, 3:8 decoder using NAND gates, BCD to decimal decoder, BCD to 7-Segment decoder.

**Multiplexer and Demultiplexer:** 4:1 and 8:1 multiplexer, 1:4 and 1:8 demultiplexer, Realization of Full adder and Full Subtractor using Multiplexer and Decoder.

**DAC and ADC:** DAC with binary weighted resistor and R-2R resistor ladder network, Successive approximation based ADC and the mention of their performance characteristics.

(Relevant Numericals wherever applicable)

#### **Unit – 4**

**15Hours**

**Sequential Logic Circuits:** SR Latch, RS, D and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Pre-set and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK and T Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

**Shift Registers and Counters:** Types of Shift Registers - Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (4-bits only), Synchronous verses asynchronous counters, Ring and Johnson counters, 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, 4-bit Synchronous counter, design of Mod 3, Mod 5 and decade Counters using K-maps.

#### **Reference Books:**

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11<sup>th</sup> Edition, Pearson Education India, 2018.
2. R. S. Sedha, "A Text book of Applied Electronics," 7<sup>th</sup> edition., S. Chand and Company Ltd., 2011.
3. David A. Bell, "Electronic Devices and Circuits," 5<sup>th</sup> Edition, Oxford Uni. Press, 2015.
4. R. A. Gayakwad, "Op-Amps and Linear Integrated Circuit," 4<sup>th</sup> Edition, Pearson Education, 2000.
5. David A. Bell, "Operational Amplifiers and Linear ICs," 3<sup>rd</sup> Edition, Oxford University Press, 2011.
6. Thomas L. Floyd, "Digital Fundamentals," 11<sup>th</sup> Edition, Pearson Education, 2015.
7. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8<sup>th</sup> Edition, TMH, 2014.
8. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1<sup>st</sup> Edition, TMH, 2011.

## Analog and Digital Electronics –Practicals

Program Name	<b>BSc in Electronics</b>	Semester	<b>Second Semester</b>
Course Title	Analog and Digital Electronics ( <b>Practicals</b> )		
Course Code:	<b>FSB 443</b>	No. of Credits	<b>2</b>
Contact hours	<b>60</b>	Duration of SEA/Exam	<b>3 hours</b>
Formative Assessment Marks	<b>25</b>	Summative Assessment Marks	<b>25</b>

### **PART- A**

1. Study the JFET characteristics and obtain the frequency response and calculate band width of single stage JFET amplifier.
2. Study of inverting and non-inverting amplifier, adder, Subtractor, and averaging amplifier using Op-amp
3. Study of differentiator and integrator using op-amp for different input waveforms.
4. Design and study Colpitt's and RC phase shift oscillator using op-amp.
5. Obtain the frequency response of first order low-pass and high-pass filters using op-amp.
6. Study of Astable and Monostable multivibrators using IC 555 timer.

### **PART- B**

1. Study of Half and Full Adder, half and full Subtractor using NAND gates.
2. Study of 4 - bit parallel binary adder and Subtractor using IC.
3. Study of Clocked RS, D and JK Flip-Flops using NAND gates.
4. Study of BCD to decimal decoder using IC, Encoders and priority encoders.
5. Study of Multiplexer and Demultiplexer using ICs.
6. Study of 4-bit asynchronous counter using JK Flip-Flop.
7. Study of 4-bit Shift Register – SISO, modification to ring counter using IC.
8. Study of Digital to Analog Converter using binary weighted resistor method

## Open Electives Course -2.1

### Fundamentals of Semiconductor Devices

Program Name	<b>BSc in Electronics</b>	Semester	<b>Second Semester</b>
Course Title	Fundamentals of Semiconductor Devices		
Course Code:	<b>FSB 860</b>	No. of Credits	<b>3</b>
Contact hours	<b>48</b>	Duration of SEA/Exam	<b>2.30 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

#### Course Objectives:

The objectives of the Course are to enable the student to understand

1. Ability to gain the knowledge of Semiconductors devices.
2. Ability to get the applications of semiconductor devices.
3. Provide students with learning experiences that develop broad knowledge and understanding of semiconductor devices and its applications.

#### Unit – 1

**12 Hours**

**Introduction to Semiconductors:** Structure of a matter, conductors, insulators and semiconductors with examples to each, Energy band diagrams, intrinsic and extrinsic semiconductors. Definition of doping, dopant, donor, and acceptor, p-type and n-type semiconductors and their comparisons.

**Diode:** Construction, working, symbol, I-V characteristics and mention of application of pn junction diode. Ideal versus practical diodes, mention of different types of diodes and their symbolic representations.

**Zener Diode:** Construction, working, symbol, I-V characteristics and mention of application of zener diode, Zener and avalanche breakdown.

**LED:** Construction, working, symbol, and mention of application of LED, seven segment display and its applications.

#### Unit – 2

**12 Hours**

**Rectifiers:** Circuit diagrams, working and waveforms of half wave, full wave center tap and bridge rectifiers. Mention of ripple factor and efficiency to each.

**Filters:** Definition of filter, circuit diagram and working of rectifiers with and without shunt capacitor filter. Mention of ripple factor with and without filter.

**Voltage Regulator:** Definition and applications, Circuit diagram and working of zener diode, voltage regulator, load and line regulation. Block diagram of regulator power supply and its applications.

**Wave-shaping Circuits:** circuit diagram and working of positive, negative clippers and clampers.

### **Unit – 3:**

**12 Hours**

**BJT:** Construction, working principle, symbol of NPN bipolar junction transistor, Mention of CE, CB, CC configurations, Definition of  $\alpha$ ,  $\beta$  and their interrelations, Characteristics of a transistor in CE mode. Circuit diagram and working principle of transistor as a switch.

**JFET:** Construction, working principle, symbol of N channel FET, Difference between P and N channel FET, comparison of FET with BJT.

**MOSFET:** Construction, working and symbol of depletion type and enhancement type MOSFET.

### **Unit – 4**

**12 Hours**

**Transistor Biasing:** Need for biasing, DC load line, operating point. Circuit diagram and working of Voltage divider bias circuit.

**Amplifier:** Circuit diagram and working of single stage CE amplifier, frequency response, definition of gain, bandwidth, lower and higher cut-off frequency, application of amplifiers. Block diagram and working of Multistage amplifier and expression for gain.

**Oscillator:** Definition and concept of positive and negative feedback, Barkhausen's criterion for sustained oscillation, Circuit diagram and working of RC phase shift oscillator using transistor.

### **Reference Books:**

1. Robert Boylestad, "Introductory circuit analysis," 5th edition, PHI, 2010.
2. Robert Boylestad and Louis Nashelsky, "Electronic Devices and circuit theory," 9<sup>th</sup> Edition, PHI, 2013.
3. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand Publishers, New Delhi, 2014.
4. R.S. Sedha, "A Text book of Electronics," S Chand and Co., Multicolour, 3<sup>rd</sup> edition, 2012.

## Open Elective Course -2.2

### Renewable Energy and Energy Harvesting

Program Name	<b>BSc in Electronics</b>	Semester	<b>Second Semester</b>
Course Title	Renewable Energy and Energy Harvesting		
Course Code:	<b>FSB 870</b>	No. of Credits	<b>3</b>
Contact hours	<b>48</b>	Duration of SEA/Exam	<b>2.30 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

#### Course Objectives

The objectives of the course are

1. To enable the students to understand the importance of non-conventional energy systems
2. Understand the method of energy harvesting using solar energy, wind energy, hydroenergy, etc.
3. Know the principle of operation of piezoelectric effect and its use in energy harvesting
4. Get the knowledge on electromagnetic energy harvesting methods

#### Unit-1

**Fossil fuels and Alternate Sources of energy:** Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(12 Hours)**

#### Unit-2

**Solar energy:** Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems. **(12 Hours)**

#### Unit-3

**Wind Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

**Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics, and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies,



Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

**Geothermal Energy:** Geothermal Resources, Geothermal Technologies. (12 Hours)

#### **Unit-4**

**Hydro Energy:**Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

**Piezoelectric Energy harvesting:**Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modelling piezoelectric generators, Piezoelectric energy harvesting applications.

**Electromagnetic Energy Harvesting:**Linear generators, physics mathematical models, recent applications.(12 Hours)

#### **Reference Books:**

1. B.H. Khan, "Non-conventional energy sources," 2<sup>nd</sup> Edition, TMH, 2017.
2. Suhas P Sukhative, "Solar energy," 8<sup>th</sup> Edition, TMH, 2008.
3. Godfrey Boyle, "Renewable Energy, Power for a sustainable future," 3<sup>rd</sup> Edition, Oxford University Press, 2012.
4. D.P.Kothari, "Renewable Energy Sources and Emerging Technologies," 2<sup>nd</sup> Edition, PHI, 2011.
5. Jayakumar, P., "Solar Energy Resource Assessment Handbook," Renewable Energy Corporation Network for the Asia Pacific, 2009.
6. John R. Balfour, "Introduction to Photovoltaic System Design," 1<sup>st</sup> Edition, Jones and Bartlett Publishers, 2011.
7. [http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy)

## Open Elective Course -2.3

### PCB Design and Fabrication

Program Name	BSc in Electronics	Semester	Second Semester
Course Title	PCB Design and Fabrication		
Course Code:	FSB 865	No. of Credits	3
Contact hours	48 Hours	Duration of Exam	2.30 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

**Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.**

#### Course Objectives:

1. The obj Understand basics of PCB designing.
2. Apply advance techniques, skills and modern tools for designing and fabrication of PCBs.
3. Apply the knowledge and techniques to fabricate Multilayer, SMT and HDI PCB.
4. Understand concepts of Packaging.

#### Unit 1

12 Hrs

**Introduction to Printed circuit board:** Fundamental of electronic components, basic electronic circuits, Basics of printed circuit board designing: Layout planning, general rule sand parameters, ground conductor considerations, thermal issues, check and inspection of artwork.

**Design rules for PCB:** Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications..

#### Unit 2

12 Hrs

**Introduction to Electronic design automation (EDA) tools for PCB designing:** Brief Introduction of various simulators, SPICE and PSPICE Environment, Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing, PCB Layout Designing, Auto routing and manual routing. Assigning specific text (silkscreen) to design, creating report of design, creating manufacturing data (GERBER) for design.

#### Unit 3

12 Hrs

**Introduction to printed circuit board production techniques:** Photo printing, film- master production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, Etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations

<b>Unit 4</b>	12 Hrs
<p><b>PCB design for EMI/EMC:</b> Subsystem/PCB Placement in an enclosure, Filtering circuit placement, decoupling and bypassing, Electronic discharge protection, Electronic waste; Printed circuit boards Recycling techniques, Introduction to Integrated Circuit Packaging and footprints, NEMA and IPC standards,</p> <p><b>PCB Technology Trends:</b> Multilayer PCBs. Multi wire PCB, Flexible PCBs, Surface mount PCBs, Reflow soldering, Introduction to High-Density Interconnection (HDI) Technology</p>	

Reference Books	
1	R.S Khandpur, "Printed Circuit Boards - Design, Fabrication, Assembly and Testing," 1 <sup>st</sup> Edition, TMH, 2017
2	Walter C. Bosshart, "Printed Circuit Boards- Design and Technology," McGraw Hill Education, 1983.
3	Clyde F. Coombs, "Printed Circuits Handbook," 6 <sup>th</sup> Edition, McGraw Hill Education, 2007
4	Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor," 2 <sup>nd</sup> Edition, Academic Press, 2019
5	. Rao R. Tummala, "Introduction to System-on-Package (SOP): Miniaturization of the Entire System," McGraw Hill, 2008.
6.	Mark I. Montrose, "EMC and the Printed Circuit Board-Design, Theory and Layout

## Semester – III - Programming in C and Digital Design using Verilog

Program Name	BSc in Electronics	Semester	Third Semester
Course Title	Programming in C and Digital Design using Verilog( <b>Theory</b> )		
Course Code:	FSC440	No. of Credits	4
Contact hours	60	Duration of SEA/Exam	2.30hours
Formative Assessment Marks	40	Summative Assessment Marks	60

### Course objectives:

After completing the course, students will be able to:

- Familiarize the difference constructs of Verilog HDL.
- Understand Verilog tasks and directives.
- Impart the concepts of Verilog HDL, Dataflow and behavioural models for the design of digital systems.
- Learn C language features and realize its importance with Verilog HDL.

### Unit I

**15 Hours**

**Over view of Digital design with Verilog HDL:** Evolution of CAD, emergence of HDLs, typical HDL-flow, Need of Verilog HDL, trends in HDLS.

**Hierarchical Modeling Concepts:** Top-down and bottom-up design methodology, Differences between modules and module instances, parts of a simulation, design block, Stimulus block.

**Basic concepts:** Lexical Conventions, data types, system tasks and Compiler Directives.

**Modules and Ports:** Module definition, port declaration, connecting the ports, hierarchical name referencing

### Unit II

**15 Hours**

**Gate level modeling:** Modeling using basic Verilog gate primitives, Description of OR, AND and NOT basic gates, rise, fall and turn- off delays, min, max and typical delays.

**Data flow modeling:** Continuous assignments, delay specifications, expressions, operators, operands, operator types.

**Behavioral Modeling:** Structured procedures, initial and always, blocking and delay control, event control, conditional statements, multi way branching, loops. non-blocking statements, delay control, event control, conditional statements, multi way branching, loops

### Unit - III

**15 Hours**

#### Basics of C Programming

**Overview of C:** Developing programs in C, Parts of simple C program (Sample C programs), structure of a C program, Programming Style, character Set, C tokens , keywords & Identifiers, constants, variables , data types.

**Operators and Expressions:** Arithmetic, relational, logical, assignment, increment & decrement, conditional, bitwise special operators, Arithmetic expressions, Expression evaluation-Precedence and associativity, type conversions.

**Input–Output:** Non-formatted and formatted inputs and out-put function and library functions

#### **Unit - IV**

**15 Hours**

**Decision making, branching & looping:** if, if-else, nested if, nested if-else, switch, while, for, do-while, special control statement-goto, break, continue, return and exit.

**Arrays and Strings:** Array declaration, initialization & types of arrays (one-dimensional & two-dimensional), declaring and initializing string variables, Reading strings from terminal, Writing strings to screen, Arithmetic operations on characters, Putting strings together, comparison of two strings, String-handling functions, Table of strings.

#### **Course outcomes**

At the end of the course the students will be able to:

- Understand the importance of digital design using Verilog.
- Understand the designing of digital circuits using various modelling concepts.
- Understand the basic concepts of C language and write C programs for various mathematical operations.

#### **Text Books:**

1. Samir Palnitkar, “Verilog HDL: A guide to digital design and synthesis”, Pearson Education, second edition.
2. Nazeish M Botros, “HDL Programming Fundamental: VHDL and Verilog”. 2009 reprint, Dream tech press.
3. E. Balaguruswamy, “Computing Fundamentals, and C Programming”, 2<sup>nd</sup> Edition.

#### **Reference Books:**

1. Donald E. Thomas, Philip R. Moorby, “The Verilog Hardware Description Language”, Springer Science+Business Media, LLC, Fifth edition.
2. Michael D Ciletti, “Advanced Digital Design with the Verilog HDL”, person (prentice Hall), second edition.
3. Padmanabhan, Tripura Sundari, “Design through Verilog HDL.” Wiley, 2016 or earlier.
4. Cyril P.R., “Fundamentals of HDL”, Pearson/Sanguine 2010.
5. Yashavant Kanetkar, “Let us C”, 18<sup>th</sup> edition Authentic guide to “C” programming language

## Semester – III Programming in C and Digital Design using Verilog-Practicals

ProgramName	<b>BScin Electronics</b>	Semester	<b>Third Semester</b>
CourseTitle	<b>Programming in C and Digital Design using Verilog (Practical)</b>		
CourseCode:	<b>FSC443</b>	No. of Credits	<b>2</b>
Formative Assessment Marks	<b>25</b>	Summative Assessment Marks	<b>25</b>
<b>Note: Minimum of 5 programmes to be written and executed in each section</b>			

### Section –A:DigitalDesign Using Verilog

- 1) Realization of gates using verilog.
- 2) Simplification of Boolean expressions and realization using verilog.
- 3) Realize Adder/Subtractor (Full/Half) circuits using Verilog dataflow description.
- 4) Realize the following code converters using verilog.
  - a) Gray to Binary and vice-versa.
  - b) Binary to excess 3andvice-versa.
- 5) To realize 4-bit ALU using verilog.
- 6) To realize using verilog description: 8:1 multiplexer, 8:3encoder.
- 7) To realize using Verilog description: 1:8 Demultiplexer, 3:8decoder.
- 8) To realize using Verilog description flip flops:
  - a) JK-type (b)SR type(c) T-type(d)D-type.
- 9) To realize counters: Up/down (BCD & Binary )using Verilog description.
- 10) Modeling of Universal shift registers.

### Section-B:Listof C–Programs

- 1) Programme to perform arithmetic operation (Addition orsubtraction).
- 2) Programme to read radius of a circle and find area and circumference of circle.
- 3) Programme to read three numbers and find the biggest of three (using nested-if).
- 4) Programme to calculate factorial of a given number.
- 5) Programme to read percentage of marks and to display appropriate message.
- 6) Programme to check for prime number.
- 7) Programme to generate n-primes.
- 8) Programme to find roots of quadratic equation (Demonstration of switch case statement).
- 9) Programme to read and display matrix elements.
- 10) Programme to read and display array elements.
- 11) Find the gross salary of an employee
- 12) Remove all vowels from a string

## Open Elective Course -3.1

### Fundamentals of Electronics

Program Name	BSc in Electronics	Semester	Third Semester
Course Title	Fundamentals of Electronics		
Course Code:	FSC 860	No. of Credits	3
Contact hours	48 Hours	Duration of Exam	2 ½ Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

*Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.*

#### Course Objectives:

After completing the course, students will be able to:

- Identify the basic electronic components and their applications
- Design simple electronic circuits

#### Unit 1

16Hrs

**Passive Components:** Overview of passive components-Fabrication, Types, colour coding, and applications. **Transformer:** Principle, construction and working, turn ratio, Types of transformers (Step up and Step down)

**Semiconductors :** Intrinsic and extrinsic semiconductors.

**Diodes:** P-N Junction theory, V-I Characteristics, Rectifiers, Clippers, and Clampers (Qualitative analysis only).

**Special diodes:** Zener diode, LED and LDR; Construction, working and applications.

#### Unit 2

16 Hrs

**Bipolar Junction Transistor (BJT):** Physical structures, modes of operations, characteristics. Transistor as an amplifier, RC-Coupled amplifier, Darlington pairs, Transistor as a switch.

**Field Effect Transistor (FET):** Physical structures and modes of operations, Characteristics.

**Electronic Instruments:** Ammeter, Voltmeter- design and construction, analog millimeter, Digital millimeter, function generator (Qualitative analysis only). Cathode Ray Tube (CRT), Cathode Ray Oscilloscope (CRO)-Block diagram.

**Digital fundamentals:** Binary numbers, signed binary numbers, binary to decimal and Decimal to Binary conversion, Binary additions, and Subtractions,

**Logic gates:** AND, OR and NOT gates.

#### Unit 3

16Hrs

### Component and Device Applications:

To design and Construct at least Ten of the following circuits.

1. V-I characteristics of semiconductor diode.
2. V-I characteristics of Zener diode. Determination of breakdown voltage.
3. V-I characteristics of LED. Determination of Cut-in voltage.
4. Characteristics of LDR.
5. Half wave rectifier; with and without filter. Determination of ripple factor.
6. Full wave rectifier (Centre tap/Bridge); with and without filter, determination of ripple factor.
7. Zener diode voltage regulator; determination of line and load regulation
8. Clipping circuits; Positive clipper, Negative Clipper, Biased positive and negative clippers. Trace the input and output waveforms.
9. Clamper circuits: Positive clamper, Negative Clamper. Trace the input and output waveforms.
10. Input and output characteristics of a transistor in Common Emitter configuration, determine the current gain  $\beta$ .
11. Input and output characteristics of a transistor in common base configuration, determine the current gain  $\alpha$ .
12. Transistor as a switch.
13. Construct RC coupled amplifier. Plot the frequency response curve and determine the bandwidth.
14. V-I Characteristics of Common Source (CS) configuration of FET. Determine the current gain.
15. Construct an ammeter to read (0-1mA) of current.
16. Construct a voltmeter to read (0-1 volt).
17. Measure  $V_p$ ,  $V_{pp}$  and Time period of Sine and Square waves using CRO.
18. Construct OR, AND and NOT gates using diodes and transistors. Verify the truth tables.
19. Verify the truth tables OR, AND and NOT gates using Integrated Chips (ICs).
20. Construct four-bit binary adder.

### Reference Books

1	Biomedical Instrumentation and measurements - L Cromwell, F J Weibell and Eapfeiffer, PHI Publications.
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## Open Elective Course - 3.3

### Medical Electronics

Program Name	<b>BScin Electronics</b>	Semester	<b>Third Semester</b>
Course Title	<b>Medical Electronics(Theory)</b>	No. of Credits	<b>3</b>
Course Code:	<b>FSC865</b>	Contact hours	<b>48Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>
<b>OE Paper is to be offered for the Students othert han Electronics stream</b>			

#### Course Objective:

The objective of the course is

- To understand, test and analyze electronic circuits.
- To Study basics of medical instruments
- To understand the Principle of medical imaging and Biomedical signal processing

#### Course Outcome:

- Students get awareness about different medical electronic equipments, medical imaging and Biomedical signal processing

#### Unit-I

**12Hours**

**Fundamental Electronics:** Amplifiers, Frequency response, signal generation. Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes Bioelectric amplifiers-instrumentation amplifiers isolation amplifiers-chopper stabilized amplifiers.

#### Unit-II

**12Hours**

**Introduction to Bio-medical instruments:** Origin of bio-electric signals, active & passive transducer for medical application—Electrocardiography-waveform-standard leads systems, typical ECG amplifier, EEG electrode—frequency bands— recording systems ,EMG basic principle-block diagram of are corder.

#### Unit-III

**12Hours**

**Medical Imaging:** Nature and production of X-rays, Improving X-ray images, Computerized axial tomography, Using ultrasound in medicine, Ultrasound scanning, Magnetic resonance imaging PET and SPECT Imaging

#### Unit-IV

**12Hours**

**Biomedical Signal Processing:** Fundamentals of signal processing, digital image, transforming image, image enhancement, image Segmentation, image compression, image restoration and reconstruction of medical images. Demonstration using MATLAB

#### Reference Book

1. Bio medical Instrumentation and measurements –L cromwell ,FJ Weibell and Eapfeiffer, PHI Publications.

## Semester – IV Electronic Communication-I

Program Name	BScin Electronics	Semester	Fourth Semester
Course Title	<b>Electronic Communication-I(Theory)</b>		
Course Code:	<b>FSD 440</b>	No. of Credits	<b>4</b>
Contact hours	<b>60Hours</b>	Duration of SEA/Exam	<b>2.30hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Objectives:

On completion of the course, Student will be able:

- To understand principle and working of communication system.
- To understand the principle and working of different modulation and demodulation techniques.
- To understand the Principle and working of Antenna, Waveguides, Transmission lines and RADAR
- To understand the basics of Satellite and Optical Fiber communication

### Course outcomes:

After studying this course, students will:

- Understand the basic principle and techniques of Analog Communication.
- Understand the Various modulation techniques and its importance in radio communication
- Understand and Analyze various analog continuous wave modulation and demodulation techniques
- Understand various radio wave propagation mechanisms and its applications
- Acquire Basic knowledge about Satellite Communication.
- Understand and characterize different components of an optical fiber communication system.
- Define optical sources and detectors. Describe LED, laser diodes, PIN diodes and photo diodes.
- Understand knowledge about Radar and Radar equations.

### **Unit I**

**15Hours**

**Introduction:** Brief idea of frequency allocation for radio communication system. Electromagnetic communication spectrum, EM band designation and usage. Block diagram of an electronic communication system.

**Propagation of EM waves:** Introduction, Ground Wave propagation, Sky-wave propagation Space-wave propagation.

**Transmission lines:** Basic principles, characteristic impedance, losses in transmission lines, standing waves.

**Noise:** Introduction, Internal noises–Thermal agitation Noise, Shot Noise, Transit-time Noise, External noises-Atmospheric noise, Extra-terrestrial noise, Industrial noise, signal to noise ratio(S/N),noise figure

## Unit II

15Hours

**Modulation:** Introduction, need and types of modulation.

**AM:** Representation of AM, Theory of AM , frequency spectrum of AM wave, power and current calculation, modulation by several sine waves. AM generation using Modulated transistor amplifiers.

**SSB:** Introduction, suppression of carrier- Balanced modulator, suppression of unwanted sideband- Filter system,

**AM Receiver**– Block diagram and working of tuned radio frequency receiver and Super heterodyne receiver and Simple diode detector.

**FM and PM:** Theory of FM and PM , frequency spectrum of FM, bandwidth, phase modulation, comparison of AM,FM and PM. FM generation using Direct method.

**FM Receiver:** Block diagram and working of Super-heterodyne receiver, Single slope FM Detector.

## Unit III

15Hours

**Antennas:** Introduction, EM radiation, resonant and non-resonant antennas, antenna gain and effective radiated power, field intensity, antenna resistance, bandwidth, beam width, polarization, antenna with parabolic reflector. Geometry and properties of parabolic reflector.

**Waveguides:** Introduction, working principle of rectangular wave guide and circular waveguide.

**Satellite Communication:** Introduction, Kepler’ s Laws, Satellite Orbits, Geostationary Satellites, Attitude control, Station keeping, Antenna Look angles, Satellite classifications, Transponders(c-band). Earth station.

## Unit IV

15Hours

**Fiber Optic Communication:** Introduction, block diagram, fiber types, cable construction, Light propagation, Optical fiber configuration: Single mode, step index fiber, multi-mode step index fiber, multimode graded index fiber, comparison, acceptance angle and cone, Numerical Aperture,

**Fiber losses:** Signal degradation in optical fibers, attenuation, scattering losses, radiative losses, absorption losses, core and cladding losses. Construction, working principle and application of LEDs and Laser diodes, PIN diodes and Avalanche-photodiodes.

**RADAR:** Block diagram and operations, range equation, block diagram and working of CWRADAR. Applications and limitations of RADAR.

**Reference Books:**

1. George Kennedy, "Electronic Communication Systems," TMH, 4<sup>th</sup> Edition, 1999
2. D. Roddy and J. Coolen, "Electronic Communications", "Pearson Education India, 4<sup>th</sup> Edition.
3. Tomasi, "Advanced Electronics Communication Systems," 6<sup>th</sup> Edition, Prentice Hall.
4. William Schweber, "Electronic communication systems, PHI, 4<sup>th</sup> Edition, 2002.
5. Dennis Roddy and Coolen, "Satellite Communication," 4<sup>th</sup> edition, McGrawHill, 2006.
6. B.P.Lathi, "Modern Digital and Analog Communication Systems," 4<sup>th</sup> e, Oxford University Press
7. Frenzel, "Principles of Electronic communication systems, " 3<sup>rd</sup> Edition, McGrawHill
8. S. Haykin, "Communication Systems," Wiley India, 2006.

## Semester – IV Electronic Communication-I – Practical

Program Name	<b>BSc in Electronics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Electronic Communication-I Practical)</b>		
Course Code:	<b>FSD 443</b>	No. of Credits	<b>2</b>
Formative Assessment Marks	<b>25</b>	Summative Assessment Marks	<b>25</b>
<b>Note:Minimum of 10 Experiments are to be performed using hardware and simulation.</b>			

### List of Experiments

1. Amplitude modulator – determination of modulation index.
2. Amplitude Demodulator - Diode detector- determination of signal frequency
3. RF amplifier - determination of the mid band gain and bandwidth
4. Frequency Modulator - determination of Modulation Index
5. AGC circuit for AM Detector
6. Frequency mixer - determination of output frequency for different input frequencies
7. Class C Tuned Amplifier – frequency response
8. Radiation pattern of LED
9. Frequency Multiplier
10. IF Amplifier–determination of IF from graph
11. FM transmitter and receiver
12. To Study the Pre-Emphasis and De-Emphasis Circuit
13. Study of intensity modulation in optical fiber
14. Frequency response of optical fiber
15. Measurement of Numerical aperture and losses in fibers
16. Gain characteristics of LED in optical fiber
17. Study of receiver characteristics.

## Open Elective Course -4.1

### Augmented and Virtual Reality

Program Name	<b>BSc in Electronics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Augmented and Virtual Reality</b>		
Course Code:	<b>FSD 860</b>	No. of Credits	<b>3</b>
Contact hours	<b>48 Hours</b>	Duration of SEA/Exam	<b>2.30 Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

#### **Course Objectives:**

The students are able

- To understand the basics of virtual reality
- Clearly get the concept of various applications of virtual reality

#### **Course Outcomes (COs):**

The course outcome are:

- Identify the application concepts, human Physiology and Perception.
- Understanding visual perception outcomes

#### **Contents**

##### **Unit 1**

15Hrs

**Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

**Augmented Reality:** Taxonomy, technology and features of augmented reality, difference between AR and VR.

##### **Unit 2**

15Hrs

**Augmented Reality:** Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

**The Geometry of Virtual Worlds &The Physiology of Human Vision:** Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR. #Exemplar/ Case Studies Sweeping coverage of eye movements.

##### **Unit 3**

15Hrs

**Visual Perception & Rendering and Motion & Tracking:** Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates #Exemplar/ Case Studies Automatic stitching of panoramas in Virtual Reality. Motion in Real and Virtual Worlds-Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies.

### Reference Books

1	Computing Fundamentals and C Programming - E. Balagurusamy, Tata McGraw-Hill, 2008.
2	Augmented and Virtual Reality - Anand R, Khanna Publishing House, Delhi.
3	How to Solve by Computer - R.G.Dromey, Pearson Education, Inc, Reprint 2009.
4	Let Us C - Yashavant P. Kanetkar, Fifth Edition, Sridhara Publication, India, 2008.

## Open Elective Course – 4.1

### IOT and Applications

Program Name	<b>BSc in Electronics</b>	Semester	<b>Fourth Semester</b>
CourseTitle	<b>IOT and Applications (Theory)</b>	No.of Credits	<b>3</b>
CourseCode:	<b>OE.ELE 4.1</b>	Contact hours	<b>48Hours</b>
Formative AssessmentMarks	<b>40</b>	Summative AssessmentMarks	<b>60</b>
<b>OE Paper is to be offered for the Students other than Electronics stream</b>			

#### Course objectives:

The objective of the course is:

- To become familiarize with IOT applications.
- To understand the wireless technology

#### **Course outcome:**

Students get awareness about an internet usage

#### **Unit-I**

**12hours**

Fundamentals of IoT: Introduction, History of IoT ,Definitions & Characteristics of IoT, IoT Architectures,Physical & Logical Design of IoT, Enabling Technologies in IoT, Components ofan IoT Solution, IoTframeworks, IoTand M2M,OpenSourceandCommercialExamples, CompetingStandards for IoT

#### **Unit-II**

**12hours**

Sensors Networks : Definition, Traditional Data Storage, Analog and Digital I/O Basics, Types of Sensors ,Types Of Actuators, Examples and Working, IoT Development Boards: Arduino IDEandBoardTypes,RaspberriPiDevelopment Kit, RFID Principles and components,Wireless Sensor Networks:History andContext,Thenode, Connectingnodes, NetworkingNodes, WSNandIoT.

#### **Unit-III**

**12hours**

Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave,BLE, Bacnet, Modbus.IPBased Protocolsfor IoTIPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.Edgeconnectivityand protocols

#### **Unit-IV**

**12hours**

Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handlingTechnologies,Flowof data,Dataacquisition, Data StorageApplicationsof IoT: HomeAutomation



## **ReferenceBooks**

1. InternetofThings -Vasudevan,Nagrajanandand Sundaram,WileyIndia.
2. InternetofThings -SrinivasaKG,CengageLearning,India2017.
3. IoT fundamentals:Networking Technologies, Protocols and uses cases for the Internet of things- DavidHanes, Gonzalo Salgueiro, Patrick Grosstete, Robert Barton, Jerome Henry, 1<sup>st</sup>Edition,PearsonEducation.
4. IoT Fundamentals-DavidHence etal,Ciscopress.

## Open Elective Course -4.2

### Application of Electronics – II

Program Name	<b>BSc in Electronics</b>	Semester	<b>Fourth Semester</b>
Course Title	<b>Application of Electronics – II</b>		
Course Code:	FSD870	No. of Credits	<b>3</b>
Contact hours	<b>48 Hours</b>	Duration of Exam	<b>2 ½ Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

**Note: This Course is for candidates who have not opted Electronics as one of the Core Courses.**

#### Course Objectives:

- Students familiarize with applications of electronics communication instruments.
- Able to understand the concept of EDUSAT, CCTV and ATM.
- Able to understand the functioning of EVMs.

#### Course Outcomes:

- Students become familiarized with applications of electronics communication instruments.
- Students are able to handle electronic gadgets like CCTV and ATM.
- Students understand the functioning of EVMs.

### **Contents**

#### **Unit 1**

12 Hrs

**Introduction to advanced communication: Radio:** Introduction, block diagram of radio and its working(transmitter and receiver) and applications of Radio,  
**TV-** Introduction, block diagram of TV and its working, types of TV and applications of TV.  
**OFC-** introduction, block diagram of OFC, principle of OFC transmission, applications  
 Embedded system - Smart card, SIM card.  
**Mobile-** introduction, Block diagram of mobile, working and applications.

#### **Unit 2**

12 Hrs

**Advanced Electronics:** CCTV camera- Introduction working principles of CCTV, types of CCTV, advantages, disadvantages and applications.  
**ATM-** Definition of ATM, block diagram working, features, advantages and disadvantages  
**Electronic voting Machine (EVM) –** Definition, history, block diagram of EVM, parts of EVM- CU, BU, VVPAT, Steps involved in casting of votes in EVM using VVPAT. Advantages And Disadvantages Of EVM

<b>Unit 3</b>	12 Hrs
<p><b>Applications of satellite and Internet:</b> Introduction, Types-remote sensing SAT, Communication SAT and EDUSAT. Advantages and disadvantages of satellite. <b>Internet:</b> Introduction -growth of internet, internet architecture, Modem, Wi-Fi, Blue tooth - principle of operation using block diagram, advantages and applications.</p>	
<b>Unit 4</b>	12 Hrs
<p><b>E-waste management-</b> Introduction, identification, sorting/separation/ dismantling/segregation in E-waste management. Extracting useful metals from E-waste, recycling. Common sources of E-waste, E-wastes produced by communication and Information Technology sector, collection and transportation of E-Waste, precautions for disposing the E-waste, responsibilities of a citizens in managing e-waste, effect of E-waste on environment, impacts of E-waste on human beings. E-waste certification.</p>	

#### Reference Books

1	<i>Basic Electronics-Solid State – B L Theraja - S Chand And Company Ltd</i>
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## Open Elective Course -4.3

### Augmented and Virtual Reality

Program Name	BSc in Electronics	Semester	Fourth Semester
Course Title	Augmented and Virtual Reality (Theory)	No. of Credits	3
Course Code:	FSD 865	Contact hours	48 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

**OE Paper is to be offered for the Students other than Electronics stream**

12Hours

#### Unit-1

**Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface of the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

#### Unit-II

12Hours

**Augmented Reality:** Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

#### Unit-III

12Hours

**The Geometry of Virtual Worlds & The Physiology of Human Vision:** Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, movements & implications for VR. # Exemplar/ Case Studies Sweeping Coverage of eye movements

#### Unit-IV

12Hours

**Visual Perception & Rendering and Motion & Tracking:** Visual Perception- Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates # Exemplar/ Case Studies Automatic stitching of panoramas in Virtual Reality. Motion in Real and Virtual Worlds-Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies

## Reference Books

1. Computing Fundamentals and C Programming - E. Balagurusamy, Tata McGraw-Hill, 2008.
2. Augmented and Virtual Reality - Anand R, Khanna Publishing House, Delhi.
3. How to Solve by Computer - R.G. Dromey, Pearson Education, Inc, Reprint 2009.
4. Let Us C - Yashavant P. Kanetkar, Fifth Edition, Sridhara Publication, India, 2008.

**SEMESTER V**  
**DIGITAL SIGNAL PROCESSING**

Credits: Theory – 04

Practical – 02

Theory: 60 Lectures

**COURSE OUTCOME:**

After completion of the course the student is able to

CO1: Identify the details of discrete/digital signals and systems

CO2: Understand the classification and characteristics of frequency domain analysis of discrete time signals.

CO3: Specify with examples DSP filters

**Unit-1**

**Discrete-Time Signals and Systems:**

Classification of Signals: Continuous-time and Discrete-Time signals, Analog and Digital signals, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals. Operations on Dependent and Independent Variables. Continuous- Time System and Discrete-Time Systems: Unit Step Response, Impulse Response and Ramp Response. Exponential signals, exponentially damped sinusoidal signals, pulse signals

Basic Discrete Time signals – Step function, Impulse function, Ramp function, Exponential function, Sinusoidal signals, Exponentially damped sinusoidal signals, Pulse signals

System Properties: Linearity, Causality; Time-Invariance, Memory, Stability and Invertibility.

Linear Time Invariant Systems- Convolution Sum. Convolution Integral, Representation for LTI System – two systems in Parallel, Two systems in Cascade. (15 Lectures)

**UNIT 2:**

**The Z-Transform:**

Introduction, Definition of Z – transform, Transform and ROC of Finite Duration Sequences – Right Sided Sequence, Left Sided Sequence, Double Sided Sequences.

Z – Transform and ROC of Infinite Duration Sequences- Positive Time Exponential Sequence, Negative Time Exponential Sequence, Double sided Exponential Sequence, ROC & Stability, Properties of ROC . Problems.

**Properties of Z-Transform**-Linearity, Time Shift or Translation, Multiplication by an Exponential, Multiplication by a Ramp, Convolution (Time-domain), Time-reversal, Convolution (Z-domain), Initial- value theorem, Final value theorem. Transforms of some useful Sequences.

**Inverse Z- transform**-Partial fraction expansion method, Inverse Z- transform by long division method.

### **UNIT 3:**

#### **Discrete-Time Fourier Transform:**

DFT - Introduction. Definition of DFT and IDFT- Lemma, Inverse DFT, Periodicity of  $X(k)$  and  $x(n)$ .

Matrix relation for computing DFT, Matrix relation for Computing IDFT, Using DFT to find IDFT, Concept circular shift and circular symmetry, Properties of DFT – Linearity, Circular time shift, Circular frequency shift.

Fast Fourier Transform (FFT) – Decimation-in-time FFT, Further reduction: Cooley-Turkey Algorithm, In-place computations, Decimation in frequency FFT. (15 Lectures)

### **UNIT 4:**

**Filter Concepts:** Linear-Phase Filter, Simple FIR Digital Filters, Simple IIR Digital Filters, All pass Filters

#### **Design of IIR Filters:**

Introduction, Analog Filter Specifications, Classification of Analog Filters, Butterworth Filters, Frequency transformations / Spectral Transformations, Design of Low pass Butterworth Filters, Digital filters, Backward difference method, Bilinear Transformations, Analog Design using Digital filters, Advantages and Disadvantages of IIR Filters. (15 Lectures)

#### **Reference Books:**

- Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India.
- Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
- Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edn. Oxford University Press.
- Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L.Harris, 2005, Cengage Learning.
- Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.
- Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G.
- Manolakis, 2007, 4th Edn., Prentice Hall.

**PRACTICAL V**  
**DIGITAL SIGNAL PROCESSING**

1. Verification of properties of a system : linear and convolution
2. Finding DFT of a given sequence - direct method
3. Finding IDFT of a given sequence - direct method
4. Linear convolution using DFT
5. Circular convolution using DFT
6. Solution of simple difference equations
7. Verification of sampling theorem
8. Determination of impulse response of a given system
9. Determination of Frequency response of system to any arbitrary input
10. Design of simple IIR filters – Butterworth
11. DFT using FFT
12. IDFT using FFT

**( Note: Minimum of Eight experiments to be done).**



**ELECTRONIC INSTRUMENTATION**

Credits: Theory – 04

Practical – 02

Theory: 60 Lectures

**COURSE OUTCOME:**

After completion of the course a student is able to

CO1: Specify in detail, basic electronic measurement instruments.

CO2: Write down the classification and working of impedance measuring instruments.

CO3: Specify the details of power supply.

CO4: Understand the working and applications of transducers

**Unit 1:**

**Measurements**

Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic Interference.

**Basic Measurement Instruments:**

DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating). Digital Multimeter; Block diagram principle of measurement of I, V, C. Accuracy and resolution of measurement.

**Measurement of Impedance-**

A.C. bridges, Measurement of Self Inductance (Anderson's bridge), Measurement of Capacitance (De Sauty's bridge), Measurement of frequency (Wien's bridge).

(15 Lectures)

**Unit 2:**

**Power supply**

Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators (78XX and 79XX), Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) and uninterruptible power supply (UPS).

**Oscilloscope:**

Block Diagram, CRT, Vertical Deflection, Horizontal Deflection. Screens for CRT, Oscilloscope probes, measurement of voltage, frequency and phase by Oscilloscope. Digital Storage Oscilloscopes. LCD display for instruments.

(15 Lectures)

**Unit 3:**

**Lock-in-amplifier:**

Basic Principles of phase locked loop (PLL), Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor), lock and capture. Basic idea of PLL IC (565 or 4046). Lock-in-amplifier, Idea of techniques for sum and averaging of signals.

### **Signal Generators:**

Function generator, Pulse Generator, (Qualitative only).

### **Virtual Instrumentation:**

Introduction, Interfacing techniques (RS 232, GPIB, USB), Idea about Audrino microcontroller and interfacing software like lab View). (15 Lectures)

### **Unit 4:**

#### **Transducers:**

Classification of transducers, Basic requirement/characteristics of transducers, Active and Passive transducers, Resistive (Potentiometer- Theory, temperature compensation & applications), Capacitive (variable air gap type), Inductive (LVDT) & piezoelectric transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells). (15 Lectures)

#### **Reference Books:**

- W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
- E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).
- David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015).
- Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Butterworth Heinmann-2008).
- S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
- Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning.

**PRACTICAL VI  
ELECTRONIC INSTRUMENTATION LAB**

1. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
2. Measurement of Capacitance by De Sauty's bridge.
3. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge).
4. To determine the Characteristics of LVDT.
5. To determine the Characteristics of Thermistors and RTD.
6. Measurement of temperature by Thermocouples.
7. Design a regulated power supply of given rating (5 V or 9V).
8. To design and study the Sample and Hold Circuit.
9. To plot the frequency response of a microphone.

**(Note: Minimum of Eight experiments to be done).**

**SEMESTER VI  
VERILOG & VHDL**

Credits: Theory – 04,  
Practical – 02

Theory: 60 Lectures

**COURSE OUTCOME:**

After completion of the course the student is able to

CO1: Identify the details of Digital logic design flow.

CO2: Learn the characteristics and model the digital circuits using VHDL behavioural modelling

CO3: Deliberate in detail the dataflow and structural modelling in VHDL

CO4: Describe digital circuits utilizing various constructs of Verilog

**Unit-1**

**Digital logic design flow**

Review of combinational circuits. Combinational building blocks: multiplexers, demultiplexer, decoders, encoders and adder circuits. Review of sequential circuit elements: flip-flop, latch and register. Finite state machines: Mealy and Moore. Other sequential circuits: shift registers and counter (15 lectures)

**Unit-2**

**Verilog HDL:**

Introduction to HDL. Verilog primitive operators and structural Verilog. Behavioural Verilog. Design verification. Modelling of combinational and sequential circuits (including FSM and FSM D) with Verilog Design examples in Verilog. (15 lectures)

**Unit-3**

**VHDL: Basic Language elements**

Identifiers, Data Objects, Data types, Operators

**Behavioral Modelling**

Entity Declaration, Architecture Body, Process statement, Variable assignment statement, Signal Assignment, Wait statement, If statement, Case statement, Null statement, Loop statement, Exit statement, Next statement, Assertion statement, Report statement, More on Signal Assignment statement, other sequential statements. (15 Lectures)

## **Unit-4**

### **Dataflow Modelling**

Concurrent Signal Assignment, Concurrent versus Sequential Signal Assignment, Delta Delay Revisited, Multiple Drivers, Conditional Signal Assignment Statement, Selected Signal Assignment Statement, The UNAFFECTED value, Block Statement, Concurrent Assertion Statement, Value of signal.

### **Structural Modeling**

An example, Component Declaration, Component Instantiation, Other examples. Resolving Signal Values (15 lectures)

### **Reference Books:**

1. LizyKurien and Charles Roth. *Principles of Digital Systems Design and VHDL*. Cengage Publishing. ISBN-13: 978-8131505748.
2. Palnitkar, Samir, *Verilog HDL*. Pearson Education; Second edition (2003).
3. Ming-Bo Lin. *Digital System Designs and Practices: Using Verilog HDL and FPGAs*. Wiley India Pvt Ltd. ISBN-13: 978-8126536948.
4. ZainalabedinNavabi. *Verilog Digital System Design*. TMH; 2nd edition. ISBN-13: 978-0070252219.
5. Wayne Wolf. *FPGA Based System Design*. Pearson Education. S. K. Mitra, Digital Signal processing, McGraw Hill, 1998.
6. VLSI design, Debaprasad Das, 2nd Edition, 2015, Oxford University Press.
7. D.J. Laja and S. Sapatnekar, Designing Digital Computer Systems with

**PRACTICAL VII  
VERILOG AND VHDL LAB**

**Experiments using Verilog**

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half Subtractor and Full Subtractor using basic and derived gates.
4. Design and simulation of a 4 bit Adder.
5. Multiplexer (4x1) and Demultiplexer using logic gates.
6. Decoder and Encoder using logic gates.
7. Clocked D, JK and T Flip flops (with Reset inputs).
8. 3-bit Ripple counter

**Experiments using VHDL**

1. Behavioral modeling and simulation of basic gates
2. Structural modeling and simulation of simple Boolean expression
3. Modeling and simulation of adders and subtractors
4. Modeling and simulation of magnitude comparators
5. Modeling and simulation of Flip-flops
6. Modeling and simulation of Shift registers
7. Modeling and simulation of Counters
8. Modeling and simulation of encoders and decoders
9. Modeling and simulation of multiplexers

**Note: At least 04 experiments - each from section A and B to be done.**

**SEMESTER VI**  
**PHOTONIC DEVICES AND POWER ELECTRONICS**

Credits: Theory – 04  
Practical – 02

Theory: 60 Lectures

**COURSE OUTCOME:**

After completion of the course the student is able to

CO1: Deliberate the Principles and operations of Photonic devices.

CO2: Deliberate the Principle of operation and characteristics of optical fibers

CO3: Understand the mode of signal propagation in optical fibres

CO4: Deliberate the characteristics and application of power devices

**UNIT 1:**

**Photonic Devices**

Classification of photonic devices. Interaction of radiation and matter, Radiative transition and optical absorption. Light Emitting Diodes- Construction, materials and operation. Semiconductor Laser- Condition for amplification, laser cavity, heterostructure and quantum well devices. Charge carrier and photon confinement, line shape function. Threshold current. Laser diode. Photodetectors: Photoconductor. Photodiodes (p-i-n, avalanche) and Photo transistors, quantum efficiency and responsivity. Photomultiplier tube. (15 Lectures)

**UNIT 2:**

**Solar Cell**

Construction, working and characteristics LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

**Introduction to Fiber Optics:**

Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

(15 Lectures)

**UNIT 3:**

**POWER ELECTRONICS**

**Power Devices:**

Need for semiconductor power devices, Power MOSFET (Qualitative). Introduction to family of thyristors. Silicon Controlled Rectifier (SCR)- structure, I-V characteristics, Turn-On and Turn-Off

characteristics, ratings, Gate-triggering circuits. Diac and Triac- Basic structure, working and V-I characteristics. Application of Diac as a triggering device for Triac. (15 Lectures)

#### **UNIT 4:**

##### **Insulated Gate Bipolar Transistors (IGBT):**

Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA).

##### **Applications of SCR:**

Phase controlled rectification, AC voltage control using SCR and Triac as a switch. Power Invertors- Need for commutating circuits and their various types, dc link invertors, Parallel capacitor commutated invertors, Series Invertor, limitations and its improved versions, bridge invertors.

(15 Lectures)

##### **Reference Books:**

1. J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996).
2. S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009).
3. AK Ghatak & K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998).
4. Power Electronics, P.C. Sen, Tata McGraw Hill.
5. Power Electronics, M.D. Singh & K.B. Khanchandani, Tata McGraw Hill.
6. Power Electronics Circuits, Devices & Applications, 3rd Edn., M.H. Rashid, Pearson Education.
7. Optoelectronic Devices and Systems, Gupta, 2nd edn., PHI learning.
8. Electronic Devices and Circuits, David A. Bell, 2015, Oxford University Press.



**PRACTICAL VIII**  
**PHOTONIC DEVICES AND POWER ELECTRONICS**

1. To determine wavelength of sodium light using Michelson's Interferometer.
2. Diffraction experiments using a laser.
3. Study of Electro-optic Effect.
4. To determine characteristics of (a) LEDs, (b) Photo voltaic cell and (c) Photo diode.
5. To study the Characteristics of LDR and Photodiode with (i) Variable Illumination intensity, and (ii) Linear Displacement of source.
6. To measure the numerical aperture of an optical fiber.
7. Output and transfer characteristics of a power MOSFET.
8. Study of I-V characteristics of SCR.
9. SCR as a half wave and full wave rectifiers with R and RL loads.
10. AC voltage controller using TRIAC with UJT triggering.
11. Study of I-V characteristics of DIAC
12. Study of I-V characteristics of TRIAC.

**ELECTRICAL CIRCUITS AND NETWORK SKILLS**

Credits: 02

Theory: 30 Lectures

Course Outcome:

After completion of the course the student acquires skill to

CO1: Design and trouble shoot the electrical circuits and networks

CO2: Carry-out simple domestic wiring.

**UNIT 1:**

**Basic Electricity Principles:**

Discussion of Voltage ( AC & DC), Current( AC & DC), Resistance, and Power. Ohm's law. Series, parallel, Series and Parallel combinations of R, L and C. Response of inductors and capacitors with DC or AC sources. Impedance in of Inductor and Capacitor

**Electrical Circuits:**

**DC Circuits** - Basic electric circuit elements and their combination in DC circuits. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements.

**AC Circuits** - . Simple numericals on network theorms. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

**Electrical Drawing and Symbols:**

Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. (15 Lectures)

**UNIT 2:**

**Generators and Transformers:**

DC Power sources. AC/DC generators. Basic principle of operation, constructional features. Transformers – Principle of working, Construction and Operation of transformers.

**Electric Motors:**

Single-phase, three-phase & DC motors - Construction and Working. Speed & power of ac motor. Interfacing DC or AC sources/ Motors to control heaters

**Solid-State Devices:** Diodes, types of diodes –symbol and applications, Rectifiers - PN junction diode as rectifier ( Half wave and Full wave rectifier) construction and working

**Electrical Protection:**

Relays - Relay as protection device, Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection.

**Electrical Wiring:**

Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, and solder. Preparation of extension board. (15 Lectures)

**Reference Books:**

1. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press.
2. A text book in Electrical Technology - B L Theraja - S Chand & Co.
3. A text book of Electrical Technology - A K Theraja.
4. Performance and design of AC machines - M G Say ELBS Edn.

<https://drive.google.com/file/d/1qzea3KMY6yomll0MIzZpsGnMQe1zCWtp/view?usp=sharing>

**COMPUTER NETWORKS**

Credits: 02

Theory: 30 Lectures

**COURSE OUTCOME:**

After completion of the course the student acquires skill to

CO1: Understand the concepts of network devices

CO2: Understand the terminology and concepts of the OSI model

**Unit 1:**

**Data communication, Components & Basic Concepts**

Line configuration- point-to-point, multipoint, Topology – Mesh, Star, Tree, Bus, Ring, and Hybrid Topologies Transmission modes – Simplex, Half Duplex, Full Duplex. Categories of networks – LAN, MAN, WAN, Internet

**Transmission Media**

Guided media – Twisted pair cable, Co-axial cable, Optical fiber

**Multiplexing:**

Many to one/one to many, types of multiplexing, Frequency division multiplexing, time division multiplexing, multiplexing applications

**Error detection**

Types of error, multiple bit error, Burst error, Detection – redundancy, Checksum Error correction – Single bit error correction, Hamming code (15 Lectures)

**Unit 2**

**The OSI Model**

Model – layered Architecture, Functions of layers- physical layer, Data link layer, Network layer, Transport layer, Session layer, Presentation Layer, Application layer

**Networking and internetworking devices**

Repeaters, Bridges- types of Bridges, Routers- Routing concepts, Gate ways

**World Wide Web:**

Uniform Resource Locator (URL), Browser Architect (15 Lectures)

**Text Book:**

Introduction to Data Communications & Networking by- BEHROUZ FOROUZAN

**Reference Book:**

Computer Networks by – ANDREW S TANENBAUM

**Model Question Paper for DSC/DSE**

**Time: 3 hours**

**Max. Marks: 70**

**Part -A**

**1. Answer all questions.**

**1 x 10 = 10m**

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)
- (g)
- (h)
- (i)
- (j)

**Part - B**

**Answer any Four questions.**

**4 x 5 = 20**

- 2.**
- 3.**
- 4.**
- 5.**
- 6.**
- 7.**

**Part - C**

**Answer any Four questions**

**4 x 10 = 40**

- 8.**
- 9.**
- 10.**
- 11.**
- 12.**
- 13.**

**Pattern of theory Question Paper for SEC**

**Time: 2 hours**

**Max. Marks: 35**

**Credits: 2**

**Part –A**

**I. Answer all questions.**

**1 x 05 =05m**

- Five questions to be set from the two units of the syllabus.
- Minimum of two questions to be set from each unit.
- Questions can be simple problems also.

**Part –B**

**II. Answer any Three questions**

**3x 10 = 30m**

- Five questions to be set from the two units of the syllabus.
- Minimum Two questions/ Problems to be set from each unit.



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**(Autonomous)**

**B N ROAD, MYSURU – 570 025**

**DEPARTMENT OF ENGLISH (UG)**

**Syllabus under**

**NEP - 2020**

**Choice Based Credit System (CBCS)**

**2022 – 23 Onwards**

**And**

**2021-22 (III& IV SEM)**

**(Approved by BOS)**

### TEMPLATES – BA, BSc & BCA (Language- 2)

Paper No	Sem	Course code	Title of the Course	Course type	LTP	Credit	Hours/ Week	C1	C2	C3	Total Marks
1	I	FHA020 FSA020 FAA020	Reverberations 1	AECC	2:1:0	3	2+2	20	20	60	100
2	II	FHB020 FSB020 FAB020	Reverberations 2	AECC	2:1:0	3	2+2	20	20	60	100
3	III	FHC020 FSC020 FAC020	Fiction and Language Component	AECC	2:1:0	3	2+2	20	20	60	100
4	IV	FHD020 FSD020 FAD020	Play and Language Component	AECC	2:1:0	3	2+2	20	20	60	100



**COURSE CODE****BA**

<b>I SEMESTER</b>	<b>II SEMESTER</b>	<b>III SEMESTER</b>	<b>IV SEMESTER</b>
FHA02031(EG) FHA02032(HP) FHA02033(KG) FHA02034(HE) FHA02035(JP)	FHB02031(EG) FHB02032(HP) FHB02033(KG) FHB02034(HE) FHB02035(JP)	FHC02031(EG) FHC02032(HP) FHC02033(KG) FHC02034(HE) FHC02035(JP)	FHD02031(EG) FHD02032(HP) FHD02033(KG) FHD02034(HE) FHD02035(JP)

**BSc**

<b>I SEMESTER</b>	<b>II SEMESTER</b>	<b>III SEMESTER</b>	<b>IV SEMESTER</b>
FSA02032(PM) FSA02034(CsM) FSA02035(PCs) FSA02036(BZ) FSA020 37(CBt) FSA02038(CZ) FSA02039(BtZ) FSA02040(BtBc) FSA02041(MbBt) FSA02043(BC)	FSB02032(PM) FSB02034(CsM) FSB02035(PCs) FSB02036(BZ) FSB0203 (CBT) FSB02038(CZ) FSB02039(BtZ) FSB02040(BtBc) FSB02041(MBt) FSA02043(Bc)	FSC02031(PC) FSC02032(PM) FSC02033(PE) FSC02034(CsM) FSC02035(PCs) FSC02036(BZ) FSC02037(CBt) FSC02038(CZ) FSC02039(BtZ) FSC02040(BtBc) FSC02041(MBt) FSC02042(MBc)	FSD02031(PC) FSD02032(PM) FSD02033(PE) FSD02034(CsM) FSD02035(PCs) FSD02036(BZ) FSD02037(CBt) FSD02038(CZ) FSD02039(BtZ) FSD02040(BtBc) FSD02041(MBt) FSD02042(MBc)

**BCA**

<b>I SEMESTER</b>	<b>II SEMESTER</b>	<b>III SEMESTER</b>	<b>IV SEMESTER</b>
FAA020	FAB020	FAC020	FAD020

## TEMPLATES – B Com & BBA (Language -2)

Paper No	Sem	Course code	Title of the Course	Course type	LTP	Credit	Hours/Week	CI	C2	C3	Total Marks
1	I	FCA020 FBA020	Resplendence 1	AECC	2:1:0	3	2+2	20	20	60	100
2	II	FCB020 FBB020	Resplendence 2	AECC	2:1:0	3	2+2	20	20	60	100
3	III	FCC020 FBC020	Fiction and Language Component	AECC	2:1:0	3	2+2	20	20	60	100
4	IV	FCD020 FBD020	Play and Commercial Correspondence	AECC	2:1:0	3	2+2	20	20	60	100

### COURSE CODE

#### B Com

I SEMESTER	II SEMESTER	III SEMESTER	IV SEMESTER
FCA020	FCB020	FCC020	FCD020

#### BBA

I SEMESTER	II SEMESTER	III SEMESTER	IV SEMESTER
FBA020	FBB020	FBC020	FBD020

## TEMPLATES – BA Honors

Paper No	Sem	Course code	Title of the Course	Course type	LTP	Credit	Hours/Week	C1	C2	C3	Total Marks
1	I	FHA 51034	Introduction to Literature	DSCC	2:1:0	3	2+1	20	20	60	100
2	I	FHA 52034	Indian Writing in English-part I	DSCC	2:1:0	3	2+1	20	20	60	100
3	II	FHB 51034	Introduction to Phonetics and Linguistics	DSCC	2:1:0	3	2+1	20	20	60	100
4	II	FHB 52034	Indian Writing in English- part 2	DSCC	2:1:0	3	2+1	20	20	60	100
5	III	FHC 51034	British Literature up to 1800 – Paper 1	DSCC	2:1:0	3	2+1	20	20	60	100
6	III	FHC 52034	Indian Literature in Translation -Paper 2	DSCC	2:1:0	3	2+1	20	20	60	100
7	IV	FHD 51034	British Literature - 19th And 20th Century (Part 2)	DSCC	2:1:0	3	2+1	20	20	60	100
8	IV	FHD 52034	Gender Studies (Part 1)	DSCC	2:1:0	3	2+1	20	20	60	100
9	V	ELE2 2224	Modern Literature	DSE	2-0-0	2	5+1	15	15	70	100
10	VI	<b>ELF2</b> <b>2224</b>	English Writing in Third World Countries	DSE	2-0-0	2	5+1	15	15	70	100

**COURSE CODE**

**BA (Honors)**

	<b>I SEMESTER</b>	<b>II SEMESTER</b>	<b>III SEMESTER</b>	<b>IV SEMESTER</b>
<b>COURSE 1</b>	FHA51034	FHB51034	FHC51034	FHD51034
<b>COURSE 2</b>	FHA52034	FHB52034	FHC52034	FHD52034

## TEMPLATES – ENGLISH OPEN ELECTIVE

Paper No	Sem	Course code	Title of the Course	Course type	LTP	Credit	Hours/Week	CI	C2	C3	Total Marks
1	I	FHA900	Functional English Grammar & Study Skills	OE	3:0:0	3	3	20	20	60	100
2	II	FHB900	Spoken English for Corporate Jobs	OE	3:0:0	3	3	20	20	60	100
3	III	FHC900	Speaking & Listening Skills	OE	3:0:0	3	3	20	20	60	100
4	IV	FHD900	Translation Theory & Practice	OE	3:0:0	3	3	20	20	60	100

### COURSE CODE: ENGLISH OPEN ELECTIVE

I SEMESTER	II SEMESTER	III SEMESTER	IV SEMESTER
FHA900	FHB900	FHC900	FHD900

## TEMPLATES – SPECIAL ENGLISH BA/ BSc/ BCA/B Com/BBA

Paper No	Sem	Course code	Title of the Course	Course type	LTP	Credit	Hours/Week	CI	C2	C3	Total Marks
1	I	FHA110	Poetry, Prose & Grammar	AECC	2:1:0	3	2+2	20	20	60	100
2	II	FHB110	Poetry, One-Act Plays & Grammar	AECC	2:1:0	3	2+2	20	20	60	100
3	III	FHC110	Novel & Language Component	AECC	2:1:0	3	2+2	20	20	60	100
4	IV	FHD110	Play & Language Component	AECC	2:1:0	3	2+2	20	20	60	100

### COURSE CODE: BA/ BSc/ BCA/BCom/BBA

I SEMESTER	II SEMESTER	III SEMESTER	IV SEMESTER
FHA110	FHB110	FHC110	FHD110

## TEMPLATES –BVoc

Paper No	Sem	Course code	Title of the Course	Course type	LTP	Credit	Hours/Week	CI	C2	C3	Total Marks
1	II	FFB020 FDB020 FMB020	Poetry, Prose & Grammar	AECC	3:0:0	3	3	20	20	60	100

Course Code: II Semester

Food Processing - FFB020  
 Software Development – FDB020  
 Animation – FMB020

Course Code: FHA02031/32/33/34/35  
FSA02031/32/33/34/35/36/37/38/39/40/42/42  
FAA020

**BA/BSc/BCA**  
**I Semester**  
**CBCS Semester Scheme NEP - 2020**  
**English Language – I**  
**Reverberations 1**

**3 Credits / 4 hours week**

**Unit – I:**

**POETRY**

- |                      |                        |
|----------------------|------------------------|
| 1. When in Disgrace  | -William Shakespeare   |
| 2. The Pulley        | - George Herbert       |
| 3. The Quiet Life    | - Alexander Pope       |
| 4. Fidelity          | - William Wordsworth   |
| 5. The Man He Killed | - Thomas Hardy         |
| 6. Freedom           | - Rabindranath Tagore  |
| 7. Refugee Blues     | - W H Auden            |
| 8. The Cold Within   | - James Patrick Kinney |

**PROSE**

- |                                    |                         |
|------------------------------------|-------------------------|
| 1. With the Photographer           | - Stephen Leacock       |
| 2. Prospects of Democracy in India | - Dr. B R Ambedkar      |
| 3. What is Science?                | - George Orwell         |
| 4. Fool's Paradise                 | - Isaac Bashevis Singer |

**Unit - II**

**LANGUAGE COMPONENT AND LITERARY ACTIVITY**

1. Punctuation
2. Articles
3. Prepositions
4. Verb in relation to tense, Person and Number of the Subject  
(Subject – Verb Agreement/Concord)

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHA02031/32/33/34/35**  
**FSA02031/32/33/34/35/36/37/38/39/40/42/42**  
**FAA020**

**Pattern of Question Paper**  
**I Semester BA/BSc/BCA Examination**  
**CBCS Semester Scheme NEP - 2020**  
**English Language - I**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I. Answer the following questions in a word or a phrase or a sentence: 8x1=8

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

**Section – B**

II. Annotate any three of the following: 3x4=12

- 1
- 2
- 3
- 4
- 5

**Section – C**

III. Answer any Two of the following: 2x5=10

- 1
- 2
- 3
- 4

**Section – D**

IV Answer any Two of the following: 2x5=10

- 1
- 2
- 3
- 4

**Section – E**

V Language Component

1. Punctuate the following: 5x1=5
2. Fill in the blanks with appropriate Articles 5x1=5
3. Fill in the blanks with appropriate Prepositions 5x1=5
4. Choose the correct form of the verb: 5x1=5



**Course Code: FHB02031/32/33/34/35**  
**FSB02031/32/33/34/35/36/37/38/39/40/42/42**  
**FAB020**

**BA/BSc/BCA**  
**II Semester**  
**CBCS Semester Scheme NEP - 2020**  
**English Language – 2**  
**Reverberations 2**

**3 Credits / 4 hours week**

**Unit – I:**

**POETRY**

- |                                   |                              |
|-----------------------------------|------------------------------|
| 1. How do I Love Thee (Sonnet 43) | - Elizabeth Barrett Browning |
| 2. The Laboratory                 | - Robert Browning            |
| 3. Thou Art Indeed Just, Lord     | - Gerald Manley Hopkins      |
| 4. The Bread of the People        | - Bertolt Brecht             |
| 5. No Men Are Foreign             | - James Kirkup               |
| 6. Bankers are Like Anybody else  | - Ogden Nash                 |
| 7. The Caged Bird                 | - Maya Angelou               |
| 8. Stammer                        | - K Satchidanandan           |

**PROSE**

- |  |                        |
|--|------------------------|
| 1. The Story of an Hour                      | - Kate Chopin          |
| 2. The Social Responsibilities of Scientists | - Bertrand Russell     |
| 3. A Devoted Son                             | - Anita Desai          |
| 4. Pandit Jasraj                             | - Captain G R Gopinath |

**Unit - II**

**LANGUAGE COMPONENT AND LITERARY ACTIVITY**

- 1 Adjective
- 2 Adverbs
- 3 Linkers (Conjunctions)
- 4 Words Often Confused

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code:** FHB02031/32/33/34/35

F SB02031/32/33/34/35/36/37/38/39/40/42/42

FAB020

**Pattern of Question Paper**  
**II Semester**  
**CBCS Semester Scheme NEP - 2020**  
**BA/BSc/BCA Examination**  
**English Language - II**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I. Answer the following questions in a word or a phrase or a sentence:

8x1=8

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

**Section – B**

II Annotate any three of the following:

3x4=12

- 1
- 2
- 3
- 4
- 5

**Section – C**

III Answer any Two of the following:

2x5=10

- 1
- 2
- 3
- 4

**Section – D**

IV Answer any Two of the following:

2x5=10

- 1
- 2
- 3
- 4

**Section – E**

V Language Component

1 Identify the adjectives in the following sentences:

5 x 1=5

2 Identify the adverbs in the following sentences:

5 x 1=5

3 Rewrite the following sentences using suitable linkers given in the brackets

5 x 1=5

4 Choose the correct word given in brackets

5 x 1=5

**Course Code: FHC02031/32/33/34/35**  
**FSC02031/32/33/34/35/36/37/38/39/40/42/42**  
**FAC020**

**BA/BSc/BCA**  
**III Semester**  
**CBCS Semester Scheme NEP - 2020**  
**English Language – 3**  
**Fiction and Language Component**

**3 Credits / 4 hours week**

**UNIT – I**

**Receptive Skills: Reading and Listening Skills**

**Novel:**

The Guide

R K Narayan

**UNIT - II**

**LANGUAGE COMPONENT**

1. Question Tag
2. Framing Question
3. One word Substitutes
4. Words Often Confused

**TUTORIAL ACTIVITIES**

News Paper Reading, Report Writing, Story Telling, Recitation, Review of Current Literature Activities, Dialogue Development, Elocution, Extempore Speech, Conversation Writing

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code:** FHC02031/32/33/34/35

FSC02031/32/33/34/35/36/37/38/39/40/42/42

FAC020

**Pattern of Question Paper  
III Semester  
CBCS Semester Scheme NEP - 2020  
BA/BSc/BCA Examination  
English Language - III**

**Hours: 02**

**Max. Marks: 60**

**Section – A  
(Novel)**

I Answer Two of the following:

2x10=20

- 1
- 2
- 3
- 4

**Section - B**

II. Write short notes on Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Section – C**

III. Language Component

- 1 Add suitable question tags for the following: 5 x1=5
- 2 Frame questions for the following so as to get the underlined word as answer: 5 x1=5
- 3 Write one-word substitute for the following: 5 x1=5
- 4 Fill in the blanks choosing the correct word from the brackets 5 x1= 5

Course Code: FHD02031/32/33/34/35  
FSD02031/32/33/34/35/36/37/38/39/40/42/42  
FAD020

**BA/BSc/BCA**  
**IV Semester**  
**CBCS Semester Scheme NEP - 2020**  
**English Language – 4**  
**Play and Language Component**

**3 Credits / 4 hours week**

**Receptive Skills: Reading and Listening Skills**

**Unit - I**

**Play:**

Othello

- William Shakespeare

**UNIT - II**

**LANGUAGE COMPONENT**

1. Active and Passive Voice
2. Linkers
3. Precise Writing
4. Essay Writing

**TUTORIAL ACTIVITIES**

News Paper Reading, Report Writing, Story Telling, Recitation, Review of Current Literature Activities, Dialogue Development, Elocution, Extempore Speech, Conversation Writing

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code:** FHD02031/32/33/34/35  
FSD02031/32/33/34/35/36/37/38/39/40/42/42  
FAD020

**Pattern of Question Paper**  
**IV Semester**  
**CBCS Semester Scheme NEP - 2020**  
**BA/BSc/BCA Examination**  
**English Language - 4**

**Hours: 02**

**Max. Marks: 60**

**Section – A**  
**(Play)**

I Annotate Four of the following:

4x5=20

- 1
- 2
- 3
- 4

**Section – B**  
**(Play)**

II Answer Two of the following:

2x10=20

- 1
- 2
- 3
- 4

**Section – C**

III. Language Component

- 1 Change the Voice of the following sentences: 5 x1=5
- 2 Combine the following sentences by using the Linkers given in the brackets: 5 x 1=5
- 3 Write a precise of the following passage: 5 x 1=5
- 4 Write an Essay on any one of the following: 5 x1= 5

**Course Code: FCA020/ FBA020**

**I Semester  
B Com/ BBA  
CBCS Semester Scheme NEP - 2020  
English Language 1  
Resplendence 1**

**3 Credits / 4 hours week**

**Unit – I:**

**POETRY**

1. When Forty Winters Shall Besiege Thy Brow (Sonnet 2) -William Shakespeare
2. Avarice - George Herbert
3. O, My Luv’s like a Red Red Rose - Robert Burns
4. The World is Too Much with Us - William Wordsworth
5. The Illusion of Religion - Rabindranath Tagore
6. A Wagon of Shoes - Avrom Sutzkever
7. On Killing A Tree - Gieve Patel
8. Nine Gold Medals - David Roth

**PROSE**

1. The Storyteller - Saki
2. The Position of Women in Hinduism and Buddhism - Dr. B R Ambedkar
3. The Miser - George Orwell
4. Going Green - Ramachandra Guha

**Unit - II**

**LANGUAGE COMPONENT AND LITERARY ACTIVITY**

1. Punctuation
2. Articles
3. Prepositions
4. Verb in relation to tense, Person and Number of the Subject  
(Subject – Verb Agreement/Concord)

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FCA020/ FBA020**

**Pattern of Question Paper  
I Semester BCom/BBA Examination  
CBCS Semester Scheme NEP - 2020  
English Language - I**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I. Answer the following questions in a word or a phrase or a sentence:

8x1=8

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

**Section – B**

II. Annotate any three of the following:

3x4=12

- 1
- 2
- 3
- 4
- 5

**Section – C (Poetry)**

III Answer any Two of the following:

2x5=10

- 1
- 2
- 3
- 4

**Section – D (Prose)**

IV Answer any Two of the following:

2x5=10

- 1
- 2
- 3
- 4

**Section – E**

V Language Component

1. Punctuate the following:

5x1=5

2. Fill in the blanks with appropriate Articles

5x1=5

3. Fill in the blanks with appropriate Prepositions

5x1=5

4. Choose the correct form of the verb:

5x1=5



Course Code: FCB020/ FBB020

**II Semester**  
**B Com/ BBA**  
**CBCS Semester Scheme NEP - 2020**  
**English Language 2**  
**Resplendence 2**

**3 Credits / 4 hours week**

**Unit – I:**

**POETRY**

- |                           |                   |
|---------------------------|-------------------|
| 1. Death, Be not Proud    | - John Donne      |
| 2. The Last Duchess       | - Robert Browning |
| 3. Ozymandias             | - P B Shelley     |
| 4. Unknown Citizen        | - W H Auden       |
| 5. I, Too                 | - Langston Hughes |
| 6. Mirror                 | - Sylvia Plath    |
| 7. Mending Wall           | - Robert Frost    |
| 8. Ulysses by the Merlion | - Edwin Thamboo   |

**PROSE**

- |                                     |                    |
|-------------------------------------|--------------------|
| 1. After Twenty Years               | - O, Henry         |
| 2. On the Rule of the Road          | - A G Gardiner     |
| 3. We Want no Caesars (Rashtrapath) | - Jawaharlal Nehru |
| 4. The Night Train at Deoli         | - Ruskin Bond      |

**Unit - II**

**LANGUAGE COMPONENT AND LITERARY ACTIVITY**

1. Adjectives
2. Adverbs
3. Linkers (Conjunctions)
4. Words often confused

**Scheme of Evaluation - Formative Assessment**

Assessment Occasion/type	Weightage in marks
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FCB020/ FBB020**

**II Semester B Com/BBA Examination  
CBCS Semester Scheme NEP - 2020  
English Language - 2**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I. Answer the following questions in a word or a phrase or a sentence:

8x1=8

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

**Section – B**

II Annotate any three of the following:

3x4=12

- 1
- 2
- 3
- 4
- 5

**Section – C**

III Answer any Two of the following:

2x5=10

- 1
- 2
- 3
- 4

**Section – D**

IV Answer any Two of the following:

2x5=10

- 1
- 2
- 3
- 4

**Section – E**

**V Language Component**

a Identify the adjectives in the following sentences:

5 x 1=5

b Identify the adverbs in the following sentences:

5 x 1=5

c Rewrite the following sentences using suitable linkers given in the brackets

5 x 1=5

d Choose the correct word given in brackets

5 x 1=5

**Course Code: FCC020/ FBC020**

**III Semester  
B Com/ BBA  
CBCS Semester Scheme NEP - 2020  
English Language – 3  
Fiction and Language Component**

**3 Credits / 4 hours week**

**UNIT – I**

**Receptive Skills: Reading and Listening Skills**

**Novel:**

The Financial Expert

R K Narayan

**UNIT - II**

**LANGUAGE COMPONENT**

1. Question Tag
2. Framing Question
3. One word Substitutes
4. Words Often Confused

**TUTORIAL ACTIVITIES**

News Paper Reading, Report Writing, Story Telling, Recitation, Review of Current Literature Activities, Dialogue Development, Elocution, Extempore Speech, Conversation Writing

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FCC020/ FBC020**

**Pattern of Question Paper  
III Semester  
CBCS Semester Scheme NEP - 2020  
B Com/BBA Examination  
English Language - III**

**Hours: 02**

**Max. Marks: 60**

**Section – A  
(Novel)**

I Answer Two of the following:

2x10=20

- 1
- 2
- 3
- 4

**Section – B  
(Novel)**

II Write short notes on Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Section – C**

III. Language Component

- |   |         |
|---|---------|
| 1 Add suitable question tags for the following:                                 | 5 x1=5  |
| 2 Frame questions for the following so as to get the underlined word as answer: | 5 x1=5  |
| 3 Write one-word substitute for the following:                                  | 5 x1=5  |
| 4 Fill in the blanks choosing the correct word from the brackets                | 5 x1= 5 |

**Course Code: FCD020/ FBD020**

**IV Semester  
B Com/ BBA  
CBCS Semester Scheme NEP - 2020  
English Language – 4  
Play and Commercial Correspondence**

**3 Credits / 4 hours week**

**UNIT – I**

**Receptive Skills: Reading and Listening Skills**

**Play:**

A Christmas Carol

Charles Dickens

**UNIT – II**

**Commercial Correspondence**

- 1 Quotation and Enquiry Letters
- 2 Orders and Complaint Letters
- 3 Circulars
- 4 Report Writing

**TUTORIAL ACTIVITIES**

News Paper Reading, Report Writing, Story Telling, Recitation, Review of Current Literature Activities, Dialogue Development, Elocution, Extempore Speech, Conversation Writing

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FCD020/ FBD020**

**Pattern of Question Paper  
IV Semester  
CBCS Semester Scheme NEP - 2020  
B Com/BBA Examination  
English Language - 4**

**Hours: 02**

**Max. Marks: 60**

**Section – A  
(Play)**

I Annotate Four of the following:

4x5=20

- 1
- 2
- 3
- 4

**Section – B  
(Play)**

II Answer Two of the following:

2x10=20

- 1
- 2
- 3
- 4

**Section – C**

III Commercial Correspondence

- 1 Quotation and Enquiry Letters
- 2 Orders and Complaint Letters
- 3 Circulars
- 4 Report Writing

5x1=5  
5x1=5  
5x1=5  
5x1=5

**Course Code: FHA510**

**BA- ENGLISH (HONOURS)  
I Semester**

**Course 1: Introduction to Literature  
DSCC**

**3 Credits / 3 hours week**

**Unit –I: Introduction to Literature**

Chapter 1: What is Literature? Define Literature. Why Study Literature?

Chapter 2: Literature and Society – Literature and Life

Chapter 3: Literature and Science. Elements of Literature

**Unit – II: Literary Forms**

Chapter 4: Poetry – Lyric, Sonnet, Ballad, Epic, Elegy

Chapter 5: Drama - Comedy, Tragedy, Tragic-comedy

Chapter 6: Prose - Novel, Short Story, Essay, Autobiography

**Unit - III: Literary Terms and Figurative Language**

Chapter 7: Couplet, Allegory, Alliteration, Assonance, Refrain, Monologue,  
Soliloquy, Plot, Character, Narrative Technique

Chapter 8: Farce, Simile, Metaphor, Personification, Hyperbole, Satire,  
Prologue, Epilogue, Metre and Metrical Devices

Chapter 9: Euphemism, Irony, Oxymoron, Synecdoche, Understatement,  
Paradox, Allusion

**Text Books:** 1. Glossary Literary Terms by M H Abrams

2. Hudson, William Henry; *An Introduction to the Study of Literature New  
DelhiAtlantic 2007*

## References

1. Baldick, Chris. *The Oxford Dictionary of Literary Terms*. OUP, 2001.
2. Bate, Jonathan. *English Literature: A Very Short Introduction*. OUP.
3. Benett, Andrew. *An Introduction to Literature, Criticism and Theory*. Routledge.
4. Eagleton, Terry. *How to Read Literature*. Yale University Press.
5. Eaglestone, Robert. *Doing English; A Guide for Literature Students*. Routledge, 2000. Gopal, Priyamvada. *The Indian English Novel; Nation History, and Narration*.
6. Hudson, William Henry. *An Introduction to the Study of Literature*. New Delhi Atlantic, 2007.
7. Mehrotra, Arvind, Ed; *An Illustrated History of Indian Literature in English*. Orient Blackswan, 2005
8. Ousby, Iain. Ed; *The Cambridge Guide to Literature in English*, Cambridge University Press. 1983
9. The McGraw-Hill. *Introduction to Literature*

**Pedagogy: Lectures, Seminar, Role play, Group discussion**

## Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	Weightage in marks
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>



**Course Code: FHA510**

**Pattern of Question Paper  
BA- ENGLISH (HONOURS)  
I Semester  
Course 1: Introduction to Literature  
Course-1  
DSCC**

**Hours: 02**

**Max. Marks: 60**

**Section – A  
Introduction to Literature**

I Answer Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Section - B  
Literary Forms**

II Answer Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Section - C  
Literary Terms and Figurative Language**

III Answer Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Course Code: FHA520**

**BA- ENGLISH (HONOURS)**  
**I Semester**  
**Course 2: Indian Writing in English-Part I**  
**DSCC (Paper-1)**

**3 Credits / 3 hours week**

**Unit – I: History of Indian English Literature (Pre-Independence period)**

Chapter 1: The Nature and Scope of Indian English Literature; Charges against Indian English Literature. (Ref: M K Naik, A History of Indian English Literature - Chapters 1 and 6)

Chapter 2: Pre-Independence Indian English Poetry, Prose, Drama and Novel

Chapter 3: Introducing authors/texts from the pre-independence era – Raja Ram Mohan Roy, Toru Dutt, Aurobindo, Swami Vivekananda, Bankim Chandra Chattopadhyay, Mahatma Gandhi, Dr. B R Ambedkar, Rabindranath Tagore, Sarojini Naidu, Henry Derozio, Dean Mahomet

**Unit - II: Pre-Independence Fiction**

Kanthapura

- Raja Rao

**Unit - III: Indian English Poetry, Short Stories and Essays**

**Poetry**

Our Casuarina Tree

- Toru Dutt

Coromandel Fishers

- Sarojini Naidu

**Short Stories**

Barber's Trade Union

- Mulk Raj Anand

My Lord, The Baby

- Rabindranath Tagore

**Essays**

The Great Sentinel

- M K Gandhi

A Childhood Journey to Koregaon

- B R Ambedkar

**Text Books:**

1. Naik, M. K. A History of Indian English Literature. Delhi: Sahitya Academy, 1992.
2. Iyengar, K R S. Indian Writing in English. New Delhi. Sterling Publisher, 1984.

**References**

1. Deshmane, Chetan, ed. Muses India: Essays on English-Language Writers from Mahometto Rushdie. Jefferson, NC, and London: McFarland & Co., 2013.
2. Iyengar R S. Indian Writing in English. New Delhi. Sterling Publisher, 1984.
3. Makarand Paranjape (Ed) *Indian Poetry in English*, Madras: Macmillan, 1993
4. Naik, M. K. A History of Indian English Literature. Delhi: Sahitya Academy, 1992.
5. (M. K. Naik (Ed) *The Indian English Short Story: A Representative Anthology*, NewDelhi: Arnold-Heinemann, 1984)
6. Mukherji, Meenakshi. The Twice Born Fiction. New Delhi: Heinemann, 1971.
7. Narasimhiah C D ed *Makers of Indian English Literature*, Delhi Pencraft International2000
8. Radhakrishnan, N. Indo Anglian Fiction: Major Trends and Themes. Madras:Emerald.1984
9. Rao, Krishna. The Indo-Anglian Novels and the Changing Tradition. Mysore: Rao andRaghavan, 1973.

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHA520**

**Pattern of Question Paper  
BA- ENGLISH (HONOURS)  
I Semester  
Course 2: Indian Writing in English-Part I  
DSCC (Paper-1)**

**Hours: 02**

**Max. Marks: 60**

**Section – A  
History of Indian English Literature (Pre-Independence Period)**

I Answer Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Section - B  
Pre-Independence Fiction**

II Answer Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Section - C  
Indian English Poetry, Short Stories and Essays**

III Answer Four of the following:

4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Course Code: FHB510**

**3 Credits / 3 hours week**

**BA- ENGLISH (HONOURS)**  
**II Semester**  
**Course 3: Introduction to Phonetics and Linguistics**  
**DSCC**

**Unit I: Introduction to Phonetics and Linguistics**

Chapter 1: Language - Its nature, definitions, characteristic features

Chapter 2: Linguistics – Definitions, Scope

Chapter 3: Branches of Linguistics

**Unit II: Phonetics and Phonology**

Chapter 4: Speech Mechanism, Organ of Speech

Chapter 5: Production of Speech Sounds, Classification of Speech Sounds – Vowels and Consonants

Chapter 6: Transcription of Words, Word Stress, Allophone-Phoneme

**Unit III: Morphology, Syntax and Semantics and Lexicon**

Chapter 7: Morphology – Morph Word Classes: Lexicon Categories, Functional Categories,

Chapter 8: Syntax – Types of Sentences – basic Terminology, Categories and functions, Functions of Clauses

Chapter 9: Semantics and Lexicon – Word meaning: Entailment and Hyponymy  
Meaning Opposites, Semantic features

### **Text Books**

1. Cruse, Alan. Meaning in Language. (Oxford: Oxford University Press, 2000).
2. Fromkin, V. (ed.) 2000. Linguistics: An Introduction to Linguistics. Cambridge: Blackwell.
3. Rocca, I., and W. Johnson. A Course in Phonology. (Oxford: Blackwell, 1994).

### **References:**

Aronoff, M., and Kirsten Fudeman. What is Morphology. (Oxford: Blackwell,2010).

Booij, G E. The Grammar of Words: An Introduction to Linguistic Morphology.

(Oxford: OUP, 2007).Catford, J. C. A Practical Introduction to Phonetics.

(Oxford: Oxford University Press, 1988).

Culicover, P. W. Principles and Parameters: An Introduction to Syntactic Theory.

(Oxford: Oxford UniversityCruse, Alan. Meaning in Language. (Oxford: Oxford University Press, 2000).

Fromkin, V. (ed.) 2000. Linguistics: An Introduction to Linguistics.

Cambridge: Blackwell. Kenstowicz, M. 1994. Phonology in Generative Grammar. Cambridge: Blackwell.

Goldsmith, J. (ed). Phonological Theory: The Essential Readings.

(Cambridge: Blackwell, 1999). Radford, A. et al. 1999. Linguistics: An Introduction. Cambridge: Cambridge University Press. Radford, A.

Transformational Grammar. (Cambridge: Cambridge University Press, 1988).

Rocca, I., and W. Johnson. A Course in Phonology. (Oxford:

Blackwell, 1994).Saeed, John I. Semantics (2nd ed). (Oxford:

Basil Blackwel, 2003)l.

**Pedagogy: Lectures, Seminar, Role play, Group discussion**

### **Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10

<b>Total</b>	<b>40</b>
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**Course Code: FHB510**

**Pattern of Question Paper**  
**BA- ENGLISH (HONOURS)**  
**II Semester**  
**Course 3: Introduction to Phonetics and Linguistics**

**DSCC**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Answer the following: (questions from all sections)

10x2=20

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

**Section – B**

II Answer four of the following: (questions from all sections)

4x5=20

- 1
- 2
- 3
- 4

**Section -C**

III Answer two of the following:

2x10=20

- 1
- 2
- 3
- 4

**Course Code: FHB520**

**3 Credits / 3 hours week**

**BA- ENGLISH (HONOURS)**  
**II Semester**  
**Course 4: Indian Writing in English- Part 2**  
**(DSCC- Paper II)**

**Unit – 1 History of Indian English Literature**

Chapter 1: Post-Independence (1947 - 1980) Indian English Poetry and Prose  
Chapter 2: Post-Independence (1947 - 1980) Indian English Drama and Novel  
Chapter 3: Post – 1980s Indian English Literature

**Unit – 2 Introducing Writers of the Post-Independence Era**

Chapter 4: Kamala Das, Shashi Deshpande, Chaman Nahal, Manohar Malgoankar, Amitav Ghosh, K A Abbas, Vikram Seth, Arundathi Roy, Arun Joshi, G B Desani, T P Kailasam, Girish Karnad  
Chapter 5: Anita Desai, Manju Kapur, Arvind Adiga, Chitra Banerjee, Divakaruni, Namitha Gokhale  
Chapter 6: Kiran Desai, Anita Nair, Mahesh Dattani, Salman Rushdie, Ruskin Bond, Jeet Thayil, Sunithi Namjoshi, Arun Kolatker

**Unit – 3 Illustrative Texts**

**Poetry**

- |   |                   |
|---|-------------------|
| 1. Don't Call Me Indo-Anglian               | -Syed Aman ud din |
| 2. An Introduction                          | - Kamala Das      |
| 3. Small Scale Reflections on a Great House | - A K Ramanujan   |
| 4. Good bye Party to Miss Pushpa T S        | - Nissim Ezekiel  |

**Novel**

Train to Pakistan - Kushwant Singh

**Short-Story**

Seven Steps Around the Fire - Mahesh Dattani  
(Stage - Play)



### Text Books

1. Naik, M. K. A History of Indian English Literature. Delhi: Sahitya Akademi, 1992.
2. Iyenger, K R S. Indian Writing in English. New Delhi. Sterling Publisher, 1984.
3. Kushwant Singh's *Train To Pakistan*
4. A short Play: Mahesh Dattani's *Seven Steps Around the Fire (Stage Play)*

### References:

Ansani, Shyam M. New Dimensions of Indian English Novels, Delhi: Doaba House, 1987  
Devy, G. N.

After Amnesia: Tradition and Changes in Indian Literary Criticism.  
Hyderabad: Orient Longman and Sangam Books, 1992.

Devy, G.N. An Another Tongue: Essays on Indian English Literature,  
Madras: Macmillan India Ltd. 1995.

Gandhi, Leela. Post-Colonialism, New : Oxford University Press, 2002.

Jain, Jasbir. Beyond Postcolonialism: Dreams and Realities of a Nation, Jaipur:  
Rawat Publications, 2006.

Makarand Paranjape (Ed) *Indian Poetry in English*, Madras: Macmillan, 1993  
(M. K. Naik (Ed) *The Indian English Short Story: A Representative Anthology*,  
New Delhi: Arnold-Heinemann, 1984)

Mukherji, Meenakshi.

The Twice Born Fiction. New Delhi: Heinemann, 1971. Vishwanathan, G. Masks of  
Conquest: Literary Study and British Role in India. New

### Pedagogy: Lectures, Seminar, Role play, Group discussion

### Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	Weightage in marks
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHB520**

**Pattern of Question Paper**  
**BA- ENGLISH (HONOURS)**  
**II Semester**  
**Course 2: Indian Writing in English-Part II**  
**DSCC (paper-1I)**

**Hours: 02**

**Max. Marks: 60**

**Section – A**  
**History of Indian English Literature (Post-Independence period)**

I Answer two of the following: 2x5=10

- 1.
- 2.
- 3.

**Section - B**  
**Introducing Writers of the Post-Independence Era**

II Answer two of the following: 2x5=10

- 1.
- 2.
- 3.

**Section – C**  
**Poetry**

III Answer four of the following: 4x5=20

- 1.
- 2.
- 3.
- 4.
- 5.

**Section – D**  
**Novel & Short Play**

IV Answer the following selecting two from Novel & two from short play: 4x5=20

- 1) Novel
  - A
  - B
  - C
- 2) Short Play
  - A
  - B
  - C

**Course Code: FHC510**

**BA – ENGLISH (HONOURS)**  
**III Semester - DSCC**  
**Course – 5: British Literature up to 1800 – Paper 1**  
**From Chaucer to the Age of Transition**

**3Credits / 3 hours week**

**UNIT – I: HISTORY OF ENGLISH LITERATURE (UP TO 1800)**

The Social Context of Medieval English Literature, Renaissance, Elizabethan Poetry, Elizabethan Drama, Metaphysical Poetry, Restoration Drama, 18th Century Prose, Development of Novel in 18th Century, Neo-classical and Transitional Poetry

**UNIT II: MAJOR AUTHORS AND WORKS**

Geoffrey Chaucer, Francis Bacon, Ben Jonson, John Milton, John Dryden, Alexander Pope, Dr. Samuel Johnson, William Shakespeare, Oliver Goldsmith, John Bunyan, Aphra Behn, Margaret Cavendish, Elizabeth Cary, Anne Finch, Amelia Lanyer, Fanny Burney, Elizabeth Carter etc.

**Examples:** *King Lear, As You Like It, Volpone, Paradise Lost, Absalom and Achitophel, Rape of the Lock, Pamela, Letters of Elizabeth Carter etc*

**UNIT III: REPRESENTATIVE TEXTS**

**Sonnet**

- Shall I Compare Thee to a Summer's Day (Sonnet 18) -William Shakespeare
- On His Blindness - John Milton

**Lyric**

- Lover's Infiniteness - John Donne
- A Poison Tree - William Blake

**Essay**

- Of Love - Francis Bacon
- Man in Black -Oliver Goldsmith

**Play**

Doctor Faustus – Christopher Marlowe

### **Books recommended and suggested Reading**

1. Andrew Sanders, English Literature, OUP, 2005
2. Edward Albert, History of English Literature, OUP, 2014
3. M. H. Abrams, A Glossary of Literary Terms, Cengage Publishers, New Delhi.

### **Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

Course Code: FHC510

3 Credits / 3 hours week

**Pattern of Question Paper  
BA – ENGLISH (HONOURS)  
III Semester - DSCC**

**Course – 5: British Literature up to 1800 – Paper 1  
From Chaucer to the Age of Transition**

**Hours: 02**

**Max. Marks: 60**

Section – A

**History of English Literature (Up To 1800)**

**1 Answer any Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4

Section – B

**Major Authors and Works:**

**II Answer any Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4

Section – C

**Representative Texts**

**III Answer the following:**

**3x5=15**

1. a. Shall I Compare thee  
or  
b. On His Blindness
2. a. Lover's Infiniteness  
or  
b. A Poison Tree
3. a. Of Love  
or  
b. Man in Black

Section – D  
**(Doctor Faustus)**

**IV Answer Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4
- 5

**Course Code: FHC520**

**BA – ENGLISH (HONOURS)**  
**III Semester - DSCC**  
**Course – 6**  
**INDIAN LITERATURE IN TRANSLATION -PAPER 2**

**3Credits / 3 hours week**

**UNIT I: INTRODUCTION TO TRANSLATION STUDIES**

Introduction to Translation Studies in India:

- Translation as Discovery - Sujit Mukherjee
- Indian Literature in English Translation - G. N. Devy

**UNIT II: REPRESENTATIVE TEXTS**

- Cripple me Father (No. 59) Vachanas of Basavanna
- The Master in the House (No. 97)
- Speaking of Shiva (No. 26 and 73) Vachanas of Akkamahadevi
- :Do Not Quarrel over Caste: Kanakadasa (Translation by Dr. S. G. Vaidya)
- Songs of Sheriff (Translation by Dr. S. G. Vaidya)

**UNIT III: REPRESENTATIVE TEXTS**

**Short Stories:**

- The Silent Rattle - Dr. Basu Bevinagidad
- The Weed - Amrita Pritam
- A Tale of 1947 - Sadat Hasan Manto
- The Curd Seller – Masti

**Novel:**

- Chemmeen - T. S. Pillai

### **Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

### **Books recommended and suggested Reading**

1. Sujit Mukharjee. Translation as Discovery
2. Sharma T. R. S. (Ed). Ancient Indian Literature: An Anthology, (Vols 2: Classical Sanskrit, Prakrit, Apabhramsa), New Delhi: Sahitya Akademi, 2000
3. Kumar, Sukrita Paul (Ed). Cultural Diversity, Linguistic Plurality and Literary Traditions in India. New Delhi: Macmillan, 2005
4. Dev, Anjana et al (Ed) Indian Literature. New Delhi: Pearson, 2000

Course Code: FHC520

3 Credits / 3 hours week

**Pattern of Question Paper**  
**BA – ENGLISH (HONOURS)**  
**III Semester – DSCC**  
**Course – 6**  
**Indian Literature in Translation -Paper 2**

**Hours: 02**

**Max. Marks: 60**

Section – A

**Introduction to Translation Studies in India**

**I Answer any Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4

Section – B

**Vachanas and Songs**

**II Answer any Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4

Section – C

**Short Stories**

**III Answer any Three of the following:**

**3x5=15**

- The Silent Rattle
- The Weed
- A Tale of 1947
- The Curd Seller

Section – D  
**(Chemmeen)**

**IV Answer Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4
- 5



**Course Code: FHD510**

**BA – ENGLISH (HONOURS)**  
**IV Semester - DSCC**  
**COURSE 7**  
**BRITISH LITERATURE - 19TH AND 20TH CENTURY (PART 2)**  
**3Credits / 3 hours week**

**UNIT - I**

Romantic Poetry, Victorian Poetry, Pre-Raphaelite Poetry, Oxford Movement, Victorian Novel, 19th century Prose, Modern Poetry, WarPoetry, Oxford Poets, Modern Novel, Modern Drama, Problem Plays, Irish Theatre Movement, Modern Prose

**UNIT II: REPRESENTATIVE WRITERS, WORKS, TRENDS**

William Wordsworth, Jane Austen, Charles Lamb, William Hazlitt, Walter Scott, Alfred Tennyson, Matthew Arnold, John Ruskin, Thomas Carlyle, Cardinal Newman, Thomas Hardy, Charles Dickens, T. S. Eliot, W.B. Yeats, W. H. Auden. G. B. Shaw, Virginia Woolf, D. H. Lawrence, Graham Green, Somerset Maugham, J. M. Synge, John Galsworthy etc

**UNIT III: REPRESENTATIVE TEXTS**

**Poems**

- Dover Beach - Arnold
- Ode on a Grecian Urn - John Keats
- Journey of the Magi - T. S. Eliot
- Second Coming - W. B. Yeats

**Essays**

- Unto this Last (Veins of Wealth ) - John Ruskin
- Enslaved by Civilization - D. H. Lawrence
- On Letter Writing - A. G. Gardiner
- With the Photographer - Stephen Leacock

**Novel**

- Heart of Darkness - Joseph Conrad

### **Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

### **Books recommended and suggested Reading**

- 1 Andrew Sanders, English Literature, OUP, 2005
- 2 Edward Albert, History of English Literature, OUP, 2014
- 3 M. H. Abrams, A Glossary of Literary Terms, Cengage Publishers, New Delhi

Course Code: FHD510

3 Credits / 3 hours week

**Pattern of Question Paper**  
**BA – ENGLISH (HONOURS)**  
**IV Semester – DSCC**  
**Course – 7:**

**British Literature - 19th And 20th Century (Part 2)**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

**British Literature - 19th And 20th Century**

**I Answer any Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4
- 5

**Section – B**

**Representative Writers, Works, Trends**

**II Answer any Three of the following:**

**3x5=15**

- 1
- 2
- 3
- 4
- 5

**Section – C**

**III Answer any Two of the following:**

**2x5=10**

- 1 Dover Beach
- 2 Ode on a Grecian Urn
- 3 Journey of the Magi
- 4 Second Coming

**III Answer any Two of the following:**

**2x5=10**

- Unto this Last (Veins of Wealth )  
Enslaved by Civilization  
On Letter Writing  
With the Photographer

**Section – D**  
**(Heart of Darkness)**

**IV Answer any Two of the following:**

**2x5=10**

- 1
- 2
- 3
- 4



**Course Code: FHD520**

**BA – ENGLISH (HONOURS)  
IV Semester - DSCC  
COURSE 8  
GENDER STUDIES (PART 1)**

**3Credits / 3 hours week**

**UNIT I**

**Introduction to Gender Studies**

Concepts and trends: Sex and Gender, Femininity, Body, Feminist Politics, Patriarchy, Masculinity, Discrimination, Gynocentrism, Dichotomy, Third Gender, Masculinity, Queer Studies etc.

**UNIT II**

**Representative Writers, Works, Trends**

**Essays**

- Toward Feminist Poetics - Elaine Showalter
- What is patriarchy? /Understanding Gender - Kamala Bhasin
- Stench of Kerosene -Amrita Pritam
- Draupadi -Mahashweta Devi
- The Shadow -Shashi Deshpande
- Gulabi Talkies -Vaidehi

**UNIT III**

**Poems**

- Meeting Poets -Eunice D'Souza
- My Grandmother's House -Kamala Das
- Blessing -Imtiaz Dharkar
- To a Daughter on Rakshabandhan -Smita Agarwal

**Novel**

- The Prison We Broke - Baby Kamble

### **Books Recommended and Suggested Reading**

1 Butler, Judith. Gender Trouble: Feminism and the Subversion of Identity. Routledge, 1990

Connell, R. W. Masculinities. University of California Press, 1995

3 Nine Indian Women Poets: An Anthology - Eunice D'Souza (FourPoems)

### **Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

Course Code: FHD510

3 Credits / 3 hours week

**Pattern of Question Paper**  
**BA – ENGLISH (HONOURS)**  
**IV Semester – DSCC**  
**Course – 8**  
**GENDER STUDIES (PART 1)**

**Hours: 02**

**Max. Marks: 60**

**Section – A**  
**Introduction to Gender Studies**

**I Answer any Two of the following:**

**2x5=10**

- 1
- 2
- 3
- 4

**Section – B**  
**Representative Writers, Works, Trends**

**II Answer any Two of the following:**

**2x5=10**

- 1 Meeting Poets
- 2 My Grandmother's House
- 3 Blessing
- 4 To a Daughter on Rakshabandhan

**Section – C**  
**Essays**

**III Answer any Four of the following:**

**4x5=20**

- 1 Toward Feminist Poetics
- 2 What is patriarchy? /Understanding Gender
- 3 Stench of Kerosene
- 4 Draupadi
- 5 The Shadow
- 6 Gulabi Talkies

**Section – D**  
**(The Prison We Broke)**

**IV Answer any Four of the following:**

**4x5=20**

- 1
- 2
- 3
- 4
- 5
- 6

**Course Code: FHA900**

**3 Credits/ 3 hours week**

**ENGLISH  
OPEN ELECTIVE -1  
FUNCTIONAL ENGLISH, GRAMMAR AND STUDY SKILLS**

**Section I: Functional English Grammar**

1. Grammar of Spoken and Written English
2. Basic Sentence Patterns in English – Analysis of Sentence Patterns (SVO, SV, SVOC, SVOA, SVOA/C)
3. Functions of Various Types of Phrases: Noun Phrases, Verb Phrases, Adjective Phrases, Adverbial Phrases, Prepositional Phrases
4. Functions of Clauses: Noun Clause, Adjective Clause and Adverbial Clause and Prepositional Clauses
5. Verbs – Tense and Aspects, Modal Verbs, Functions and Use

**Section II: Writing Skills**

1. Writing as a Skill – Its Importance, Mechanism of Writing, Words and Sentences, Paragraph as a Unit of Structuring the Whole Text, Analysis of Paragraph
2. Functional Uses of Writing: Personal, Academic and Business
3. Writing Process: Planning a Text, Finding Materials, Drafting, Revising, Editing, Finalising Draft
4. Models of Writing: Expansion of Ideas, Dialogue Writing, Drafting an Email

**Section III: Reading Skills**

1. Meaning and Process of Reading
2. Strategies and methods to Improve Reading Skill
5. Sub-skills of Reading: Skimming, Scanning, Extensive Reading, Intensive Reading



### Scheme of Evaluation - Formative Assessment

Assessment Occasion/type	Weightage in marks
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

#### Suggested Reading:

1. Geoffrey Leech and Svartik. *Communicative Grammar of English*, Pearson
2. Geoffrey Leech. *English Grammar for Today*, Palgrave
3. Prasad P. *The Functional Aspects of Communicative Skills*.
4. Leena Sen. *Communication Skills*, Princeton Hall
5. Vandana Singh. *The Written Word*, OUP

**Course Code: FHB900**

**Pattern of Question Paper  
ENGLISH  
OPEN ELECTIVE -1  
FUNCTIONAL ENGLISH GRAMMAR AND STUDY SKILLS**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Answer the following: (questions from all sections) 10x2=20

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- J)

**Section – B**

II Answer the following: (questions from all sections) 4x5=20

- a)
- b)
- c)
- d)

**Section -C**

III Answer the following: 2x5=10

- 1) Write an imaginary conversation on any one of the following:
  - a)
  - b)
- 2) Expand any one of the following:
  - a)
  - b)

**Section – D  
Reading and Writing Skills**

IV Answer any one of the following: 1x10=10

- a) Writing skill
- b) Reading skill

Course Code: FHB900

3 Credits/ 3 hours Week

**ENGLISH OPEN ELECTIVE -2**  
**SPOKEN ENGLISH FOR CORPORATE JOBS**

**Section I:** English for Front Desk Management 1. Greeting, Welcoming 2. Dealing with Complaints, Giving Instructions or Directions 3. Giving Information: About Various Facilities, Distance, Area, Local Specialities, 4. Consultation and Solution of Problems 5. Accepting Praises and Criticism, Apologizing

**Section II:** Fluency and Etiquettes 1. Polite sentences and Words  
2. Use of Persuading words 3. Intonation and Voice Modulation  
4. Developing Vocabulary

**Section III:** Business Speeches 1. Principles of Effective Speech and Presentations 2. Speeches: Introduction, Vote of Thanks, Occasional Speech, Theme Speech 3. Use of Audio-Visual Aids in Presentations

**Section IV:** Cross-Cultural Communication 1. Dealing with Language Differences 2. Probing Questions to get information 3. Etiquettes in Cross-cultural Communication

**Scheme of Evaluation - Formative Assessment**

Assessment Occasion/type	Weightage in marks
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Suggested Readings:**

1. More effective communication – J V Vilanilam, Sage Publication Pvt Ltd.
2. Effective Documentation & Presentation – Rai & Raj Himalaya Publishing house – Mumbai
3. Commercial Correspondence & Office Management – R S N Pillai & Bhagawati, S Chand & Co.
4. Communication Today – Ray Rubeen, Himalaya Publishing House – Mumbai.
5. Business Communication – Lesikar & Pettit – AITBS – Publishers Delhi
6. Business Communication Today – Sushil Bahl – Response Books, Sage Publication, N. Delhi.
7. The Essence of Effective Communication – Ludlow & Panton PHI, N. Delhi.
8. Business Communication Pradhan Bhende & thankur Himalaya Publishing House – Mumbai.
9. Mastering Communication Skills and Soft Skills – N Krishnaswamy , Lalitha Krishnaswamy and others – Bloomsbury, New Delhi, 2015
10. Developing Communication Skills – Krishna Mohan and Banarji.

**Course Code: FHB900**

**Pattern of Question Paper  
ENGLISH  
OPEN ELECTIVE -2  
SPOKEN ENGLISH FOR CORPORATE JOBS**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Answer the following:

10x2=20

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

**Section - B**

II Write short notes on any four of the following:

4x5=20

- a)
- b)
- c)
- d)
- e)
- f)

**Section – C**

III Answer any two of the following:

2x10=20

- a)
- b)
- c)
- d)

**ENGLISH OPEN ELECTIVE -3**

**SPEAKING AND LISTENING SKILLS**

**Section I: Introduction to Phonetics**

**Speech Organs:**

Speech Mechanism – Classification of English Sounds, Description of English Vowels and Consonants, Consonant Clusters, IPA Symbols and Transcription (words, sentence and short paragraphs)

The Syllable Structure, Stress and Intonation – Their Patterns of Stress and Intonation in English Sentences and words (Transcription of short dialogues); Rules for Pronunciation

**2. Section II: Speaking Skills**

**Formal and Informal Speeches**

Language Functions: Greetings, Making Requests, Persuading, Complaining, Apologizing, Asking for and Giving Permission, Instruction and Directions, Agreeing and Disagreeing, Seeking for/ Giving Advice and Inviting.

**3. Section III: Listening Skills**

1. Definition of Listening; Listening versus Hearing, Process of Listening, Problems the Students Face in Listening; Sub-skills of Listening
2. What is Good Listening?
3. Barriers to Listening
4. Strategies of Listening
5. Listening Activities: Listening to News Broadcast, Telecast and News Bulletins

**4. Section IV: Presentation Skills**

1. Definition, Meaning and Goals of Presentation
2. Some Useful Expressions while Making Presentations – Opening Remarks, Stating Purposes, Giving an Outline, Giving Preliminary Information and Starting with a Context, Emphasizing Important Points, Drawing Attention to Visuals, Making Recommendation, Keeping Audience Involved, Summarising and Concluding, Inviting Questions.
3. Presentation in Practice - Making Welcome Speech, Introducing Guests to Audience, Making Farewell Speech, Proposing Vote of Thanks

**5. Suggested Reading:**

1. Kenneth and Anderson and Tony Lynch. *Study Speaking*, OUP
2. Sethy J. Et. Al., *Practice Course in English Pronunciation*, Princeton Hall
3. Prasad P. *Communication Skills*
4. Balasubrahmanya. *A Course in Phonetics for Indian Students*, MacMillan
5. Jayashree Mohanraj, *Speak Well*, Black Swan

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHC900**

**Pattern of Question Paper  
ENGLISH  
OPEN ELECTIVE -3  
SPEAKING AND LISTENING SKILLS**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Answer the following:

10x2=20

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

**Section - B**

II Write short notes on any four of the following:

4x5=20

- a)
- b)
- c)
- d)
- e)
- f)

**Section – C**

III Answer any two of the following:

2x10=20

- a)
- b)
- c)
- d)

**Question Paper Pattern**

1. Very Short Answer Questions on all sections 10x2 =20 Marks
2. Four Short Notes on all sections 4x 5 = 20 Marks
3. One Question on Presentation of Speeches 1x10 = 10 Marks
4. One Essay Type Question 1x10= 10 Marks

**Course Code: FHD900**

**3 Credits/ 3 hours Week**

**ENGLISH OPEN ELECTIVE -4**

**TRANSLATION THEORY AND PRACTICE**

**1 Translation**

Meaning, methods, problems and challenges of Translation  
Source Language and Target Language  
Translating poetry and prose, Technical translation

**2 Problems of Translation**

**3 Translation in Practice**

Practice five passages from Kannada to English and Five passages from English to Kannada

**Course and Skill Outcome**

1. This paper aims at teaching the students English language through literature.
2. It teaches them communication skills.

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>



**Course Code: FHA110**

**3 Credits/4 Hours Week**

**SPECIAL ENGLISH LANGUAGE**  
**I Semester - BA/BSc/BCA/B Com/BBA**  
**Poetry, Prose & Grammar**

**Unit -I**

**Poetry**

1. Seven Ages of Man - William Shakespeare
2. Death the Leveller - James Shirley
3. Partition - W H Auden
4. Night of the Scorpion - Nissim Ezekiel
5. Playthings - Rabindranath Tagore

**Unit – II**

**Prose**

1. On the Rule of the Road - A G Gardiner
2. The Tiger in the Tunnel - Ruskin Bond
3. How I became a Public Speaker - George Bernard Shaw
4. From Decolonizing the Mind - Ngugi wa Thiongo'O
5. The Accompanist - Anita Desai

**Unit - III**

**Grammar**

1. Parts of Speech
2. Punctuation
3. Letter Writing (Letter of Application/ Grievance Letter/ Personal Letter)
4. Comprehension

**Tutorial Activities**

Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHA110**

**Pattern of Question Paper  
BA/BSc/BCA/B com/BBA  
I Semester- Special English Language  
Poetry, Prose & Grammar**

**Hours: 03**

**Max. Marks: 60**

**Section – A**

I Answer the following questions in a word or a phrase or a sentence:

10x1=10

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

**Section – B  
(Poetry)**

II Answer any Three of the following:

3x5=15

- 1
- 2
- 3
- 4
- 5

**Section – C  
(Prose)**

III Answer any Three of the following:

3x5=15

- 1
- 2
- 3
- 4
- 5

**Section – D  
Grammar**

IV

- |                    |   |
|--------------------|---|
| 1. Parts of Speech | 5 |
| 2. Punctuation     | 5 |
| 3. Letter Writing  | 5 |
| 4. Comprehension   | 5 |

**SPECIAL ENGLISH LANGUAGE**  
**II Semester - BA/BSc/BCA/B Com/BBA**  
**Poetry, One-Act Plays & Grammar**

**Unit - I**

**Poetry**

- |                                  |                       |
|----------------------------------|-----------------------|
| 1. Sonnet 130                    | - William Shakespeare |
| 2. The Solitary Reaper           | - William Wordsworth  |
| 3. Mending Wall                  | - Robert Frost        |
| 4. The Ballad of Father Gilligan | - W B Yeats           |
| 5. Barter                        | - Sara Teasdale       |

**Unit – II**

**One-Act Plays**

- |                         |                   |
|-------------------------|-------------------|
| 1. The Pie and The Tart | - Hugh Chesterman |
| 2. The Man Upstairs     | - Hugh Beresford  |
| 3. The Never-Never Nest | - Cedric Mount    |

**Unit III**

**Grammar & Language Component**

1. Subject – Verb Agreement
2. Antonyms
3. Synonyms
4. Articles

**Tutorial Activities**

Newspaper Reading, Report Writing, Story Telling, Recitation, Dialogue development, Elocution, Extempore Speech, Conversation Writing

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHB110**

**Pattern of Question Paper  
BA/BSc/BCA/B com/BBA  
II Semester- Special English Language  
Poetry, Prose & Grammar**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Answer the following questions in a word or a phrase or a sentence:

10x1=10

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

**Section – B  
(Poetry)**

II Answer any Three of the following:

3x5=15

- 1
- 2
- 3
- 4
- 5

**Section – C  
(One-Act Plays)**

III Answer any Three of the following:

3x5=15

- 1
- 2
- 3
- 4
- 5

**Section – D  
Grammar**

IV

1. Subject – Verb Agreement
2. Antonyms
3. Synonyms
4. Articles

5x1=5

5x1=5

5x1=5

5x1=5

**Course Code: FHC110**

**3 Credits/4 Hours Week**

**SPECIAL ENGLISH LANGUAGE  
NOVEL AND LANGUAGE COMPONENT  
III Semester - BA/BSc/BCA/B Com/BBA**

**UNIT I:**

**Novel**

Things Fall Apart

Chinua Achebe

**UNIT II**

**Language Component**

Comprehension

Expansion of an idea

Idioms and Phrases

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHC110**

**Pattern of Question Paper  
BA/BSc/BCA/BCom/BBA  
III Semester- Special English Language**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Answer two of the following:

10x2=20

- 1
- 2
- 3
- 4

**Section – B**

II Write short notes on Four of the following:

4x5=20

- 1
- 2
- 3
- 4
- 5

**Section – C**

**Grammar**

1. Read the following passage and answer the questions set on it:

5x2=10

2 Expand one of the following:

1x5=5

- a
- b
- c

3 Use the following idioms and phrases in sentences of your own

1x5=5

Course Code: FHD110

3 Credits/4 Hours Week

**SPECIAL ENGLISH LANGUAGE  
PLAY AND LANGUAGE COMPONENT**

**IV Semester - BA/BSc/BCA/B Com/BBA**

**UNIT I:**

**Play**

The Merchant of Venice

William Shakespeare

**UNIT II**

**Language Component**

1 Paraphrase Writing

2 Correction of sentences

3 Linkers

**Scheme of Evaluation - Formative Assessment**

<b>Assessment Occasion/type</b>	<b>Weightage in marks</b>
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10
<b>Total</b>	<b>40</b>

**Course Code: FHD110**

**Pattern of Question Paper  
BA/BSc/BCA/BCom/BBA  
IV Semester- Special English Language**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Annotate three of the following:

3x5=15

- 1
- 2
- 3
- 4

**Section – B**

II Answer three of the following

3x10=30

- 1
- 2
- 3
- 4
- 5

**Section – C  
Grammar**

1. Paraphrase the following:

5x1=5

2 Correct the following sentences

1x5=5

- a
- b
- c
- d
- e

3 Complete the following sentences using the linkers given in the brackets

5x1=5



**B Voc**  
**LANGUAGE ENGLISH**  
**Semester - II**

**Unit – I**

**Prose**

- |                                  |                       |
|----------------------------------|-----------------------|
| 1. Playing the English Gentleman | - Mahatma Gandhi      |
| 2. Sweets for Angels             | - R K Narayan         |
| 3. Let's Go Home                 | - Kewlin Sio          |
| 4. How I became a Public Speaker | - George Bernard Shaw |
| 5. Marriage is a Private Affair  | - Chinua Achebe       |

**Unit – II**

**Poetry**

- |                       |                   |
|-----------------------|-------------------|
| 1. Ozymandias         | - P B Shelley     |
| 2. Matilda            | - Hilaire Belloc  |
| 3. River              | - A. K. Ramanujan |
| 4. The Road not Taken | - Robert Frost    |
| 5. If                 | - Rudyard Kipling |

**Unit III**

**Grammar**

1. Tenses (with focus on use of simple present tense and past tense)
2. Correction of Errors
3. Dialogue Writing: Common situations
4. Short speeches for welcoming, introducing, proposing vote of thanks and Independence Day and Republic Day

**Scheme of Evaluation - Formative Assessment**

Assessment Occasion/type	Weightage in marks
First Internal Test	10
Second Internal Test	10
First Class Test/ Assignments	10
Second Class Test/Assignments	10

<b>Total</b>	<b>40</b>
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**Course Code: FFB020, FDB020, FMB020**

**B Voc  
LANGUAGE ENGLISH  
Semester - II**

**Hours: 02**

**Max. Marks: 60**

**Section – A**

I Answer the following questions in a word or a phrase or a sentence:

10x1=10

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

**Section – B  
(Poetry)**

II Answer any Three of the following:

3x5=15

- 1
- 2
- 3
- 4
- 5

**Section – C  
(Prose)**

III Answer any Three of the following:

3x5=15

- 1
- 2
- 3
- 4
- 5

**Section – D  
Grammar**

IV

1. Tenses (with focus on use of simple present tense and past tense) 5
2. Correction of Errors 5
3. Dialogue Writing: Common situations 5
4. Short speeches for welcoming, introducing, proposing vote of thanks and Independence Day and Republic Day 5

## SEMESTER V

Course code-

### Modern Literature DSE – V B

#### Course Outcome:

After completion of the course the student is able to

- CO1. Have better understanding of life.
- CO2. Develop analytical and critical quality.
- CO3. Be creative in his day to day life and face the problems
- CO4. Relation between literature and real life.
- CO5. Compare and contrast the historical and modern works

#### UNIT 1: Poetry

- |                |  |
|----------------|--|
| 1. G.M.Hopkins | Pied Beauty<br>Thou Art Indeed Just, Lord<br>Starlight Night |
| 2. W. B. Yeats | Easter 1916<br>A Prayer for My Daughter                      |
| 3. T.S.Eliot   | Geration<br>The Hippopotamus                                 |
| 4. W.H.Auden   | Unknown Citizen<br>Muse De Beaux Arts                        |

#### Prose

- |            |   |
|------------|---|
| M.K.Gandhi | My Experiments with Truth<br>(Autobiography) Part I |
|------------|---|

#### Criticism

- |                               |   |
|-------------------------------|---|
| T.S.Eliot                     | Tradition and Individual Talent                   |
| D.H.Lawrence                  | Why the Novel Matters?                            |
| Chinua Achebe                 | Novelist as a Teacher                             |
| History of English Literature | The Modern age                                    |
| Mathew Arnold                 | The Functions of Criticism at the<br>present time |

#### Ref. Books:

*Poetry: Forces in Modern British Literature by W.Y.Tindall*  
*Narain Series*

*20<sup>th</sup> C Literature Penguin Classics*

*Criticism*

*An Outline of English Literature- Pat Rogers*

*Narain Series*

*20<sup>th</sup> C views*

*My Experiment with Truth – Mahadev Desai*

*An Introduction to the History of English Literature- W.H.Hudson*

*The Life and Death of Mahatma Gandhi- Robert Payne*

*The American Theatre- Allan S Downer*

DLF22214/ DLF22215

**BA VI Semester**  
**English Writing in Third World Countries**  
**DSE – V1 D**

**Course Outcome:**

**After completion of the course the student is able to**

- CO1. Understand the problems the of third world countries
- CO2. Know the rift between colonised and coloniser
- CO3. Understand the spirit of independence and limitations of freedom.
- CO4. Get the knowledge of pre and post independent socio-political and economic aspects of India.
- CO5. Develop critical and rational thinking.
- CO6. Understand the diversity and similarity in socio-cultural aspects of the third world countries.

**Unit- I- Poetry**

A.D.Hope	Song for St. Cecelia's Day
Rabindranath Tagore	Where the Mind is Without Fear
Peter Porter	Your Attention Please
Dennis Brutus	You Laughed, Laughed, and Laughed
Margaret Atwood	Journey to the Interior
Derek Walcott	A Far Cry From Africa
KishwarNaheed	I Am Not That Woman

**Unit-II-Novel**

Chinua Achebe	Things Fall Apart
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**Unit-III- Fiction**

V.S.Naipaul	A House for Mr. Biswas
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***Ref.:***

*Narain series*

*Online reference*

**Pattern of Question Paper  
Optional English**

**Max. Hrs- 3Max.**

**Marks-100**

**Section A**

**I. Annotate Four (2 from poetry & 2 from drama) of the following: 4x5=20**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Section B**

**Poetry**

**II. Answer Two of the following: 2x10=20**

- 1.
- 2.
- 3.
- 4.

**Section C**

**Drama**

**III. Answer Two of the following: 2x10=20**

- 1.
- 2.
- 3.
- 4.

**Section D**

**Essay**

**IV. Answer Two of the following: 2x5=10**

- 1.
- 2.
- 3.
- 4.

**V. Internal Assessment**

**30**





## NATIONAL EDUCATION POLICY- 2020

### Universities of Karnataka State under NEP-2020 in ENVIRONMENTAL SCIENCE

#### AECC - ENVIRONMENTAL STUDIES SYLLABUS

Number of Theory Credits	Number of lecture hours	Number of field work hours
2	45	5

	Content of AECC – Environmental Studies	45 hours
Unit 1	Introduction to Environmental Studies	45HOURS
	Multidisciplinary nature of environmental studies Scope and importance; Concept of sustainability and sustainable development.	2
Unit 2	Ecosystems	6
	What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem, c) Desert ecosystem, Aquatic ecosystems (ponds, , lakes, rivers,)	
Unit 3	Natural Resources: Renewable	8

	<b>and Non-Renewable</b>	
	land-use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.	
Unit 4	<b>Biodiversity and Conservation</b>	8
	biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	

Unit 5	Environmental Pollution	8
	Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks Solid waste management, Control measures of urban and industrial waste	
Unit 6	Environmental Policies & Practices	7
	Climate change, global warming, ozone layer depletion, acid Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).	
Unit 7	Human Communities and the Environment	6
	Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental	

	<p>movements: Chipko, Silent valley,  Bishnois of Rajasthan  Environmental ethics: Role of  Indian and other religions and  cultures in environmental  conservation</p>	
Unit 8	Field work	5

**JSS MAHAVIDYAPEETHA**  
**JSS COLLEGE OF ARTS, COMMERCE AND**  
**SCIENCE**  
**OOTY ROAD, MYSURU - 570025**



**Structure & Detailed**  
**Syllabus**

Four years Multidisciplinary Undergraduate  
Programme with Multiple Exit options  
in

**GEOGRAPHY**

B.A. / B.Sc. Geography Degree  
(Basic/Honours)

**2021 –2022**  
**2022 – 2023 onwards**

## **Syllabus & Regulations Governing the Choice-Based Credit System (CBCS)**

For the Four-Years (Eight Semesters) Bachelor of Arts / Bachelor of Science (B.A./B.Sc.) Geography Program

### **Eligibility for Admission:**

Candidates who have passed PUC in Science, Commerce, Arts in Karnataka State or any other States in India with equal qualifications are eligible for admission to the course, provided they have secured minimum of 50% marks in the qualifying examination (PUC/ +2 Level) (45% for SC / ST / Category-I Candidates).

The Candidates not studied Geography as an optional subject in PU/ 10+2 Level need to undergo one week bridge course programme conducted by the Geography department of the concerned Colleges.

### **Scheme and Duration of the Course:**

B.A./B.Sc. Geography Program consists of 8 semesters in four academic years.

### **Discipline Specific Core (DSC) Courses: (B-3 Model)**

First, second, third and fourth semesters will have one DSC course each. Every DSC course has 6 credits including practical component for 2 credits (4 credits for theory and 2 credits for practical).

Fifth and sixth semesters will have two Discipline Specific Core (DSC) courses in each semester for 5 credits including practical component for 2 credits (3 credits for theory and 2 credits for practical).

Seventh and eighth semesters will have three Discipline Specific Core (DSC) courses in each semester. In seventh semester, two DSC courses for 5 credits each including practical component for 2 credits (3 credits for theory and 2 credits for practical) and one DSC course has 3 credits without practical component. Whereas in eighth semester, one course will have a practical component for 2 credits apart from theory for 3 credits and the remaining two DSC courses for 3 credits each without practical component. Totally, the program has 14 DSC courses.

### **Open Elective (OE) Courses:**

Open Elective Course (OE) refers to Elective courses/papers in a non-core subject across all disciplines. First, second, third and fourth semesters will have one OE course in each semester. Every OE course has 3 credits with no practical component. OE courses are offered by the department for other disciplines and the candidates have to choose one OE from the pool in each semester. The OE courses enhance the geographical knowledge and help students in learning Geographical thinking and make them geographic literates. There are totally 4 OE courses in the program.

### **Vocational Courses:**

Fifth and Sixth semesters will have one vocational course for 3 credit in each semester. The candidates have to choose any one vocational course from the pool in each semester.

### **Internship:**

In sixth semester internship course for 2 credits is prescribed which is mandatory in nature. Each student is expected to prepare a report on Internship and shall make a presentation during the examination. The candidates are expected to complete this course between the Fifth and sixth semester under the supervision of a teaching faculty of the concerned department. These courses can enable students to obtain the required technical knowledge along with practical skill

### Discipline Specific Elective (DSE) Courses:

Fifth, Seventh and eighth semesters will have DSE courses. In Fifth semester one DSE course, in seventh semester two DSE courses and in Eighth semester two DSE course for credit of 3 each need to be studied by a student apart from the Research methodology course in seventh semester for 3 credits and Research project course for six credits in eighth semester. All the DSE courses have 3 credits with no practical component (100 marks).

### Research Methodology and Research Project:

The seventh semester will have research methodology course for 3 credits (60+40=100 marks) and in eighth semester students have to take up a research project course for 6 credits (100+100=200 marks). If a candidate is not interested to opt for the Research Project in the eighth semester such candidates can choose two more DSE course of 3 credits each from the given pool or can opt for Internship programme for 6 credits.

It is mandatory to select research project for six credits in Eighth semester and Research Methodology course in Seventh Semester for a candidate willing to pursue PhD program.

There shall be University examination at the end of each semester. The course pattern and the scheme of examinations are as follows:

### Duration of the Course:

The duration of the B.A./B.Sc. Geography Program shall extend over 8 semesters (Four academic years) of 16 weeks or more, each with a maximum of 90 actual working days of instruction in each semester.

### Course pattern:

The number of credits per semester may vary from 20 to 25, an average of 23 credits per semester and a total of around 186 credits for the program. The credits shall be based on the number of instructional hours per week, generally 1 credit per hour of instruction in theory and 1 credit for 2 hours of practical or project work or internship per week. The courses offered in the programme covers the Discipline Specific Core (DSC), Discipline Specific Elective (DSE), Open Elective (OE) Vocational courses and Internship.

### Medium of instruction:

The medium of instruction shall be English / Kannada.

### Attendance:

The course shall be treated as an independent unit for the purpose of attendance. A student shall attend a minimum of 75% of the total instruction hours in a course including assignments and seminars in each semester. The student who fails to secure 75% attendance in a course shall be required to repeat that semester.

### Internal Assessment:

Marks for internal assessment shall be awarded on the basis of Attendance, conducting internal Tests, assigning Case Studies and Assignments / Seminars and other activities. The internal assessment marks shall be notified on the department / college notice board for the information of the students and it shall be communicated to the Registrar (Evaluation) within a stipulated time prescribed by the university.

All DSC, DSE theory and Vocational courses shall have internal assessment for 40 Marks.

The practical, Internship and Skill Enhancement courses shall have internal assessment for 25 marks each, including the 10 marks for the practical record.

Research Project shall have internal assessment for 100 marks.

The outline for continuous assessment activities for C1 and C2 components of a course shall be as under

<b>Activities</b>	<b>C1 Component</b>	<b>C2 Component</b>	<b>Total Marks</b>
Session test	10 marks	10 marks	20
Seminars/ presentation/activities	10 marks		10
Case study/assignment/field work/project work etc.		10 marks	10
<b>Total</b>	<b>20</b>	<b>20</b>	<b>40 marks</b>

#### **Board of Examiners (BOE):**

Board of examiners constituted by the University shall consist of a Chairman, internal and external members out of which at least one shall be from the Department / College offering the course and at least two external members from other universities. The board shall scrutinize the question papers and shall forward for the approval of university.

#### **Results:**

A candidate should obtain a minimum of 40% marks in each course in the University examination including internal assessment marks. The candidates who have passed in all the semester examinations are eligible for the award of B.A./B.Sc. Honors Degree in Geography. If the candidates chooses Geography as major along with any social science stream subjects as minor, like Sociology, Political Science, History, Economics, etc, such candidates can be awarded B.A. Degree and for those studied geography as major with any science subjects as minor such candidates shall be awarded B.Sc. Honors in Geography.

#### **Carryover:**

A candidate who fails in a lower semester examination may go to the higher semester, however, the result of the candidates who have passed the VIII semester examination but not passed the lower semester examinations shall be declared as NCL (not completed lower semester examinations). Such candidates shall be eligible for the award of degree only after completion of all the lower semester examinations.



**Question Paper Pattern:**

The Theory exam shall be conducted for 60 Marks and it consists of 3 Sections namely Section A, Section B, Section C with internal choices. (Short, Medium and Long answer questions).

Section A - Each question carries 3 marks and student has to answer 4 out of 6 questions.

Section B - Each question carries 6 marks and student has to answer 3 out of 5 questions, and

Section C - Each question carries 10 marks and student has to answer 3 out of 4 questions.

## Model Curriculum

Name of the Degree Program:	B.A. / B.Sc. (Basic / Honours) Degree in Geography
Discipline Core:	Geography
Total Credits for the Program:	186
Starting year of implementation:	2021-2022

### Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome based education (OBE) for details on Program Outcomes)

### PO1: Relating to Knowledge

By the end of the program the students will be able to:

- Give explanation of relevant terms and concept of geography including definitions.
- Give better explanation about relevant principles, theories and models in geography.
- Show clear knowledge relating to man and environmental process and factors.

### PO2: Understanding and application

By the end of the program the students will be able to:

- Identify the importance of spatial scale and time scale.
- Know the complex and interactive nature of physical and human environments.
- Identify the importance of the resemblances and variance between places, environments and people.
- Comprehend how processes bring changes in systems, distributions and environments.

### PO3: Students Skills

By the end of the program the students will be able to:

- Interpret a variety of types of geographical data and sources and recognise their limitations.
- Communicate geographical evidence, ideas and arguments.
- Use geographical data to identify trends and patterns.
- Use diagrams and sketch maps to demonstrate geographical aspects.
- Demonstrate skill of analysis and synthesis of geographical information

## **PO4: Students Evaluation**

By the end of the program the students will be able to:

Critically evaluate geographical principles, theories and models

Assess the effects of geographical processes and change on physical and human environments.

Assess how the viewpoints of different groups of people, potential conflicts of interest and other factors interact in the management of physical and human environments.

Evaluate the relative success or failure of initiatives.

## **Syllabus Aims:**

The aims of the syllabus describe the B.A. / B.Sc program in geography at 5th, 6th, 7th & 8th Level. These aims outline the educational context in which syllabus content should be viewed. Many of these aims may be delivered by the use of suitable case-studies, through application of geographical skills and practical field visits.

### **The BA./ B.Sc Geography syllabus aims to enable students to:**

- Know the significance of scale in studying geography
- Know the processes functioning at various scales within physical and human environments
- Improve a sense of space, place and location
- Develop consciousness of the relevance of geography to understanding and solving contemporary environmental problems
- Realisation of the main fundamentals of physical geography and human geography and the interconnectedness between them
- Explain the causes and effects of change over space and time on physical and human environments
- Develop an appreciation of the nature, value, limitations and importance of different approaches to analysis and explanation in geography
- Increase the knowledge of, and ability to use and apply, appropriate skills and techniques including fieldwork
- Improve a logical approach in order to present a structured, coherent and evidence-based argument
- Develop a concern for accuracy and objectivity in extracting, recording, processing, presenting, analysing and interpreting geographical data.

### Curriculum Structure for Undergraduate Program B.A. / B.Sc. Geography

Name of the Degree Program: B.A./B.Sc.	Total Credits for the Program: 186
Discipline/Subject: Geography	Starting year of implementation: 2021-2022

#### Program Articulation Matrix for Core Courses:

Semester	Title /Name of the course	Program outcomes that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
I	Principles of Geomorphology	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Interactive Lectures, Case Studies	In-course & End Course Assessment
II	Introduction to Climatology	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Interactive Lectures, Case Studies	In-course & End Course Assessment
III	Fundamentals of Human Geography	PO-1, PO-3, PO-4	No Pre-requisite course(s)	Interactive Lectures, Case Studies, Seminar	In-course & End Course Assessment
IV	India: Resources and Sustainability	PO-2, PO-3	No Pre-requisite course(s)	Interactive Lectures, Case Studies, Quiz	In-course & End Course Assessment
V	Population Resource & Dynamics	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Inquiry-based learning, Interactive Lectures	In-course & End Course Assessment
	Fundamentals of Remote Sensing	PO-1, PO-3	Cartography & Spatial Statistics	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
VI	Environmental Geography	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Investigative Case-Based Learning, Seminar	In-course & End Course Assessment
	Fundamentals of Geographic Information System	PO-1, PO-3	Basics of Cartography	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
VII	Advanced Geomorphology	PO-2, PO-4	Principles of Geomorphology	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Advanced Climatology	PO-2, PO-4	Introduction to Climatology	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Conceptual Development in Geography	PO-2, PO-3, PO-4	No Pre-requisite course(s)	Interactive Lectures, Group Activity	In-course & End Course Assessment
VIII	Sustainable Soil Resource Management	PO-1, PO-2, PO-4	Principles of Geomorphology	Cooperative Learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Agriculture & Food Security	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Principles of spatial models in Geography	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Blended learning, Interactive Lectures, MOOCs	In-course & End Course Assessment
	Research Project / Internship (6)	PO-2, PO-3, PO-4	Research Methodology	Process-Oriented Guided Inquiry Learning (POGIL), Problem or Project Based	In-course & End Course Assessment, Final report

### Program Articulation Matrix for Open Elective (OE)

Semester	Title of the course	PO that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
I	Introduction Physical Geography	PO-1, PO-2, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
	Fundamentals of Remote Sensing	PO-1, PO-2, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
II	Human of Geography	PO-1, PO-2	No Pre-requisite course(s)	Inquiry-based learning, Interactive Lectures	In-course & End Course Assessment
	Basics of Geographic Information Systems	PO-1, PO-2, PO-3	Fundamentals of Remote Sensing	Interactive lectures, Blended learning	In-course & End Course Assessment
III	Geography of India	PO-1, PO-2	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
	Application of GIS & Remote Sensing	PO-1, PO-2, PO-4	Fundamentals of Remote Sensing, Basics of GIS	Interactive lectures, Blended learning	In-course & End Course Assessment
IV	Geography of Karnataka	PO-1, PO-2	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment
	Population & Settlement Geography	PO-1, PO-2	No Pre-requisite course(s)	Interactive lectures, Blended learning	In-course & End Course Assessment

### Program Articulation Matrix for Vocational Courses:

Semester	Title of the course	PO that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
V	Geo-surveying	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, ,Hands on experience	In-course & End Courses assessment
	Statistical Techniques in Geography	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, Hands on experience	In-course & End Courses assessment
VI	Open Source GIS: Applications	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, Hands on experience	In-course & End Courses assessment
	Digital Cartography and Mobile Mapping	PO-1, PO-3	No Pre-requisite course(s)	Interactive lectures, Blended learning, Hands on experience	In-course & End Courses assessment

**Program Articulation Matrix for Discipline Specific Elective (DSE):**

Semester	Title Of the course	PO that the course addresses	Pre-requisite course(s)	Pedagogy	Assessment
V	Regional Geography of Karnataka	PO-1	No Pre-requisite course	Blended learning, Investigative Case-Based Learning, Seminar	In-course & End Coursesassessment
	Tourism Geography	PO-1	No Pre-requisite course	Inquiry-based learning, Interactive Lectures, case studies	In-course & End Courses Assessment
VII	Regional planning and Development	PO-1	No Pre-requisite course(s)	Interactive Lectures, case studies	In-course & End Courses Assessment
	Settlement Geography	PO-1	No Pre-requisite course(s)	Interactive Lectures, case studies	In-course & End Courses Assessment
	Bio geography	PO-1	No Pre-requisite course(s)	Interactive Lectures, case studies	In-course & End Courses Assessment
	Climate Change: Vulnerability & Adaptation	PO-1	No Pre-requisite course(s)	Interactive Lectures, case studies	In-course & End Courses Assessment
VIII	Sustainable Rural development	PO-1	Regional Planning Development	Blended learning, Interactive Lectures, MOOCs	In-course & End Coursesassessment
	Urban geography	PO-1, PO-2, PO-4	Settlement Geography	Blended learning, Interactive Lectures, MOOCs	In-course & End Coursesassessment
	Geography of Health & Wellbeing /	PO-2, PO-4	Principles of Geomorphology and Bio-geography Introduction to Climatology Fundamentals of Human Geography	Blended learning, Investigative Case-Based Learning, Seminar	In-course & End Coursesassessment
	Natural Resource Management	PO-1, PO-2, PO-4	Regional Planning and Development Fundamentals of Human Geography	Cooperative Learning, Group Activity, Interactive Lectures, MOOCs	In-course & End Coursesassessment
	Geopolitics	PO-1, PO-2, PO-4	Fundamentals of Human Geography	Inquiry-based learning, Interactive Lectures, case studies	In-course & End Coursesassessment
	Transport Geography	PO-1, PO-2, PO-4	No Pre-requisite course(s)	Cooperative Learning, Group Activity, Interactive Lectures, MOOCs	In-course & End Coursesassessment

**B.A. / B.Sc. (Basic / Honours) Degree in Geography Contents of Courses in the Program**

Course Type					
Semester	Discipline Specific Core (DSC)	Open Elective (OE)/(3)	Vocational Courses (3)	Discipline Specific Elective (DSE)(4)	Research/Other Courses
I	Principles of Geomorphology	1. Introduction Physical Geography 2. Fundamentals of Remote Sensing	Nil	Nil	
II	Introduction to Climatology	1. Human of Geography 2. Basics of Geographic Information Systems	Nil	Nil	
III	Fundamentals of Human Geography	1. Geography of India 2. Application of GIS & Remote Sensing	Nil	Nil	
IV	India: Resources and Sustainability	1. Geography of Karnataka 2. Population & Settlement Geography	Nil	Nil	
V	Population Resource & Dynamics* Fundamentals of Remote Sensing <b>*course for those opting Geography as Minor</b>	Nil	1. Geo-Surveying / 2. Statistical Techniques in Geography	1. Regional Geography of Karnataka/ 2. Tourism Geography	
VI	Environmental Geography* Fundamentals of Geographic Information System <b>*course for those opting Geography as Minor</b>	Nil	1. Open Source GIS: Applications 2. Digital Cartography and Mobile Mapping	Nil	Internship



VII	Advanced Geomorphology Advanced Climatology Conceptual Development in Geography	Nil	Nil	1.Regional planning and Development 2.Settlement Geography 3.Bio geography 4.Climate Change: Vulnerability & Adaptation	Research Methodology
VIII	Sustainable Soil Resource Management  Agriculture & Food Security Principles of Spatial Models in Geography	Nil	Nil	1.Sustainable Rural development 2.Urban geography 3.Geography of Health & Wellbeing / 4.Natural Resource Management 5.Geopolitics 6.Transport Geography	Research Project

## Course Pattern and scheme of Examination for BA/BSc Geography Programme as per NEP2020

Semester	Course Type	Course Name	Credits T = Theory P = Practical			Instruction Hour Per Week		Total No. of Hours/ Semester		Marks for Exam		Marks for IA			Duration of Exam (in Hours)	
			T	P	Total	Theory	Practical	T	P	Theory	Practical	T	P	Total	Theory	Practical
I	GEOG DSC T1.1	Principles of Geomorphology	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T1.1	1. Introduction Physical Geography 2. Fundamentals of Remote sensing	3	-	3	3	-	42	-	60	-	40	-	100	2	-
II	GEOG DSC T2.1	Introduction to Climatology	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T2.1	1. Human of Geography 2. Basics of Geographic Information Systems	3	-	3	3	-	42	-	60	-	40	-	100	2	-
III	GEOG DSC T3.1	Fundamentals of Human Geography	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T3.1	1. Geography of India 2. Applications of GIS & Remote Sensing	3	-	3	3	-	42	-	60	-	40	-	100	2	-
IV	GEOG DSC T4.1	India: Resources and Sustainability	4	2	6	4	4	52	52	60	25	40	25	150	2	2
	GEOG OE T4.1	1. Geography of Karnataka 2. Population & Settlement Geography	3	-	3	3	-	42	-	60	-	40	-	100	2	-



Semester	Course Type	Course Name	Credits T = Theory P = Practical			Instruction Hour Per Week		Total No. of Hours/ Semester		Marks for Exam		Marks for IA			Duration of Exam (in Hours)	
			T	P	Total	Theory	Practical	T	P	Theory	Practical	T	P	Total	Theory	Practical
VII	GEOG DSC T7.1	Advanced Geomorphology	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG DSC T7.2	Advanced Climatology	3	2	5	3	4	42	52	60	25	40	25	150	2	2
	GEOG DSC T7.3	Conceptual Development in Geography	3		3	3		42		60		40		100	2	
	GEOG DSE T7.1 GEOG DSE T7.2 (ANY TWO)	1.Regional planning and Development	3		3	3		42		60		40		100	2	
		2.Settlement Geography	3		3	3		42		60		40		100	2	
		3.Bio geography	3		3	3		42		60		40		100	2	
		4.Climate Change: Vulnerability & Adaptation	3		3	3		42		60		40		100	2	
GEOG RM T7.3 (Compulsory)	RESEARCH METHODS IN GEOGRAPHY	3		3	3		42		60		40		100	2		
VIII	GEOG DSC T8.1	Sustainable Soil Resource Management	3	2	5	3	4	42	52	60	25	40	25	100	2	2
	GEOG DSC T8.2	Agriculture and food security	3		3	3		42		60		40		100	2	
	GEOG DSC T8.3	Principles of Spatial Models in Geography	3		3	3		42		60		40		100	2	
	GEOG RSP8.1	<b>RESEARCH PROJECT</b>			6					100		100		200	2	
	GEOG DSET8.1 GEOG DSET8.2 (ANY TWO) (any2 additional course For Non Research Project candidates)	1.Sustainable Rural development	3		3	3		42		60		40		100	2	
		2.Urban geography	3		3	3		42		60		40		100	2	
		3.Geography of Health & Wellbeing/	3		3	3		42		60		40		100	2	
4.Natural Resource Management		3		3	3		42		60		40		100	2		
5.Geopolitics		3		3	3		42		60		40		100	2		
	6.Transport Geography	3		3	3		42		60		40		100	2		

## Program Structure for the B.A./B.Sc. Geography (Basic / Honours) Degree

Semester	Discipline Specific Core (DSC) (Credits) (L+T+P)	Discipline Specific Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), Languages (L+T+P)		Skill Enhancement Course (SEC)			Total Credits
					Skill-based (Credits) (L+T+P)	Value-based (Credits) (L+T+P)		
I	DSC-A1 Principles of Geomorphology (4+2) <b>DSC-B1 (4+2)</b>	OE-1.1 Introduction Physical OE-1.4 Fundamentals of Remote Sensing (3)	L1-1 (3), L2-1 (3) (3+1+0 each)	Nil	SEC-1: Digital Fluency (2) (1+0+2)	Physical Education for Fitness (1) (0+0+2)	Health & Wellness (1) (0+0+2)	25
II	DSC-A2 Introduction to Climatology (4+2) <b>DSC-B2 (4+2)</b>	OE-2.1 Human Geography / OE-2.2 Basics of Geographic Information Systems (3)	L2-1 (3), L2-1 (3) (3+1+0 each)	Environmental Studies (2)	Nil	Physical Education - Yoga (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	25
Exit option with Certificate (50 Credits)								
III	DSC-A 3 fundamentals of Human Geography (4+2) <b>DSC-B3 (4+2)</b>	OE-3.1 Geography of India / OE-3.2 Application of GIS & Remote Sensing (3)	L1-3 (3), L2-3 (3) (3+1+0 each)	Nil	SEC-2: Artificial Intelligence (2) (1+0+2)	Physical Education - Sports Skills (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	25
IV	DSC-A4 India: Resources and Sustainability <b>DSC-B4 (4+2)</b>	OE-4.1 Geography of Karnataka / OE-4.2 Population & Settlement Geography	L1-4 (3), L2-4 (3) (3+1+0 each)	Constitution of India (2)	Nil	Physical Education - Games (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	25
Exit option with Diploma (100 Credits)								
Choose any one Discipline as Major, the other as the Minor								
V	DSC-A5 Population Resource & Dynamics * (3 + 2) DSC-A6 Fundamentals of Remote Sensing (3+2) <b>DSC-B5 (3+2)</b> <b>*for minor candidates</b>	DSE1 1. Geography of Karnataka/ 2. Tourism Geography Vocational – 1 (3) Voc 1.1 Geo-Surveying Voc 1.2 Statistical Techniques in Geography	Nil	Nil	SEC-3: Such as Cyber Security (2) (1+0+2)	Physical Education – Games (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	24

VI	DSC-A7 Environmental Geography* (3 + 2) DSC-A8 Fundamentals of Geographic Information Systems (3+2) <b>DSC-B6 (4)</b> *for minor candidates	Vocational – 2 (3) Voc 2.1 Open Source GIS: Applications Voc 2.2 Digital Cartography and Mobile mapping  <b>Internship (2)</b>	Nil	Nil	SEC-4: Professional Communication (2)	Physical Education – Games (1) (0+0+2)	NCC/ NSS/R&R (S&G)/ Cultural (1) (0+0+2)	23
Exit option with Bachelor of Arts, B.A. / Bachelor of Science, B.Sc Basic Degree (144 Credits)								
VII	DSC-A9 Advanced Geomorphology (3+2) DSC-A10 Advanced Climatology (3+2) DSC-A11 Conceptual Development in Geography(3)	DSE-2 and DSE-3 ( <b>Any two</b> ) 1.Regional planning and Development 2.Settlement Geography 3.Bio geography 4.Climate Change: Vulnerability & Adaptation  <b>Research Methods in Geography (3)</b>	Nil	Nil	Nil	Nil	Nil	22
VIII	DSC-A12 Sustainable Soil Resource Management (3+2) DSC-A13 Agriculture & FoodSecurity (3) DSC-A14 Principles of Spatial Models in Geography(3)	DSE-4 ( <b>AnyTwo</b> ) DSE -5 1. Sustainable Rural development 2. Urban geography 3. Geography of Health & Wellbeing / 4. Natural Resource Management 5. Geopolitics 6. Transport Geography  <b>Research Project (6)/Internship</b> (any two additional DSE courses or Internship programme can be opted by students if Research Project is not selected)	Nil	Nil	Nil	Nil	Nil	21
Award of Bachelor of Arts Honours, / Bachelor of Science Honours Degree (186 Credits)								

## Technical Skills and possible jobs after each exit during and after the program

Semester	Exit Level	Credits	Technical Skills	Possible Jobs
Ii	Certificate	50	<ul style="list-style-type: none"> <li>• Map Interpretation</li> <li>• Geomorphic Analysis</li> <li>• Climate Data Analysis &amp; Interpretation</li> </ul>	<ul style="list-style-type: none"> <li>• Field Surveyor</li> <li>• Weather Data Analyst</li> </ul>
IV	Diploma	100	<ul style="list-style-type: none"> <li>• Cartography</li> <li>• Statistics Analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Field Surveyor</li> <li>• Cartographer</li> </ul>
VI	Degree	142	<ul style="list-style-type: none"> <li>• Cartography</li> <li>• GIS and Image Analysis</li> <li>• Tourism Management</li> </ul>	<ul style="list-style-type: none"> <li>• GIS Field Surveyor</li> <li>• GIS Trainee</li> <li>• Nature Conservation Officer</li> <li>• School Teacher</li> </ul>
VIII	Degree with Honors	186	<ul style="list-style-type: none"> <li>• GIS &amp; Image Analysis</li> <li>• Resource Management</li> <li>• Town Planning</li> <li>• Tourism Management</li> </ul>	<ul style="list-style-type: none"> <li>• Sustainability Consultant</li> <li>• Tourism officer</li> <li>• Transport planner</li> <li>• Cartographer</li> <li>• GIS Engineer</li> <li>• Environmental consultant</li> <li>• Geography Teacher</li> <li>• Geography Researcher</li> </ul>

**BA/ B.Sc. With Geography as a minor In  
the 3<sup>rd</sup> year  
V Semester**

<b>Course Type</b>					
Semester	Discipline Specific Core (DSC)	Open Elective (OE)/(3)	Vocational Courses (3)	Discipline Specific Elective (DSE)(4)	Research/ Other Courses
I	Principles of Geomorphology	1. Introduction to Physical Geography/ 2. Fundamentals of Remote Sensing	Nil	Nil	
II	Introduction to Climatology	1. Human of Geography/ 2. Basics of Geographic Information Systems	Nil	Nil	
III	Fundamentals of Human Geography	1. Geography of India 2. Application of GIS & Remote Sensing	Nil	Nil	
IV	India: Resources and Sustainability	1. Geography of Karnataka 2. Population & Settlement Geography	Nil	Nil	
V	1.Population Resource & Dynamics	Nil	Nil	Nil	
VI	1.Environmental Geography	Nil	Nil	Nil	



## B.A/B.Sc Semester 1

### Title of the Course: Principles of Geomorphology

Code: GEOGDSC T1.1

Number of Theory Credits	Number of lecture hours/ semester	Number of practical Credits	Number of practical hours/ semesters
4	52 or 56	2	52 or 56
<p><b>Course Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. After the completion of this course, students should be able to:</li> <li>2. Define the field of Geomorphology and to explain the essential principles of it.</li> <li>3. To outline the mechanism of dynamic nature of the Earth's surface and interior of the Earth.</li> <li>4. To illustrate and explain the forces affecting the crust of the earth and its effect on it.</li> <li>5. To understand the conceptual and dynamic aspects of landform development</li> </ol>			
<p><b>Course Objectives:</b></p> <p>This course aims to:</p> <ol style="list-style-type: none"> <li>1. To define the concepts in Geomorphology and Physical Geography</li> <li>2. To introduce various concept to understand cycles of the solid Earth surface</li> <li>3. To understand the dynamic nature of the Earth's surface, various processes, and landforms.</li> <li>4. To study the impact human on geomorphic system.</li> </ol>			

Content of Theory Course 1	52/56Hrs
<b>Unit – 1 Geomorphology</b>	13/14
Introduction to geography: physical and human geography Introduction to Geomorphology: meaning, nature, development, and scope Principles of Geomorphology Geological Time Scale Distribution of continents and oceans	
<b>Unit – 2 Systems and Cycles of the Solid Earth</b>	13/14
Internal structure of the earth Alfred Wegener's continental drift Theory of Isostasy: Views of Pratt and Airy Convectional current theory and concept of sea floor spreading Theory of Plate Tectonics: plate boundaries, subduction, Case Studies: Volcano, Earthquake: reporting of latest incidents Case Studies: Volcano, Earthquake: reporting of latest incidents	
<b>Unit – 3 The Dynamics of Earth</b>	13/14
Earth's Movements: Endogenetic and Exogenetic forces, Sudden and Diastrophic movements- Epeirogenetic and Orogenetic Movements-Process of folding and faulting Vulcanicity and earthquake Rocks: Characteristics, types, importance, and rock cycle Weathering: meaning, types and controlling factors Mass Movement: meaning, controlling factors, types-landslides, rock-falls	

<b>Unit – 4 Evolution of Landforms</b>	13/14
<p>Evolution of Landforms</p> <p>Landforms: meaning, types and factors controlling landforms development</p> <p>Slope development: concept and types</p> <p>Concept of Cycle of Erosion–W.M. Davis and W. Penck</p> <p>Agents of Denudation: river; drainage patterns, groundwater, Sea waves, Wind and Glaciers and resultant landforms.</p> <p>Application of geomorphology: in India and Karnataka (Regional planning, Urban planning and transportation, Mining, Hazard management, Agriculture and Environmental management).</p>	

### References

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2. Bloom A.L. (1978) Geomorphology: A Systematic Analysis of Late Cenozoic Landforms Prentice – Hall of India, New Delhi.
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12. Nanjannavar S S: Physical Geography (Kannada Version)
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14. Ranganath Principles of Physical Geography (Kannada Version)
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17. Verstappen H. (1983) Applied Geomorphology, Geomorphological Surveys for Environmental Development, Elsevier, Amsterdam

### Reference Websites

1. <http://www.solarviews.com/eng/earth.htm>
2. <http://www.moorlandschool.co.uk/earth/tectonic.htm>
3. <https://www.usgs.gov/>
4. <https://www.ksndmc.org/>

## Pedagogy

Formative Assessment	
Assessment Occasion/type	Weightage in Marks
Case Studies	30%
Assignment	20%
CIA	50%
<b>Total</b>	<b>100%</b>

GEOGDSC P1.1 **Geomorphology Practical**

**CREDIT:02**

**Content of Practical Course 1:** List of Experiments to be conducted

**Exercise-1:** Identification of Rocks and Minerals. Mineral samples: Iron ore, Bauxite ore and Manganese. Rock Samples: Granite, Basalt, Lime Stones, Sandstone, quartzite, and marble.

**Exercise-2:** Extraction and interpretation of Geomorphic information from Topographical maps

**Exercise-3:** Preparation of contour map from toposheet, Construction of Relief Profiles-serial, Super imposed, Projected & Composite.

**Exercise-4:** Slope Analysis - Slope Maps (Wentworth method) Slope calculation and conversion (isotan and isosin) and aspect maps & Hypsometric curve and integral

**Exercise-5:** Drainage Morphometry: delineation of watershed, stream ordering and Morphometric analysis: mean stream length, drainage density and drainage frequency. **Field Work:** Measurement of channel cross-sections in the field, Geomorphic map of channel bed, Study of erosional and depositional features in the field.

**Case Study:** students must be taken to observe local land formation and degradation and write areport on their effectiveness.

## B.A. / BSc Semester 1

### Title of the Course: GEOG0E T1.1 - 1. Introduction to Physical Geography

Number of Theory Credits	Number of lecture hours/ semester	
3	42 - 45	
<b>Course Outcomes:</b> <ol style="list-style-type: none"><li>1. Students will be able to understand the fundamental concepts in Earth Sciences</li><li>2. Understands basic terminology used to describe physical processes and landscapeforms.</li><li>3. Describe elements of the atmosphere and the oceans</li></ol>		
<b>Course Objectives:</b> <p>This course aims to</p> <ol style="list-style-type: none"><li>1. Study basic principles of the Earth Sciences</li><li>2. Understand the landforms, atmospheric elements and structure and basics of oceanography</li></ol>		
Content of Theory Course 1		42/45Hrs
<b>Unit – 1</b>		11
Origin, Shape and Size of the Earth, Movement of the Earth- Rotation and Revolution, Effects of the movement of Earth,Coordinates -Latitude, Longitude and Time. Structure of the Earth,		
<b>Unit – 2</b>		11
Rocks - types,significance, Weathering – types. Agents of Denudation - River, Glacier, Wind and Under Ground water. Volcanicity, Earthquakes and Tsunamis		
<b>Unit – 3</b>		11
Structure and Composition of Atmosphere,Weather and Climate. Atmospheric Temperature, Heat Budget of the atmosphere Atmospheric Pressure, Winds and Precipitation		
<b>Unit – 4</b>		12
Distribution of Land and Sea, Submarine Relief of the Ocean, Temperature and Salinity of Sea Water. Ocean Tides, Waves and Deposits, Ocean currents - Atlantic, Pacific and IndianOceans. Marine Resources: Biotic, mineral and energy resources		

#### References

1. B.S. Negi (1993) Physical Geography. S.J. Publication, Meerut
2. D.S. Lal (1998) Climatology. Chaitnya publishing house, Allahabad
3. K. Siddhartha (2001) Atmosphere, Weather and Climate. Kisalaya publication, NewDelhi
4. R.N. Tikka (2002) Physical Geography. Kedarnath Ramnath & co, Meerut.
5. Willian D. Thornbury (1997) Principle of Geomorphology. New Age International (PvtLtd.) New Delhi.

### Pedagogy

Formative Assessment	
Assessment Occasion/type	Weightage in Marks
Quiz	30%
Assignment	20%
CIA	50%
<b>Total</b>	<b>100%</b>

### B.A. / BSc Semester 1

#### Title of the Course: OE 1.1.2 Fundamentals of Remote Sensing

Code: GEOGOE T1.1.2

Number of Theory Credits	Number of lecture hours/ semester
3	42 - 45
<b>Course Outcomes:</b> <ol style="list-style-type: none"><li>1. This course is to make understand the basic concepts of Remote Sensing and to impart necessary skills of remote sensing analysis, and image interpretation to the students. So that, students acquire employable skills in remote sensing.</li><li>2. Students will learn how to handle and process the satellite images for understanding of biophysical phenomena of the earth system.</li></ol>	
<b>Course Objectives:</b> <ol style="list-style-type: none"><li>1. To congregate the basic concepts and fundamentals of physical principles of remote sensing</li><li>2. To create a firm basis for successful integration of remote sensing in any field of application.</li><li>3. To study basics of digital image processing and image interpretation techniques.</li><li>4. To study the applications of the remote sensing to solve the real-world problems.</li></ol>	
<b>Content of Theory Course 1</b>	
<b>Unit – 1 Introduction</b>	11
Definition of Remote Sensing, developmental stages, Laws of Physics, electromagnetic waves, spectrum, regions, wavelength, frequencies, and applications. Types-Satellites, Sensors, Payloads, Orbits, telemetry of satellites.	
<b>Process and types of Remote Sensing</b>	11
Process of remote sensing, interaction of radiation with atmosphere and targets, atmospheric noises, attenuation in radiance, resolutions of remote sensing, optical remote sensing, visible region of the spectrum, thermal remote sensing, microwave remote sensing, Hyperspectral remote sensing, LiDAR, and other remote sensing Platforms.	

<b>Unit – 3 Image Classification and Interpretation</b>	11
Satellite products and its spectral characteristics, composite images, band ratios; Land use land cover classification schemes-Anderson and NRSC; Visual image interpretation, elements, stages of interpretation and interpretation keys. Image classification- supervised, unsupervised, and principal component analysis (PCA) and accuracy assessment.	
<b>Unit – 4 Applications of Remote Sensing</b>	12
Disaster Management, Meteorological Studies, Agricultural and Irrigation Studies, Forestry Studies, Hydrological Studies, Natural Resource, Oceanic and Coastal mapping, Soil resource mapping, Urban and Rural Mapping and Management.	

## References

1. Image processing and GIS for remote sensing: techniques and applications; Second Edition (2016) - Liu, Jian-Guo, Mason, Philippa J
  2. Introduction to Remote Sensing and Image Interpretation (2003); Lillesand T.M.
  3. Introduction to Remote Sensing, Fifth Edition (2011); James B. Campbell, Randolph H.Wynne
  4. Introductory Digital Image Processing: A Remote Sensing Perspective, Fourth Edition(2015) - John R. Jensen
  5. Practical handbook of remote sensing, First Edition (2016) - Lavender, Andrew, Lavender, Samantha
  6. Remote Sensing and GIS, Second Edition (2011), Bhatta, B.
  7. Remote sensing and image interpretation (2015); Chipman, Jonathan W., Kiefer, Ralph W., Lillesand
  8. Remote Sensing of the Environment: An Earth Resource Perspective (Prentice HallSeries in Geographic Information Science) - Second Edition (2006), John Jensen
1. [https://onlinecourses.nptel.ac.in/noc19\\_ce41/preview](https://onlinecourses.nptel.ac.in/noc19_ce41/preview)

## Pedagogy

<b>Formative Assessment</b>	
<b>Assessment Occasion/type</b>	<b>Weightage in Marks</b>
Quiz	30%
Assignment	20%
CIA	50%
<b>Total</b>	<b>100%</b>

## B.A. / BSc Semester 2

### Title of the Course: Introduction to Climatology

**CODE:** GEOGDSC T2.1

Number of Theory Credits	Number of lecture hours/ semester	Number of practical Credits	Number of practical hours/ semesters
4	52 or 56	2	52 or 56
<p><b>Course Outcomes:</b></p> <p>After the completion of this course, students should be able to</p> <ol style="list-style-type: none"> <li>define the field of climatology and to understand the atmospheric composition and structure.</li> <li>to outline the mechanism and process of solar radiation transfer to earth surface and to explain the temperature distribution and variation according to time and space.</li> <li>to illustrate and explain the air pressure system, wind regulating forces and the formation of the Atmospheric Disturbance.</li> <li>to understand and compute the air humidity as well as to explain the process of Condensation and formation of precipitation and its types.</li> </ol>			
<p><b>Course Objectives:</b></p> <p>This course aims to:</p> <ol style="list-style-type: none"> <li>to define the field of climatology and components of the climate system</li> <li>to introduce various dimensions of climatology like structure and composition.</li> <li>to understand the global atmospheric pressure, temperature, and wind system.</li> <li>to study the concept of atmospheric moisture and its types</li> </ol>			
<b>Content of Theory Course 1</b>			<b>52/56Hrs</b>
<b>Unit – 1 Composition and Structure of the Atmosphere</b>			14
Nature and Scope of Climatology, Atmospheric Sciences; Climatology and Meteorology Origin and structure of the Atmosphere: Troposphere, Stratosphere, Mesosphere, Ionosphere, Exosphere and their characteristics. Composition of the atmosphere Weather and Climate			
<b>Unit – 2 Atmospheric Temperature</b>			14
Insolation: Definition, Mechanism, Solar Constant. Factors affecting the Insolation: Angle of incidence, length of the day, Sunspots, Distance between the earth and the sun, effect of the atmosphere. Heating and cooling process of the atmosphere-Radiation, Conduction, convection, and advection. Temperature: meaning and Influencing Factors on the Distribution of Temperature Distribution of the temperature: Vertical, Horizontal, and Inversion of temperature. Global Energy Budget: Incoming shortwave solar radiation, Outgoing Longwave Terrestrial radiation, Albedo. Net Radiation and Latitudinal Heat Balances.			
<b>Unit – 3 Atmospheric Pressure and Winds</b>			14

Atmospheric Pressure: Influencing factors on atmospheric pressure. Vertical and Horizontal Distribution of the atmospheric pressure and Pressure Belts, Pressure Gradient. Tri-cellular-Hadley, Ferrel's and Polar Cells. Winds: influencing factors, Types - planetary, seasonal, local wind Variable winds-Cyclones and anti-cyclones. Air-Masses and Fronts: Definition, Nature, Source Regions, Classification.	
<b>Unit – 4 Atmospheric Moisture</b>	14
Humidity: Sources, influencing factors and types-Absolute, Relative and Specific. Hydrological cycle: process of evaporation, condensation. Clouds and its types Precipitation and its forms. Climate Change: Causes and consequences, recent issues-floods, drought,	

### References

1. Lal, D. S. (1998). Climatology. Allahabad: Chaitanya Publishing House.
2. P Mallappa, Physical Geography (Kannada Version)
3. Ranganath Principles of Physical Geography (Kannada Version)
4. Nanjannavar S S: Physical Geography (Kannada Version)
5. Hugar M R Physical Geography part 1(Kannada Version)
6. Goudar M B, Physical Geography (Kannada Version)
7. Kolhapure and S S Nanjan, Physical Geography (Kannada Version)
8. Lutgens, Frederic K. & Tarbuck, Edward J. (2010). The Atmosphere: An Introduction to Meteorology. New Jersey: Pearson Prentice Hall.
9. Oliver, John E. & Hidore, John J. (2003). Climatology: An Atmospheric Science. Delhi: Pearson Education.
10. Singh, S. (2005). Climatology. Allahabad: Prayag Pustak Bhawan.
11. Barry, R.G. and Chorley, R.J. (2003): Atmosphere, Weather and Climate; Psychology Press, Hove; East Sussex.
12. Critchfield, H.J., (1975): general Climatology, Prentice Hall, New Jersey.
13. Mather, J.R. (1974): Climatology: Fundamentals and Applications; Mc Craw Hill Book Co., U.S.A.
14. Rumney, G.R. (1968): Climatology and the World Climates, Macmillan, London.
15. Trewartha, G.T. (1980): An Introduction to Climate; McGraw Hill, New York, 5th edition, (International Student Edition)

### Reference Websites

1. <https://earthobservatory.nasa.gov/>
2. <https://mausam.imd.gov.in/>
3. <https://www.weatheronline.in/>
4. <https://earthexplorer.usgs.gov/>
5. <https://www.nhc.noaa.gov/satellite.php>



## Pedagogy

Formative Assessment	
Assessment Occasion/type	Weightage in Marks
Quiz	30%
Assignment	20%
CIA	50%
<b>Total</b>	<b>100%</b>

### GEOGDSC P2.1- Climatology Practical CREDITS: 2

**Content of Practical Course 1:** List of Experiments to be conducted

*Conduct all exercises with Goal, Procedure, devices, and findings.*

**Exercise 1:** Understanding Structure and functions of the Indian Meteorological Department (IMD).

**Exercise 2:** Collection of climatic data from IMD website.

<https://mausam.imd.gov.in/bengaluru/>

**Exercise 3:** Plotting of downloaded climatic data using graphical methods-

#### Elementary Instrumental Observation:

**Exercise 4:** Centigrade and Fahrenheit thermometer for measuring temperature.

**Exercise 5:** Mercurial Barometer and Aneroid Barometer for measuring atmospheric pressure

**Exercise 6:** Wind Vane and cup-anemometer.

**Exercise 7:** Wet and Dry bulb thermometer for measuring humidity

**Exercise 8:** Rain gauge- Dial type for measuring rainfall Exercise 3: Rainfall Trend Analysis.

**Exercise 9:** Interpretation of Indian Daily Weather charts.

**Exercise 10:** Deriving water balance chart, Actual and potential evapotranspiration

*Note: Students are expected to download weather charts of the four seasons.*

## B.A. / BSc Semester 2

### **Title of the Course: 1 Introduction to Human Geography**

**CODE: GEOGOE T2.1.1**

Number of Theory Credits	Number of lecture hours/ semester
3	42 - 45
<b>Course Outcomes:</b> <ol style="list-style-type: none"> <li>1. Students will learn how human, physical, and environmental components of the world interact.</li> <li>2. Students will be familiarized with economic processes such as globalization, trade and their impacts on economic, cultural and social activities.</li> <li>3. The student will describe what geography and human geography are.</li> <li>4. Understand population dynamics and migration.</li> </ol>	
<b>Course Objectives:</b> This course aims to <ol style="list-style-type: none"> <li>1. Understand the basic concepts of human geography</li> <li>2. Study population attributes and dynamic nature of it</li> <li>3. Introduce economic, cultural, and trade activities and their impact on the development of the region</li> </ol>	
<b>Content of Theory Course 1</b>	
<b>45Hrs</b>	
<b>Unit – 1 Introduction to Human Geography</b>	
11	
Nature and scope, Development Environmental Determinism and Possibilism, Neo determinism (stop and go determinism) Approaches to human geography: Exploration and Descriptive approach, regional analysis Approach, Areal Differentiation Approach, Spatial organization Approach. Modern approaches: Welfare or Humanistic Approach, Radical Approach, Behavioral Approach, Post Modernism in geography Fields and sub fields in Human geography	
<b>Unit – 2 Geographical Analysis of Population</b>	
11	
Distribution and Growth of Population Density of population: meaning and Types: Arithmetic Density and Physiological Density. Regional distribution of Density of Population. Population Movement: Migration, Ravenstein's Law of Migration, Factors of population Migration, Economic Push and Pull factors, Cultural Push and Pull Factors, Environmental Push and Pull Factors. Migration Types: Immigration and Emigration, Internal and International Migration	
<b>Unit – 3 Cultural Patterns and Processes</b>	
11	
Concept of Culture, Material and Non material culture Cultural Regions, cultural Traits and Complexes, cultural Hearths, cultural Diffusion. Languages of the World: Types, Classification and Distribution. Religions: Types and Classification. Distribution. Universalizing Religions: Christianity, Islam, Buddhism. Ethnic Religions: Hinduism, the Chinese religion, Shintoism, Judaism. The Major tribal population of the world.	

<b>Unit – 4 Human Economic Activities, Development and Settlements</b>	12
<p>Primary Economic Activities – Agriculture, Types: Primitive Subsistence, Intensive subsistence, Plantation Agriculture, Extensive Commercial grain cultivation, Mixed Farming, Dairy Farming</p> <p>Secondary Activities: Manufacturing, classification – based on size – Small Scale and Large scale. Based on Raw material – Argo-based, Mineral based, Chemical Based and Forest based. Industrial Regions of the world.</p> <p>Tertiary Activities: Types: Trade and commerce, Retail Trading services, Wholesale trading. Transport and communications: Factors, communication services – Telecommunication. Services: Informal and Non formal sector. Information technology and service.</p> <p>Human Settlements: Factors, Classification, Types and Patterns: Rural, Urban. Compact or Nucleated and Dispersed settlements. Rural settlement Patterns: linear, rectangular, circular, star shaped, T shaped.</p>	

### References

1. Hartshorne, T. A., & Alexander, J. W. (2010). Economic Geography. New Delhi: PHI Learning.
2. Knox, P., Agnew, J., & McCarthy, L. (2008). The Geography of the World Economy. London: Hodder Arnold.
3. Lloyd, P., & Dicken, B. (1972). Location in Space: A Theoretical Approach to Economic Geography. New York: Harper and Row.
4. Siddhartha, K. (2000). Economic Geography: Theories, Process and Patterns, New Delhi: Kisalaya Publications.
5. Smith, D. M. (1971). Industrial Location: An Economic Geographical Analysis, New York: John Wiley and Sons.

### Pedagogy

<b>Formative Assessment</b>	
<b>Assessment Occasion/type</b>	<b>Weightage in Marks</b>
Quiz	30%
Assignment	20%
CIA	50%
<b>Total</b>	<b>100%</b>

## B.A. / BSc Semester 2

### **Title of the Course: 2. Basics of Geographic Information Systems (GIS)**

**CODE: GEOGOE T2.1.2**

Number of Theory Credits	Number of lecture hours/ semester
<b>3</b>	<b>39 or 42</b>
<p><b>Course Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Students are trained to adapt the theoretical concepts in a practical way through the mathematical models of geography.</li> <li>2. Students will have the hands-on training on various modes of spatial and non-spatial data collection, data storage, data analytics, data interpretation and data display through the thematic maps.</li> <li>3. Students are exposed on spatial thinking to solve the geographical problems with range of proven mathematical and statistical models.</li> <li>4. Students can employ in various corporate and government organisation where they deal to solve geographical problems.</li> </ol>	
<p><b>Course Objectives:</b> This course aims to:</p> <ol style="list-style-type: none"> <li>1. Understand the concept and techniques of the Geographic Information Systems.</li> <li>2. Define the GIS data types and structures.</li> <li>3. Study geo processing and visualization concepts and techniques in GIS.</li> </ol>	
<b>Content of Theory Course 1</b>	
<b>52/56Hrs</b>	
<b>Unit – 1 Introduction</b>	
10	
Emergence of GI Science, Milestone and Developmental stages in GIS, Definition, scope, role of GIS in digital world; Components, functionalities, merits and demerits, global market, interdisciplinary domains, and its integration with GIS.	
<b>Unit – 2 Geodesy and Spatial Mathematics</b>	
10	
Cartesian coordinates, latitude, longitudes, formats of angular units, geographical coordinates, Datum: WGS84, vs NAD32. UTM, Aerial Distance measurement using Geographic and projected coordinates, Area, Perimeter, length by coordinates and various international measures.	
<b>Unit – 3 GIS Data and Scale</b>	
10	
Spatial Data and its structures; sources and types of data collection; data errors, topology of data and relationship. Large Scale vs Small Scale, generalization; precision and accuracy of data-logical consistency and non-spatial data integration	
<b>Unit – 4 Geoprocessing and Visualization</b>	
12	
Spatial and Non-Spatial Queries, proximity analysis, Preparation of Terrain and Surface models. Hotspot and density mapping. Types of maps, thematic maps and Its types, relief maps, flow maps and cartograms. Tabulations: Graphs and Pivot tables	

## References

1. An Introduction to Geographical Information Systems - Ian Heywood (2011)
2. Geographic Information Systems and Cartographic Modelling - Tomlin, C.D. (1990)
3. Geographic Information Systems and Environmental Modelling - Clarke, C., K. (2002)
4. Geographic [Information Systems](#) and Science - Paul A. Longley, et. al. (2015)
5. Geographic Information Systems: A Management Perspective - Aronoff, S. (1989)
6. GIS - Fundamentals, Applications, and Implementations - Elangovan, K. (2006)
7. Introduction to Geographical Information Systems - Chang, Kang-Tsung (2015)
8. Mathematical Modeling in Geographical Information System, Global Positioning System and Digital Cartography - Sharma, H.S. (2006)
9. Remote Sensing and GIS - Bhatta, B. (2011)
10. Spatial analysis and Location-Allocation Models - Ghosh, A. and G. Rushton (1987)

## Reference Websites

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2. ITC Netherlands, Principles of GIS [https://webapps.itc.utwente.nl/librarywww/papers\\_2009/general/principlesgis.pdf](https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf)
3. Geographical Information Systems: Principles, Techniques, Management and Applications [https://www.geos.ed.ac.uk/~gisteac/gis\\_book\\_abridged/](https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/)

## Pedagogy

Formative Assessment	
Assessment Occasion/type	Weightage in Marks
Quiz	30%
Assignment	20%
CIA	50%
<b>Total</b>	100%

**University of Mysore**  
**B.A. / B.Sc. (Geography) Degree**  
 (Basic / Honours)  
**Scheme & Syllabus - NEP-2020Second**  
**Year**

Semester	Course code	Course title	Teaching hours	Hours / week	Examination Pattern- Max & min marks/ paper		Duration of Examination in Hrs	Total Marks	Credits
					Exam	IA			
III	DSC T 3.1	Fundamentals of Human Geography	56	4	60	40	2	100	4
	DSC P 3.1	Fundamental Techniques in Human Geography	56	4	25	25	2	50	2
	OE 3.1	Geography of India	42	3	60	40	2	100	3
	OE 3.2	Application of GIS and Remote sensing	42	3	60	40	2	100	3

semester	Course code	Course title	Teaching hours	Hours / week	Examination Pattern- Max & min marks/ paper		Duration of Examination in Hrs	Total Marks	Credits
					Exam	IA			
IV	DSC T 4.1	India: Resources and Sustainability	56	4	60	40	2	100	4
	DSC P 4.1	Representation of Indian Geographical features and resources.	56	4	25	25	2	50	2
	OE 4.1	Geography of Karnataka	42	3	60	40	2	100	3
	OE 4.2	Population and settlement Geography	42	3	60	40	2	100	3

## B.A. / B.Sc. honors Programme

### Semester III

**Title of the Course: Fundamentals of Human Geography**

**CODE: DSC T 3.1**

Number of Theory Credits	Number of lecture hours/semester
4	56
<p><b>Course Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Students will earn Basic concepts, approaches and development of Human Geography.</li> <li>2. Learn how human interact with environmental components of the world and also learn how human beings and environment mutually influences one another.</li> <li>3. Students will be familiarized with cultural and economic processes at different scales such as globalization, trade, cultural and social activities.</li> <li>4. The student will be able differentiate between geography and human geography.</li> <li>5. Understand population dynamics and human settlements.</li> </ol>	
<p><b>Course Objectives:</b></p> <p>This course aims to</p> <ol style="list-style-type: none"> <li>1. Understand the basics concepts and approaches of human geography</li> <li>2. Study the nature and distribution of cultural elements and their process and to appraise the mutual interaction between People and places.</li> <li>3. To examine the population attributes and dynamic nature of them.</li> <li>4. To study different types of economic activities and their adaptation with the environment and their impact on the development of the regions.</li> </ol>	
<p><b>Module –1: Introduction to Human Geography</b></p>	
	14
<p>Nature and scope, Development and Branches of Human Geography, Themes in Geography: Location, Place, Human-Environment Interaction, Movement and Region.</p> <p>Man- Environment Relation: Environmental Determinism and Possibilism, Neo-Determinism (stop and go determinism)</p> <p>Approaches to Human geography: Exploration and Descriptive Approach, Regional Approach, Areal Differentiation Approach, Spatial organization Approach. Modern Approaches: Welfare or Humanistic Approach, Radical Approach, Behavioral Approach, Post Modernism in geography.</p>	
<p><b>Module –2: Cultural patterns and Processes</b></p>	
	14
<p>Concept of culture, Material and Non-material Culture, Cultural traits and Cultural regions.</p> <p>Meaning and Definition of races, Classification of races, Main characteristics (traits) and Broad racial groups of the world and their distribution.</p> <p>Languages: Classification and Distribution of languages.</p> <p>Religion: Types, Classification, and Distribution of religions: Hinduism, Christianity, Islam and Buddhism.</p> <p><b>Assignment:</b> Each student is expected to prepare a brief report on the cultural composition of their own locality/ place/ village/ ward/town or neighborhoods through field investigation and also can use published data.</p>	

<b>Module –3: Population and Settlements</b>	14
<p>Distribution and Growth of Population; Factors affecting population Distribution.</p> <p>Density of Population: Meaning and Types; Arithmetic Density, Physiological Density and Agricultural density, Regional Distribution of Density of Population; Carrying capacity and Sustainability, Concept of Settlements, Origin and evolution of Human settlements, Factors of settlements, origin and distribution, types and pattern of settlements, Rural and Urban settlements, Trends and Patterns of World Urbanization.</p> <p><b>Field Activity:</b> Students should study and identify the factors influencing on the origin and growth of the settlement and each student is expected to identify patterns of settlements by visiting nearest settlement. The students are advised to carry topographical map of the place during field visit.</p>	
<b>Module–4: Economic Activities</b>	14
<p>Concept and Classification of Economic activities; Factors affecting Economic Activities.</p> <p>Primary Economic Activities – Agriculture, Types: Primitive Subsistence, Intensive Subsistence, Plantation Agriculture, Extensive Commercial grain Cultivation, Mixed Farming, Dairy Farming.</p> <p>Secondary Activities: Manufacturing, Classification – 1. Based on size – Small Scale and Large scale. 2. Based on Raw Material – Agro-based, Mineral based, Chemical Based and Forest based. Industrial Regions of the world.</p> <p>Tertiary Activities: Types: Trade and Commerce, Retail Trading Services, Wholesale Trading. Transport and communications: Factors, Communication Services – Telecommunication. Services: Informal and Non formal sector. Information technology and service.</p> <p><b>Case Study:</b> Students have to visit a village/a town nearby and observe the economic activities and understand different classes and identify the most dominant economic activities..</p>	

## References

- 1) De Blij H. J., Alexander B Murphy, Erin H Foubert, (2006) Human Geography: people, Place and culture, Abe books Published by Wiley ISBN 10: 0471679518 / ISBN 13: 9780471679516
- 2) Sarah Bendarz, Mark Bockenbauer, Fredrik Hiebert, 2020, Human Geography: A Spatial Perspective; NatlGeographics School Pub Inc.
- 3) Majid Hussein 2018 Human Geography, Rawat Publication ( Fifth Edition)
- 4) David Dorrell, Joseph Henderson, Todd Lindley and Georgeta Cannon (2019) Introduction to Human Geography, University System of Georgia, <https://ung.edu/university-press/books/introduction-to-human-geography.php>
- 5) Hartshorne, T.A., & Alexander, J.W. (2010). Economic Geography. New Delhi: PHI Learning.
- 6) Nellson, Gabler Vining (1995) Human Geography, People, Cultures and Landscapes
- 7) Ranganath (2002) Principles of Human Geography ( Kannada Version) Vidyanidhi, Gadag
- 8) Rubenstein J.M (2016). An Introduction to Human Geography, Macmillan Publishing Company, New York
- 9) Knox, P., Agnew, J., & McCarthy, L. (2008). The Geography of the World Economy. London: Hodder Arnold.
- 10) Lloyd, P., & Dicken, B. (1972). Location in Space: A Theoretical Approach to Economic



Geography. New York: Harper and Row.

- 11) Siddhartha, K. (2000). Economic Geography: Theories, Process and Patterns, New Delhi: Kishalaya Publications.
- 12) Smith, D.M. (1971). Industrial Location: An Economic Geographical Analysis, New York: John Wiley and Sons.

## B.A./ B.Sc. honors Programme

### Semester III

**Title of the Course: Fundamental Techniques in Human Geography, CODE: DSC P 3.1**

Number of Theory Credits	Number of lecture hours / semester
2	56
<p><b>Course Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Students will learn the geographical concepts such as scale, map, projections, distance, direction, and learn how these features are used in map production and area visualization.</li> <li>2. Students will be familiarized with different methods of computing population growth, understanding the techniques of nearest neighbor analysis.</li> <li>3. The student will be able to understand the factors affecting settlement development and economic activities therein.</li> </ol>	
<p><b>Course Objectives:</b></p> <p>This course aims to</p> <ol style="list-style-type: none"> <li>1. Understand the application of the cartography in mapping of population</li> <li>2. Study population growth models</li> <li>3. Introduce how economic, cultural, and trade activities impact on the development of the settlement</li> </ol>	

Content of the Practical Course		
<b>Exercise 1</b>	<p><b>Maps:</b> Definition, Elements of map: scale, direction, map projection, conventional signs and symbols, legend,</p> <p>Types of map: <b>1. Based on scale:</b> A. large scale: cadastral maps, Topographic maps, B. Small scale: wall maps, atlas maps, maps</p> <p><b>2. Based on purpose and content:</b> Physical Maps, Political Maps, Thematic Maps. Uses of Maps.</p>	08
<b>Exercise 2</b>	<p><b>Map Scales:</b> Definition of Scale, Methods of representing Scales: Statement Method, Graphical Method, Ratio Method (R F).</p>	08
<b>Exercise 3</b>	<p><b>Conversion of Scale:</b> Verbal to RF, RF to Verbal, Verbal to Graphical.</p> <p>Exercises on Measuring Distances on Map and converting map distance to ground distance.</p>	08
<b>Exercise 4 and 5</b>	<p><b>Map Projections:</b> Meaning and Purpose, Latitudes and Longitudes, Classification of Map Projections and their general properties: Conical Projections, Cylindrical Projections, Zenithal Projections. UTM Projections. Choice of Map Projection.</p>	08
<b>Exercise 6</b>	<p>Drawing of conical projection with One Std. Parallel and Two Std. Parallels,</p>	08

<b>Exercise 7</b>	Drawing of Cylindrical Equal Area Projection.	06
<b>Exercise 8</b>	Drawing of Zenithal Polar Gnomonic Projection.	06
<b>Exercise 9</b>	Introduction to UTM Projection, uses and importance.	4

### References:

1. Dr.L.R.Singh (2010), Fundamentals Of Practical Geography, Sharda Pustak Bhavan, Allahabad, India.
2. Pijushkanti Saha, Partha Basu (2013) Advanced Practical Geography
3. Ashis Sarkar (2015) Practical Geography: A Systematic Approach, Orient Black swan Pvt Ltd.
4. Rana Pb Singh Rl Singh(2018), Elements of Practical Geography. Kalyani Publishers
5. Dent B.D., 1999. Cartography: Thematic Map Design, (Vol. 1), McGraw Hill
6. Gupta K.K and Tyagi V.C., 1992. Working with Maps, Survey of India, DST, New Delhi.
7. Mishra R.P. and Ramesh A., 1989. Fundamentals of Cartography, Concept Publishing.
8. Monk house, F.J. and Wilkinson, H.R., 1971. Maps and Diagrams. Methuen and Co. Ltd., London. K.
9. Singh, R.L., 2005. Elements of Practical Geography. Kalyani Publishers, New Delhi. India.

## B.A. /B.Sc. Honors Programme

### III Semester (Open Elective)

**Title of the Paper: Geography of India**

**Code:OE3.1**

<b>Number of Theory Credits</b>	<b>Number of lecture hours / semester</b>
<b>3</b>	<b>42</b>
<p><b>Course Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. This is intended to ensure the Students of other discipline to gain geographical knowledge about India.</li> <li>2. Prepare them to think geographically about our nation and to enhance the pride of our Nation.</li> </ol>	
<p><b>Course Objectives:</b></p> <p>After the completion of this course the Students are expected to</p> <ol style="list-style-type: none"> <li>1. Have an understanding of the Physical, ecological, economic, demographic and cultural characteristics of our nation.</li> <li>2. By that they can apply geographical knowledge and skills in deeper understanding of the Core Subjects.</li> </ol>	

<b>Module</b>	<b>Content</b>	<b>Hours</b>
<b>Module -1 Physical Bases</b>		12
	Location, Size and Extent, Political Divisions Relief Features-Northern Mountains, Northern Great Plain, The Peninsular Plateau and Coastal Plain and Islands Climate: Seasons – Summer Season, South-West Monsoon, Retreating Monsoon Season, Winter Season, Drainage system- Rivers of North India, Rivers of South India, Vegetation - Types and Distribution- Afforestation programs	
<b>Module – 2 Irrigation and Agriculture</b>		10
	Irrigation: Need for Irrigation and Types Agriculture: Significance and Types- Intensive and Extensive Farming, Subsistence and Mixed Farming Major Crops- Production and Distribution : Rice, Wheat Cotton, Sugar cane and Tea Development of Agriculture- Green Revolution	
<b>Module - 3 Minerals, Power and Industries</b>		10
	Mineral and Power Resources-Types and Significance Production and Distribution: Iron Ore, Manganese Production and Distribution: Coal, Petroleum, Hydro Electricity Major industries- Iron and Steel, Cotton textile, Sugar. Major industrial regions of India Special Economic Zones	
<b>Module -4 Transport, Communication and Human Population</b>		10
	Roadways, Railways, Airways Waterways. Important Ports: Calcutta, Chennai, Mumbai and New Mangalore. Indian Space Programme. Growth of Population Distribution and Density of Population Population Composition – Sex Ratio, Literacy Problems of Population	
	<b>Total</b>	42

### References:

1. Gopal Singh : Geography of India, Atmarama and Sons, New Delhi.
2. Hussain M, 2014, Geography of India, Tata McGraw-Hill Education- New Delhi
3. ICAR: Cropping pattern in India, 1974.
4. Mathur, S.M.: Physical Geology of India, NBT 1991.
5. Ranganath : Regional and economic Geography of India (Kan. Ver) Vidyanidhi Prakashana, Gadag, 2020.
6. Mallappa P : Economic Geography of India ( Kan. Ver.) K V Lalitha Publishers

7. Ranjit Thirtha, 1996, Geography of India, Raniat, Jaipur.
8. Khullar D.R.2000, India a Comprehensive Geography ,Kalyani Publishers,Ludhiana.
9. Sharma T C,2012, Economic Geography of India, Rawath Publications, Delhi
10. Tiwari R.C 2006, Geography of India, Prayag Pustak Bhawan, Allahabad,
11. Pritivish Nag &Smita Sengupta, 1992, Geography of India, Concept Publishing Company, New Delhi.
12. Ranganatha, 2007, Geography of India, Vidhyanidhi Prakashan, Station Road, Gadag-01.
13. Phani Deka &Abani Bhaga bati,1992, Geography: Economic and Regional, Wiley Eastern Limited,AnsariRaod, Daryaganj, N. Delhi-01.

**Websites:**

1. <http://www.mapsofindia.com/geography/>
2. <https://agricoop.nic.in/en>
3. <https://www.resourcedata.org/dataset/rgi-ministry-of-minerals-energy-and-water-resources>
4. <https://dpiit.gov.in/>
5. <http://rfrfoundation.org/nadi-ko-jano/>
6. <https://jalshakti-ddws.gov.in/>

**B.A. /B.Sc. Honors Programme**

**III Semester (Open Elective)**

**Title of the course: Application of GIS and Remote sensing      OE.3.2 Credits: 3**

Number of Theory Credits	Number of lecture hours / semester	
<b>3</b>	<b>42</b>	
<b>Course Outcomes:</b>		
<ol style="list-style-type: none"> <li>1. This is intended to ensure the Students of other discipline should understand fundamentals of remote sensing and Geographical Information system.</li> <li>2. prepare them to think geographically and Apply this knowledge to their respective field of enquiry for spatial and other kinds of planning.</li> </ol>		
<b>Course Objectives:</b>		
<p>After the completion of this course the Students are expected to</p> <ol style="list-style-type: none"> <li>1. Have an understanding of the Geo-spatial tools and their significance and utilization.</li> <li>2. Utilize different tools and techniques of remote sensing and GIS for addressing various problems which are both natural and societal in nature.</li> <li>3. By that they can apply geographical knowledge and skills in deeper understanding of the Core Subjects.</li> </ol>		
Module	Content	Hours
Module - 1	Remote Sensing; Concept, Definition, Evolution of Remote Sensing, Process of Remote sensing, EMR; Wave length, Frequency, Electromagnetic Spectrum; Bands, Atmospheric window, Interaction of EMR with atmosphere and surface. Spectral signature.	12
Module - 2	Remote Sensing Platforms, Orbit, Active and Passive Remote Sensing, Indian remote sensing satellites and launch vehicle's,	10

	Application of Remote Sensing in Agriculture, Disaster management, Urban studies, Coastal management and EIA.	
Module - 3	Geographic information System; Definition, Development of GIS, Components of GIS, Data types; Spatial and Non-spatial data, Raster and Vector data models, Data Sources, errors, Data input methods; Manual and Automated.	10
Module 4	Data Analysis; Buffer Analysis and its applications, Overlay functions, Query, Network Analysis, GIS Applications in urban monitoring & planning, Disaster Mitigation, Forestry, Wetland monitoring.	10

### References:

1. Lilles and Thomas M. & Kiefer Ralph: Remote Sensing and Image Interpretation Third Edition John Wiley
2. Campbell John B.: Introduction to Remote Sensing Taylor & Francis
3. Floyd F. Sabins : Remote Sensing and Principles and Image Interpretation
4. Manual of Remote Sensing: American Society of Photogrammetry and Remote Sensing.
5. George Joseph: Fundamentals of Remote Sensing; Universities Press India Pvt Ltd, Hyderabad, India
6. Editors: John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, 2001. Manual of Geospatial Science and Technology, November 2001, Vol 1 Part I and II.
7. Paul M. Mather, 1999. Computer Processing of Remotely sensed Images: An Introduction. John Wiley
8. Aronoff, S. (1991). Geographic Information Systems: A Management Perspective, WDL Publications, Ottawa, Canada.
9. Chang, Kang-Tsung (2006). Introduction to geographic information systems. Boston: McGraw-Hill Higher Education.
10. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2005). Geographic information systems and science. John Wiley & Sons.
11. Bernhardsen, T. (2002). Geographic information systems: an introduction. John Wiley & Sons.
12. Ian Heywood, Sarah Cornelius and Steve Carver (2010). An introduction to geographical information systems. Prentice Hall - Pearson Education limited.
13. Chang, Kang-tsung (2002). Introduction to Geographic Information Systems, McGraw-Hill Companies, Inc
14. Chrisman, N. (1997): Exploring Geographic Information systems, John Wiley & Sons., New York
15. The ESRI Guide to GIS Analysis, by Andy Mitchell, ESRI Press, 1999, 188 pp.

## B.A./B.Sc. honors programme

### Semester IV

**Title of the Course: India- Resources and Sustainability**

**CODE: DSC 4.1**

<b>Number of Theory Credits</b>	<b>Number of lecture hours / semester</b>
<b>4</b>	<b>56</b>
<b>Course Outcomes:</b> <ol style="list-style-type: none"><li>1. Students will learn about the physical setting of India.</li><li>2. Students will be familiarized with the water and Agricultural Resources of India and they will understand the importance of these resources in the national development and prosperity.</li><li>3. The student will be able to understand the factors affecting, location and distribution of Industries and different modes of Transport.</li></ol>	
<b>Course Objectives:</b> <p>This course aims to</p> <ol style="list-style-type: none"><li>1. Understand the physical setting of India.</li><li>2. Study water and agricultural resources of India.</li><li>3. Study the nature of transport and communication, Industries and population growth.</li><li>4. Introduce how economic, cultural, and trade activities impact on the development</li></ol>	
<b>Module -1 Physical Setting:</b>	<b>14</b>
Location, Size and Extent. Major Physiographic Regions - Northern Mountains, Northern Great Plains, Peninsular Plateau and Coastal Plains and Islands) and their Characteristics; Climate: Seasonal Weather Characteristics, Climatic Zones. Mechanism and Characteristics of Indian Monsoons. Tropical Cyclones and Western Disturbances. Floods and Droughts Drainage System. Soil: Types, Erosion and Conservation. Vegetation: Types, Distribution, Afforestation programs, National Parks, Wildlife Sanctuaries, and Biosphere reserves.	
<b>Module -2 Water and Agricultural Resources:</b>	<b>14</b>
Water resources of India, Surface and Groundwater, Water Demand and Utilization. Irrigation: Sources, Types and Intensity. Issues and Challenges: Water Resources Scarcity, Water Conservation and Management. Watershed Management, Rainwater Harvesting, Recycle and Reuse of water. Interlinking of Rivers, National Water Policies, National Water Mission, Jalashakti	

	<p>Abhiyaan. Command Area Development and Water Management. Central Water Commission and Water Tribunal and their role.</p> <p>2.5 Agriculture: Land Use and Cropping Pattern – Meaning and Concepts, Land Use and Cropping Pattern in India, Agro-climatic Regions, Green Revolution – Causes and Effects, Hunger Index and Malnutrition; Food security and right to food to achieve Zero hunger and Good Health and Wellbeing..</p>	
<b>Module -3 Industries, Transportation and Communication:</b>		14
	<p>Locational factors of industries, Major Industrial Regions and their characteristics,</p> <p>Classification of Industries: Agro-based, Mineral-based, Forest-based and Animal-based industries.</p> <p>Special Economic Zones: Industrial / Economic Corridor.</p> <p>Transport &amp; Communication: Significance, Growth and Development – Road ways, Railways, Waterways, Airways and Pipeline Networks and their Complementary and Competition.</p> <p>Communication: Means of Communication and their Significance</p> <p><b>Assignment:</b> Selecting a region students have to study the locational factors nearby industry and prepare a report.</p>	
<b>Module -4 Human Resources:</b>		14
	<p>Growth, Distribution and Density of Population.</p> <p>Composition of Population: Age, Sex, Rural-Urban Population Composition.</p> <p>Migration: Meaning, Factors, Types, Causes and Consequences.</p> <p>Human Development in India: Measures, Levels of Development based on HDI</p> <p><b>Field Study:</b> Selecting a region / district students have to examine the levels of Human Development using HDI and prepare a report.</p>	

### References:

1. Majid Husain (2020) Geography of India, McGraw Hill Publishers
2. R.C. Tiwari (2016) Geography of India, Provolika Publications, Allahabad
3. D.R.Khullar (2019) India: A Comprehensive Geography, Kalyani Publishers
4. R.L.Singh (1993) India: A Regional Geography, National Geographical Society of India, New Delhi.
5. Dr Deep Shikha (2016) Geography of India - A Text Book;
6. AlkaGautam (2009) Geography of India, Sharada pustak bhawan, University Road, Allahabad – UP.
7. Sharma TC & Coutinho O (2005) : Economic and Commercial geography of India, Vikas Publishing House Ltd., New Delhi-14
8. Pritivish Nag & Smita Sengupta (1992) Geography of India, Concept Publishing Company, New Delhi.
9. Ranganath (2007) Geography of India, Vidhyanidhi Prakashan, Station Road, Gadag-01

### Websites:

1. <http://www.mapsofindia.com/geography/>
2. <https://mausam.imd.gov.in/>

3. <https://tourism.gov.in/>
4. <https://www.resourcedata.org/dataset/rgi-ministry-of-minerals-energy-and-water-resources>
5. <https://dpiit.gov.in/>
6. <https://agricoop.nic.in/en>
7. <https://www.fao.org/soils-portal/en/>

## B.A./B.Sc. honors Programme

### Semester IV

**Title of the Course: Representation of Indian Geographical features and Resources.**

**Code: DSC P-4.1**

Number of Theory Credits	Number of lecture hours / semester
2	56
<b>Course Outcomes:</b>	
After the completion of this course, students should be able to	
<ol style="list-style-type: none"> <li>1. Understand holistically about the geography of India and plotting resources on Indian outline map.</li> <li>2. Interpret and apply the concepts on resource distribution of India and related economic activities</li> <li>3. Demonstrate the economic development through the connectivity of transport and communication.</li> </ol>	
<b>Course Objectives:</b>	
This course aims to	
<ol style="list-style-type: none"> <li>1. Understand the basics geographical setting of India</li> <li>2. Study physiographic divisions with drainage, soil and vegetation of India.</li> <li>3. Gets exact information regarding mechanism of monsoon and its impact.</li> </ol>	

Content of the Practical Course		
<b>Ex.No.1</b>	Mapping exercises on Indian outline Map: International Boundaries, Mountain peaks, Passes, Glaciers and important Physical Divisions of India, Rivers, National Biospheres and National Parks, Dams and Reservoirs, Lakes and Water Bodies, Islands, National Waterways, Ports and Harbours, National High ways, Important Airports, Industrial Corridors, Important Coastal Zones and Beaches, Ecologically Sensitive areas, Important industrial zones, Special Economic Zones, Resource centres and Mining, Cultural Regions, Tribal Areas.  <b>Note:</b> Each student is expected to complete at least 3 mapping exercises from the above topics which should cover brief description on: Location (Latitude and longitude, state, district, place,) geographic/environmental/ ecological/ political/ economic significance of the place/ location. Minimum 10 locations shall be involved in each exercise.	10
<b>Ex.no.2 and 3,</b>	Mapping Temperature and Rainfall Distribution of India / Karnataka using Isopleth method.	10
<b>Ex.no.4 and 5</b>	Mapping of Agro-climatic zones of India, Flood Prone and Drought Prone Areas,	8



<b>Ex. No.6 and 7</b>	Mapping of Cropping Pattern and Crop intensity of India/ Karnataka. Weaver's Method, Bhatia's Method. Calculation and mapping of Irrigation intensity.	10
<b>Ex.no.8</b>	Human Development Index: Concept, Calculation and Mapping	6
<b>Ex.no.9</b>	Gender Development Index: Concept, Calculation and Mapping	6
<b>Ex.no.10</b>	Human Poverty Index: Concept and Calculation and Mapping	6

### Reference:

- 1) Hartshorne, T.A., & Alexander, J.W. (2010). Economic Geography. New Delhi: PHI Learning.
- 2) Knox, P., Agnew, J., & Mc Carthy, L. (2008). The Geography of the World Economy. London: Hodder Arnold.
- 3) Lloyd, P., & Dicken, B. (1972). Location in Space: A Theoretical Approach to Economic Geography. New York: Harper and Row.
- 4) Siddhartha, K. (2000). Economic Geography: Theories, Process and Patterns, New Delhi: Kishalay Publications.
- 5) Smith, D.M. (1971). Industrial Location: An Economic Geographical Analysis, New York: John Wiley and Sons.

## B.A. / B.Sc. Honors Programme Semester IV (Open Elective)

**Title of the Course : GEOGRAPHY OF KARNATAKA**

**Code: OE.4.1 Credits:3**

<b>Number of Theory Credits</b>	<b>Number of lecture hours / semester</b>
<b>3</b>	<b>42</b>
<p><b>Course Outcomes:</b> After the completion of this course, students should be able to</p> <ol style="list-style-type: none"> <li>1. Understand the physical, economic and socio-demographic aspects of Karnataka state in a broader sense.</li> <li>2. Understand the resource base of the state i.e., forests, soils, minerals, water and climate, and its impact on the socio-demographic and economic development of different regions of Karnataka in terms of agriculture, industries, transportation and other fields of human activities.</li> <li>3. Understand the development of irrigational projects and industrial projects and special Economic zones (SEZ's)</li> </ol>	
<p><b>Course Objectives:</b> This course aims to</p> <ol style="list-style-type: none"> <li>1. Understand the site and situation of Karnataka</li> <li>2. Intellectual connect to the resources and economic activities of Karnataka</li> <li>3. Assess demographic composition of Karnataka state</li> </ol>	

<b>Module</b>	<b>Content</b>	<b>Hours</b>
<b>Module -1</b>	<b>Physical Background</b>	12
	<p>Location, size and Administrative divisions.</p> <p>Physiographic Divisions: Coastal Regions, Malnad Regions and Maidan Regions.</p> <p>Weather and Climate: Seasons, Distribution of Rainfall and Temperature, Climatic regions, Drought prone areas in Karnataka.</p> <p>Drainage Systems: Major Drainage Systems in Karnataka. East flowing rivers and West flowing rivers.</p> <p>Natural Vegetation: Types of vegetation, Distribution of forests in Karnataka, Protection and Conservations. Reserve Forests and Protected Forests in Karnataka, National Parks and Bird Sanctuaries in Karnataka.</p>	
<b>Module -2</b>	<b>Soil, irrigation and Agriculture:</b>	10
	<p>Soil: Types and Distribution, Regional Issues of Soil Quality and Management.</p> <p>Water Resources: Distribution of Water Resources, Irrigation –Sources of irrigation, Multipurpose River Valley Projects.</p> <p>River Water Disputes with the neighbouring states.</p> <p>Agriculture regions of Karnataka. Major Food Crops – Paddy, Ragi, Maize, Pulses.</p> <p>Commercial Corps – Cotton, Sugarcane, Tobacco, Coffee, Spices, Livestock and Fishing.</p> <p><b>Assignment:</b> Students need to visit local fields and get to know how soil conservation plans are prepared and submit report</p>	
<b>Module - 3</b>	<b>Minerals, Energy and Manufacturing:</b>	10
	<p>Major Mineral resources of Karnataka and their Regionalization. Iron ore, Manganese, Gold, Bauxite</p> <p>Energy Resources: Types and their Distributions. Conventional and Non-Conventional Sources.</p> <p>Industries: Textile Industries, Iron and Steel Industries, Sugar Industries. Industrial Regions and Special Economic Zones of Karnataka.,</p>	
<b>Module – 4 Transport, Information &amp; Communication Technology and Population</b>		10
	<p>Transportation: Types of Transportation, Distribution of Transportation.</p> <p>Growth and Distribution of Information Technology in Karnataka.</p> <p><b>Population</b> Growth, Distribution and Density of Population. Population Composition – Sex Ratio, Literacy. Human Development in Karnataka (HDI)</p>	

### Reference:

1. Ranganath (2015), Geography of Karnataka, Publisher: Mysore Book House

2. S.S.Nanjannavar (2016), Geography of Karnataka, Prabhu publications
3. R. N. Tikka (2002),Physical Geography
4. MisraR.P(1969) Geography of Mysore State
5. SarmahDipak (2019), Forest of Karnataka-A Paronomic View, Notion Press
6. Director, Census Reports Published by Govt. of Karnataka
7. Karnataka State Gazetteer Volume- I & II

**Websites:**

1. <https://ksrsac.karnataka.gov.in/>
2. <https://ksdma.karnataka.gov.in/english>
3. <https://raitamitra.karnataka.gov.in/english>
4. <https://www.karnatakaturism.org/tourism-department/>

## BA/BSc Honors Programme

### Semester IV (Open Elective)

**Title of the course: Population and Settlement Geography**

**Code: OE.4.2 Credits: 3**

<b>Number of Theory Credits</b>	<b>Number of lecture hours / semester</b>	
<b>3</b>	<b>42</b>	
<b>Course Outcomes:</b>		
After the completion of this course, students should be able to		
<ol style="list-style-type: none"> <li>1. Understand the concepts of both Population and Settlement geography.</li> <li>2. Appreciate the man environment interplay which are expressed in different kinds and patterns in the distribution and density of population and Human settlements over space.</li> <li>3. Understand the Demographic dynamics like birth, Death and Migration of Population and its relation with settlement dynamics like settlement size, types and rural urban settlements and its issues.</li> </ol>		
<b>Course Objectives:</b>		
This course aims to		
<ol style="list-style-type: none"> <li>1. Introduce the basic concepts of Population Geography to the students.</li> <li>2. Introduce the basic concepts of Settlement Geography to the students.</li> <li>3. Bring the significance of Environment and society on Population dynamics and Mobility.</li> <li>4. Critically examine the nature of man-environment relation and interaction with reference to human settlement types and patterns.</li> </ol>		
<b>Module</b>	<b>Content</b>	<b>Hours</b>
Module -1	<b>Population Geography -</b>	12
	Meaning, Definitions, Scope and nature of population geography Global Population size and growth, Malthus Theory, Demographic Transition Theory Over, Under and Optimum Population Population Policies in the world – Social Well being, Quality of Life	

<b>Module -2</b>	<b>Population Dynamics</b>	10
	Fertility – Measures and Distribution Mortality – Measures and Distribution Migration – Types, Causes and Consequences	
<b>Module -3</b>	<b>Settlement Geography</b>	10
	Meaning, Definitions, nature and importance of settlement geography, Origin of settlement, influencing factors Site and situation of settlement – Stable and Unstable settlement	
<b>Module -4</b>	<b>Classification of Settlements- Rural and Urban Settlements</b>	10
	Rural Settlement – Types, Pattern, Functions Rural-Urban Continuum and Fringe Urban Settlement - Definition of urban place, Hierarchy, Functional classification of towns, Concept of Urban morphology. Primate City, Rank Size Rule	

#### References:

1. Alan Bowman and Andrew Wilson (2011), Settlement, Urbanization, and Population, Oxford University Press, UK.
2. Chandna R.C (2011), Geography of Population, Kalyani publishers, Bangalore.
3. Izzi Howell (2019), Population and Settlement Geography (Geographics), Franklin Watts, UK.
4. John Pallister (2004), GCSE Geography: Human - Population and Settlement, Hodder Education Group, UK.
5. Majid Husain (2011) Human Geography, Rawat Publication, Jaipur.
6. Prithvish Nag, Debnath (2021), Population Geography, BharatiPrakashan, Bangalore.
7. Rama Yagya Singh (1994), Geography of Settlement, Rawat Publications, Jaipur
8. Sumita Ghosh (1998), Introduction to Settlement Geography, Orient Longman, Hyderabad.

**DEPARTMENT OF GEOGRAPHY**

**MODEL QUESTION PAPER**

**B.A GEOGRAPHY**

**(For I, II, III, IV, V AND VI semesters)**

**Time: 2 Hours**

**Max. Marks: 60**

**Part-A**

**I. Answer any FOUR of the following questions**  
**4x3=12**

- 1).....
- 2).....
- 3).....
- 4).....
- 5).....
- 6).....

**Part-B**

**II. Answer any THREE of the following questions**  
**3x6=18**

- 7).....
- 8).....
- 9).....
- 10).....
- 11).....

**Part -C**

**III. Answer any THREE of the following questions**  
**3x10=30**

- 12).....
- 13).....
- 14).....
- 15).....

.....



**JSS COLLEGE OF ARTS, COMMERCE AND  
SCIENCE  
(AUTONOMOUS)  
B.N. ROAD, MYSURU-570025**



**DEPARTMENT OF GEOGRAPHY**

**Revised Syllabus for Undergraduate (UG)  
CBCS scheme - 2017-18**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY**  
**ROAD, MYSURU-25 DEPARTMENT OF GEOGRAPHY**  
**PROFORMA OF INSTRUCTIONS AND EXAMINATION FOR BA PROGRAMME IN**  
**GEOGRAPHY (CBCS) DURATION OF THE COURSE: 3YEARS (6 SEMESTER)**  
**PROGRAMME: BA EG PROGRAMME CODE: BA11 (2017-18)**

Year	SEM	Course code & Core course	Title of the paper	L + P hours per week	L:T:P	Total Credit	Total		Percentage			Maximum Marks in			Exam		
							hours		exam/Assessment			Duration					
							Th	Pr	Th	Pr	IA	Th	Pr	IA	Th	Pr	
I BA	I	<b>DLA23011</b>	Physical Geography	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h	
		DSC-I :Theory															
	<b>DLA23311</b>	Contour diagrams and meteorological instruments	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h		
	DSC-I: Pract-I																
	II	II	<b>DLB23011</b>	Human Geography	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h
			DSC-II: Theory														
<b>DLB23311</b>		Interpretation of Topographical Maps and Indian Daily Weather Maps	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h		
DSC-II: Pract-II																	
II BA	III	<b>DLC23011</b>	General Cartography	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h	
		DSC-III:Theory															
		<b>DLC23311</b>															Map Projection
	DSC-III:PractIII																
	IV	IV	<b>DLD23011</b>	Environmental Geography	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h
			DSC-IV: Theory														
<b>DLD23311</b>		Statistical Methods in Geography	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h		
DSC-IV:PractIV																	



III BA	V		<b>Choose any one</b>	4												
		DSE-V: Theory														
		<b>DLE23011(A)/</b>	DSE- A: Geography of India		04:00:02	<b>6</b>	60	60	50	20	30	70	70	30	3h	3h
		<b>DLE23011(B)</b>	DSE- B: Economic Geography													
		<b>DLE23711</b> DSE- V:Pract- V	Fundamentals of GIS	4												
		SEC	<b>Choose any one</b>													
		<b>DLE23211(A)/</b>	SEC-A : Regional Planning and Development													
		<b>DLE23211 (B)</b>	SEC-B: Remote Sensing and GPS Based Project Report	4	04:00:00	<b>4</b>	60	-	70	-	30	70	-	30	3h	--
		<b>GE 1</b>	Regional Geography of India	4												
		<b>DLE23411</b>														
		<b>DLE23711</b> GE-I V:Pract-I	Computer Mapping	4	04:00:02	<b>6</b>	60	60	50	20	30	70	70	30	3h	3h
		Theory	<b>Choose any one</b>	4												
	DSE-VI:															
	<b>DLF23011(A)/</b>	DSE- A: Disaster Management	04:00:02		<b>6</b>	60	60	50	20	30	70	70	30	3h	3h	
	<b>DLF23011(B)</b>	DSE -B :Geography of Tourism														
	<b>DLF23711</b>	Computer Mapping and GPS Surveying	4													
	DSE- VI:PractVI															
	SEC	<b>Choose any one</b>	4													
	<b>DLF23211(A)/</b>	SEC-A : GIS Based Project Report														
	<b>DLF23211(B)</b>	SEC-B: Field Techniques and Survey Based Project Report		04:00:00	<b>4</b>	60	-	70	-	30	70	-	30	3h	--	
	<b>GE-2</b>	Regional Geography of India	4													
	<b>DLF23411</b>															
	<b>DLF23711</b> GE-2 VI:Pract-I	Computer Mapping	4	04:00:02	<b>6</b>	60	60	50	20	30	70	70	30	3h	3h	
				<b>56</b>												



III BA	V		Choose any one	4												
		DSE-V: Theory														
		DLE23013(A)/	DSE- A: Geography of India		04:00:02	6	60	60	50	20	30	70	70	30	3h	3h
		DLE23013(B)	DSE- B: Economic Geography													
		DLE23713 DSE- V:Pract- V	Fundamentals of GIS	4												
		SEC	Choose any one													
		DLE23213(A)/	SEC-A : Regional Planning and Development													
		DLE23213 (B)	SEC-B: Remote Sensing and GPS Based Project Report	4	04:00:00	4	60	-	70	-	30	70	-	30	3h	--
		GE 1	Regional Geography of India	4												
		DLE23413														
	DLE23713 GE-I V:Pract-I	Computer Mapping	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h	
		Theory	4													
		DSE-VI:														
	DLF23013(A)/	DSE- A: Disaster Management		04:00:02	6	60	60	50	20	30	70	70	30	3h	3h	
	DLF23013(B)	DSE -B :Geography of Tourism														
	DLF23713 DSE- VI:PractVI	Computer Mapping and GPS Surveying	4													
		SEC	4													
	DLF23213(A)/	SEC-A : GIS Based Project Report														
	DLF23213(B)	SEC-B: Field Techniques and Survey Based Project Report		04:00:00	4	60	-	70	-	30	70	-	30	3h	--	
		GE-2	4													
	DLF23413	Regional Geography of India														
	DLF23713 GE-2 VI:Pract-I	Computer Mapping	4	04:00:02	6	60	60	50	20	30	70	70	30	3h	3h	
				56												

## **Programme Outcome**

### **After completing the graduation in B A (EG) the students are able to:**

- PO1. Explain, graph, and analyze key economics models
- PO2. Understand current events and evaluate specific policy proposals
- PO3. To address problem that do not have clear economic solutions
- PO4. Develop critical and quantitative thinking skills
- PO5. Communicate effectively in written, oral and graphical form about specific issues
- PO6. Apply economic analysis to everyday problems in real world situations
- PO7. Understand and appreciate relationship between man and Environment
- PO8. Read, interpret, and generate maps and other geographic representations
- PO9. To extract, analyze, and present information from a spatial perspective
- PO10. Understand physical-geographic processes, global distribution of  
Landforms and ecosystems
- PO11. The role of physical environment on human population
- PO12. Develop the ethical aptitudes and dispositions necessary to acquire and hold  
Leadership positions in industry, government, and professional organizations

## **Programme Outcome**

### **After completing the graduation in B A (KG) the students will:**

PO1. Develop human values and a sense of social service

PO2. Become a responsible and dutiful citizen.

PO3. Able to enhance critical temper and creative ability

PO4. Understand and appreciate relationship between man and Environment.

PO5. Read, interpret, and generate maps and other geographic representations

PO6. Understand physical- geographic processes, the global distribution of landforms and  
Ecosystems

PO7. Role of the physical environment on human populations

## **Programme Specific Outcome**

### **On Completion of BA (EG) students will:**

PSO1. Understand theoretical and practical aspects of Economics and Geography

PSO2. Evaluate Economic behavior inconsonance with Geographical factors

PSO3. Suggest the policy makers about desirable changes to be made in Micro and Macro

Economic issues based on geographical factors

PSO4. Gain ability to understand the economic problems in Geographical indicators

PSO5. Able to offer palatable solutions for economic and geographical challenges

PSO6. Attain Proficiency to analyze the economic decision of Government and non-Govt.

Entities that correlate with Geographical factors

PSO7. Gain requisite knowledge to evaluate land use pattern and demographical profile

PSO8. Apply GIS for understanding Market situation, Transport problem change in

Weather Condition, Cropping Pattern, and Natural Calamities and so on

## **Programme Specific Outcome**

### **On Completion of BA (KG) students will:**

PSO 1: Know more specific terminologies along with its etymology

PSO2: Know the changes in the differences in formation of society and their culture

PSO3: Help to understand different races, Society, and culture.

PSO4 Understand the relationship between man and environment

PSO6. Understand in simple language environmental problems their cause, Effect and Remedies.

PSO7. Help the students to pursue higher studies and even in research

PSO8 Helpful for competitive examinations

PSO9. Students may help to guide agricultural activities, fertility of soils, their characteristics,

Climatic condition, in regional language

DLE23011 (A) / DLE23013 (A)

**V – SEMSETER**  
**Geography V: GEOGRAPHY OF INDIA**

**Course outcome**

- CO 1. Deliberate in depth physical stunting of India
- CO 2. Write down in details with examples Irrigation system of India
- CO 3. Identify in depth population study of India
- CO 4. Learn in depth resources base study of India
- CO 5. Identify the characteristics of economic study of India

<b>UNIT</b>	<b>No. of Hours</b>
1. Location, size and extent of India – Relief features- Drainage system – Climate	15
2. Irrigation – Types, multipurpose river valley projects – DVC, Bhakra- Nangal, Alamatti	10
3. Population – Size and Growth since 1901, Population Density and Distribution, Literacy, Sex Ratio.	10
4. Resource Base –Livestock (cattle & fisheries),Power (Coal,& hydroelectricity) Minerals (iron ore and bauxite).	10
5. Economy – Agriculture (Rice, Wheat, Sugarcane, Tea, Cotton); Industries (Cotton Textile, Iron-Steel, Automobile), Transportation Modes (Road and Rail).	15

**References:**

1. Hussain M., 1992: *Geography of India*, Tata McGraw Hill Education.
2. Mamoria C. B., 1980: *Economic and Commercial Geography of India*, Shiva Lal Agarwala.
3. Miller F. P., Vandome A. F. and McBrewster J., 2009: *Geography of India: Indo-Gangetic Plain, Thar Desert, Major Rivers of India, Climate of India and Geology of India* - Alphascript Publishing.
4. Nag P. and Sengupta S., 1992: *Geography of India*, Concept Publishing.
5. Pichamuthu C. S., 1967: *Physical Geography of India*, National Book Trust.
6. Sharma T. C. and Coutinho O., 1997: *Economic and Commercial Geography of India*, Vikas Publishing.
7. Singh Gopal, 1976: *A Geography of India*, Atma Ram.
8. Spate O. H. K. and Learmonth A. T. A., 1967: *India and Pakistan: A General and Regional Geography*,

**DLE23011 (B) / DLE23013 (B)**

**V–SEMSTER**  
**GEOGRAPHY V: ECONOMIC GEOGRAPHY**

**Course outcome**

- CO 1. Identify the classification and characteristics of concepts of economic geography
- CO 2. Understand the characteristics of locational theories
- CO 3. Understand in depth study of primary activities
- CO 4. Learn the details of study of secondary activities
- CO 5. Write down in details with examples study of tertiary and quaternary activities

<b>UNIT</b>	<b>No. of Hours</b>
1. Definition, Approaches and Fundamental Concepts of Economic Geography; Patterns of Development.	12
2. Locational Theories – Agriculture (Von Thunen) and Industrial (Weber).	12
3. Primary Activities – Intensive Subsistence Farming, Commercial Grain Farming, Plantation, Commercial Dairy Farming, Commercial Fishing, and Mining (iron ore, coal and petroleum).	12
4. Secondary Activities – Cotton Textile Industry, Petro-Chemical Industry, Major Manufacturing Regions.	12
5. Tertiary and Quaternary Activities – Modes of Transportation, Patterns of International Trade, and Information and Communication Technology Industry.	12

**Reading List**

1. Alexander J. W., 1963: *Economic Geography*, Prentice-Hall Inc., Englewood Cliffs, New Jersey.
2. Bagchi-Sen S. and Smith H. L., 2006: *Economic Geography: Past, Present and Future*, Taylor and Francis.
3. Coe N. M., Kelly P. F. and Yeung H. W., 2007: *Economic Geography: A Contemporary Introduction*, Wiley-Blackwell.
4. Combes P., Mayer T. and Thisse J. F., 2008: *Economic Geography: The Integration of Regions and Nations*, Princeton University Press.
5. Durand L., 1961: *Economic Geography*, Crowell.
6. Hodder B. W. and Lee R., 1974: *Economic Geography*, Taylor and Francis.
7. Wheeler J. O., 1998: *Economic Geography*, Wiley.
8. Willington D. E., 2008: *Economic Geography*, Husband Pres



**DLE23711 / DLE23713**

**V– SEMESTER**  
**Practical V: FUNDAMENTALS OF G.I.S**

<b>UNIT</b>		<b>No. of Hours</b>
1	a) Meaning, definitions, components and importance of GIS b) Spatial entities – Point, line and polygon Sources of spatial data- Census, Topographical Maps, Aerial Photographs and Satellite Imageries	20
2	a) Spatial Data Structure Raster and vector data Structures Linking spatial and non spatial data b) Introduction to MapInfo software	20
3	a) Geo – referencing , Choice of map projection – Digitization, Attaching attribute data (Creating data base), Editing, Map layout, Thematic map	20

**References:**

1. Burrough P.A. : Geographical Information Systems for Land Resources
2. Maguire D. J. : Computers in Geography
3. Star J. C and J.E. : Geographic Information Systems
4. Internet : GIS. Development
5. Heywood : Introduction to GIS, 2002.
6. Mahesh : Introduction to GSI Shivalingappa Chandrashekar :

**V – SEMSETER**  
**Geography VI: REGIONAL PLANNING AND DEVELOPMENT**

**Course outcome**

- CO 1. Deliberate the details of concept of regional planning and development
- CO 2. Write down in details with application, if applicable, characteristics and delineation of planning region
- CO 3. Write down the characteristics of regionalization of India for planning
- CO 4. Deliberate the details of models for regional planning
- CO 5. Learn in depth backward regions and regional plans

<b>UNIT</b>	<b>No. of Hours</b>
1. Concept, Need and Types of Regional Planning.	8
2. Characteristics and Delineation of Planning Region.	10
3. Regionalization of India for Planning (Agro Ecological Zones).	12
4. Models for Regional Planning: Growth Pole Theory; Core Periphery Model and Growth Foci Concept in Indian Context	
5. Backward Regions and Regional Plans- Special Area Development Plans in India; DVC-The Success Story and the Failures; NITI Aayog.	15

**References:**

1. Blij H. J. De, 1971: Geography: Regions and Concepts, John Wiley and Sons.
2. Claval P.I, 1998: An Introduction to Regional Geography, Blackwell Publishers, Oxford and Massachusetts.
3. Friedmann J. and Alonso W. (1975): Regional Policy - Readings in Theory and Applications, MIT Press, Massachusetts.
4. Gore C. G., 1984: Regions in Question: Space, Development Theory and Regional Policy, Methuen, London.
5. Gore C. G., Köhler G., Reich U-P. and Ziesemer T., 1996: Questioning Development; Essays on the Theory, Policies and Practice of Development Intervention, Metropolis- Verlag, Marburg.
6. Haynes J., 2008: Development Studies, Polity Short Introduction Series.
7. Johnson E. A. J., 1970: The Organization of Space in Developing Countries, MIT Press,
8. Peet R., 1999: Theories of Development, The Guilford Press, New York
9. UNDP 2001-04: Human Development Report, Oxford University Press
10. World Bank 2001-05: World Development Report, Oxford University Press, New

**DLE23211 (B) / DLE23213 (B)**

**V – SEMESTER**

**Geography VI: REMOTE SENSING AND GPS BASED PROJECT  
REPORT**

**Course Outcome**

- CO 1. Understand the characteristics of concept of remote sensing
- CO 2. Identify in details with examples study of aerial photography
- CO 3. Specify the details of principals of remote sensing satellites
- CO 4. Write down the classification and characteristics of interpretation and application of remote sensing
- CO 5. Deliberate in details with application, if applicable, study of global positing system

**UNIT**

**No. of Hours**

- |  |    |
|--|----|
| 1. Remote Sensing: Definition, Development, Platforms and Types.   | 12 |
| 2. Aerial Photography: Principles, Types and Geometry.   | 12 |
| 3. Satellite Remote Sensing: Principles, EMR Interaction with Atmosphere and Earth Surface; Satellites (Land sat and IRS) and Sensors. | 12 |
| 4. Interpretation and Application of Remote Sensing: Land use/ Land Cover.   | 12 |
| 5. Global Positioning System (GPS) – Principles and Uses   | 12 |

**Practical Record:** A project file consisting of five exercises will be done from aerial photos, satellite images (scale, orientation and interpretation) and GPS field survey.

**Reading List**

1. Campbell J. B., 2007: Introduction to Remote Sensing, Guildford Press.
2. Jensen J. R., 2004: Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall.
3. Joseph, G. 2005: Fundamentals of Remote Sensing, United Press India.
4. Lillesand T. M., Kiefer R. W. and Chipman J. W., 2004: Remote Sensing and Image Interpretation, Wiley. (Wiley Student Edition).
5. Nag P. and Kudra, M., 1998: Digital Remote Sensing, Concept, New Delhi.
6. Rees W. G., 2001: Physical Principles of Remote Sensing, Cambridge University Press.
7. Singh R. B. and Murai S., 1998: Space-informatics for Sustainable Development, Oxford and IBH Pub.
8. Wolf P. R. and Dewitt B. A., 2000: Elements of Photogrammetry: With Applications in GIS, McGraw-Hill.

**DLE23411**

**GENERIC ELECTIVES - I  
V – SEMESTER  
GEOGRAPHY V: REGIONAL GEOGRAPHY OF INDIA**

**Course outcome**

- CO 1. Identify the characteristics of size and extent of India
- CO 2. Understand the classification and characteristics of multipurpose river
- CO 3. Identify the classification and characteristics of Population density and distribution
- CO 4. Learn in details with examples power resources of India
- CO 5. Specify the characteristics of Transportation modes

**UNITS**

**No. of Hours**

- |  |    |
|--|----|
| 1. Location, size and extent of India – Relief features- Drainage system – Climate   | 15 |
| 2. Irrigation – Types, multipurpose river valley projects – DVC, Bhakra- Nangal, Alamatti  | 10 |
| 3. Population – Size and Growth since 1901, Population Density and Distribution, Literacy, Sex Ratio.  | 10 |
| 4. Resource Base –Livestock (cattle & fisheries),Power (Coal,& hydroelectricity) Minerals (iron ore and bauxite).  | 10 |
| 5. Economy – Agriculture (Rice, Wheat, Sugarcane, Tea, Cotton); Industries (Cotton Textile, Iron-Steel, Automobile), Transportation Modes (Road and Rail). | 15 |

**Reference:**

1. Hussain M., 1992: Geography of India, Tata McGraw Hill Education.
2. Mamoria C. B., 1980: Economic and Commercial Geography of India, Shiva Lal Agarwala.
3. Miller F. P., Vandome A. F. and McBrewster J., 2009: Geography of India: Indo- Gangetic Plain, Thar Desert, Major Rivers of India, Climate of India, Geology of India, Alphascript Publishing
4. Nag P. and Sengupta S., 1992: Geography of India, Concept Publishing  
Pichamuthu C. S., 1967: Physical Geography of India, National Book Trust.
5. Sharma T. C. and Coutinho O., 1997: Economic and Commercial Geography of India, Vikas Publishing.
6. Singh Gopal, 1976: A Geography of India, Atma Ram.
7. Spate O. H. K. and Learmonth A. T. A., 1967: India and Pakistan: A General and Regional Geography,

**DLE23711**

**GENERIC ELECTIVES - I  
V – SEMESTER  
PRACTICAL V: COMPUTER MAPPING**

<b>UNIT</b>	<b>No. of Hours</b>
1. Introduction to Computer : Generation of Computers, Hardware and Software Components	20
2. Computer graphics : Creating Data base in computer, creation of Line, Bar and Pie diagrams. Thematic Maps - Choro chromatic and Schematic Maps	20
3. GPS - Meaning, Function and its applications.	10
4. Tour report / Factory visit	10

**References:**

1. Singh L.R. : Fundamentals of Practical Geography, Sharadha Pustaka Bhavan, Alahabad, 2006
2. Dr. M.A. Siddaqui : Introduction to Geographical Information System, Sharadha Pustaka Bhavan, Alahabad, 2006
3. Chang : Introduction to GIS, Tata McGraw Hill W, New Delhi.

**VI – Semester**  
**Geography VI: DISASTER MANAGEMENT**

**Course Outcome**

- CO 1. Identify in details with application, if applicable, hazards and disasters concepts
- CO 2. Specify the characteristics of flood, landslide, drought are in India
- CO 3. Write down in details with examples earthquake tsunami and cyclone are in India
- CO 4. Identify the classification and characteristics of human induced disasters
- CO 5. Learn in details with examples response and mitigation to disaster

<b>UNIT</b>	<b>No. of Hours</b>
1. Hazards, Risk, Vulnerability and Disasters: Definition and Concepts.	12
2. Disasters in India: (a) Causes, Impact, Distribution and Mapping: Flood, Landslide, Drought.	12
3. Disasters in India: (b) Causes, Impact, Distribution and Mapping: Earthquake, Tsunami and Cyclone.	12
4. Human induced disasters: Causes, Impact, Distribution and Mapping.	12
5. Response and Mitigation to Disasters: Mitigation and Preparedness, NDMA and NIDM; Indigenous Knowledge and Community-Based Disaster Management; Do's and Don'ts During Disasters	12

**Reading List**

1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
2. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.
3. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
4. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
5. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
6. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
7. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
8. Singh Jagbir (2007) "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India ([www.ikbooks.com](http://www.ikbooks.com)).

**DLF23011 (B) / DLF23013 (B)**

**VI – SEMESTER**  
**Geography VI: GEOGRAPHY OF TOURISM**

**Course outcome**

- CO 1. Learn in depth geography of tourism concepts
- CO 2. Specify in details with examples types of tourism
- CO 3. Learn in details with application, if applicable, recent trends of tourism
- CO 4. Identify in details with application, if applicable, impact of tourism
- CO 5. Understand the details of tourism in India

<b>UNIT</b>	<b>No. of Hours</b>
1. Origin, Development and significance of Tourism – factors influencing on tourism	10
1. Type of Tourism: Nature Tourism, Cultural Tourism, Medical Tourism, Pilgrimage	15
2. Recent Trends of Tourism: International and Regional; Domestic (India); Eco- Tourism, Sustainable Tourism, Meetings, Incentives, Conventions And Exhibitions (MICE), Carrying capacity of Tourism	15
3. Impact of Tourism: Economy; Environment; Society	10
4. Tourism in India: Tourism Infrastructure; Case Studies of Himalaya, Desert and Coastal and Heritage; National Tourism Policy	10

**Reference:**

1. Dhar, P.N. (2006) International Tourism: Emerging Challenges and Future Prospects. Kanishka, New Delhi.
2. Hall, M. and Stephen, P. (2006) Geography of Tourism and Recreation – Environment, Place and Space, Routledge, London.
3. Kamra, K. K. and Chand, M. (2007) Basics of Tourism: Theory, Operation and Practise, Kanishka Publishers, Pune.
4. Page, S. J. (2011) Tourism Management: An Introduction, Butterworth-Heinemann- USA.
5. Raj, R. and Nigel, D. (2007) Morpeth Religious Tourism and Pilgrimage Festivals Management: An International perspective by, CABI, Cambridge, USA, [www.cabi.org](http://www.cabi.org).
6. Tourism Recreation and Research Journal, Center for Tourism Research and Development, Lucknow
7. Singh Jagbir (2014) “Eco-Tourism” Published by - I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India([www.ikbooks.com](http://www.ikbooks.com)).

**DLF23711 / DLF23713**

**VI – SEMESTER**  
**Practical VI: COMPUTER MAPPING AND GPS SURVEYING**

<b>UNIT</b>	<b>No. of Hours</b>
1. Introduction to Computer : Generation of Computers, Hardware and Software Components	20
2. Computer graphics : Creating Data base in computer, creation of Line, Bar and Pie diagrams. Thematic Maps - Choro chromatic and Schematic Maps	20
3. GPS Surveying: Concepts, Segments and applications, plotting way Points by using map source software.	20
4. Tour report / Factory visit	

**References:**

1. Singh L.R. : Fundamentals of Practical Geography, Sharadha Pustaka Bhavan, Alahabad, 2006
2. Dr. M.A. Siddaqui : Introduction to Geographical Information System, Sharadha Pustaka Bhavan, Alahabad, 2006
3. Chang : Introduction to GIS, Tata McGraw Hill W, New Delhi.



**DLF23211 (A) / DLF23213 (A)**

**VI – SEMESTER**

**Geography VI: GIS BASED PROJECT REPORT**

**Course Outcome**

- CO 1. Identify the characteristics of study of GIS
- CO 2. Specify in depth GIS data structures
- CO 3. Write down in depth GIS data analysis
- CO 4. Deliberate in details with examples Application of GIS in Land use
- CO 5. Identify the classification and characteristics of Application of GIS in Urban and Forest monitoring

<b>UNIT</b>	<b>No. of Hours</b>
1. Geographical Information System (GIS): Definition and Components.	12
2. GIS Data Structures: Types (spatial and Non-spatial), Raster And Vector Data Structure.	12
3. GIS Data Analysis: Input; Geo-Referencing; Editing and Output; Overlays.	12
4. Application of GIS in Land Use/Land Cover Mapping.	12
5. Application of GIS in Urban Sprawl and Forests Monitoring	12

**Practical Record:** A project file consisting of 5 exercises on using any GIS Software on above mentioned themes.

**Reference:**

1. Bhatta, B. (2010) Analysis of Urban Growth and Sprawl from Remote Sensing, Springer, Berlin Heidelberg.41
2. Burrough, P.A., and McDonnell, R.A. (2000) Principles of Geographical Information System-Spatial Information System and Geo-statistics. Oxford University Press
3. Chauniyal, D.D. (2010) Sudur Samvedan evam Bhogolik Suchana Pranali, Sharda Pustak Bhawan, Allahabad
4. Heywoods, I., Cornelius, S and Carver, S. (2006) An Introduction to Geographical Infromation system. Prentice Hall.
5. Jha, M.M. and Singh, R.B. (2008) Land Use: Reflection on Spatial Informatics Agriculture and Development, New Delhi: Concept.
6. Nag, P. (2008) Introduction to GIS, Concept India, New Delhi.
7. Sarkar, A. (2015) Practical geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi
8. Singh, R.B. and Murai, S. (1998) Space Informatics for Sustainable Development, Oxford and IBH, New Delhi.

**DLF23211 (B) / DLF23213 (B)**

**VI – SEMESTER**

**Geography VI: FIELD TECHNIQUES AND SURVEY BASED PROJECT  
REPORT**

**Course outcome**

- CO 1. Understand the characteristics of field techniques
- CO 2. Deliberate in details with application, if applicable, case study rural and urban
- CO 3. Specify in details with examples field work in Geographical studies
- CO 4. Understand in details with examples preparation of questionnaires
- CO 5. Learn the details of designing the field report

**UNIT**

**No. of Hours**

1. Field Work in Geographical Studies – Role, Value and Ethics of Field-Work  
10
2. Defining the Field and Identifying the Case Study – Rural /Urban /Physical /Human /  
Environmental.  
10
3. Field Techniques – Merits, Demerits and Selection of the Appropriate Technique;  
Observation (Participant / Non Participant).  
12
4. Questionnaires (Open/ Closed / Structured / Non-Structured); Interview with  
16  
Special Focus on Focused Group Discussions; Space Survey (Transects and  
Quadrants, Constructing a Sketch).
5. Designing the Field Report – Aims and Objectives, Methodology, Analysis,  
Interpretation and Writing the Report.  
12

**Practical Record**

1. Each student will prepare an individual report based on primary and secondary data collected during field work.
2. The duration of the field work should not exceed 10 days.
3. The word count of the report should be about **8000 to 12,000** excluding figures, tables, photographs, maps, references and appendices.
4. One copy of the report on A 4 size paper should be submitted in soft binding.

**References:**

1. Creswell J., 1994: *Research Design: Qualitative and Quantitative Approaches* Sage Publications.
2. Dikshit, R. D. 2003. *The Art and Science of Geography: Integrated Readings*. Prentice-Hall of India, New Delhi.
3. Evans M., 1988: "Participant Observation: The Researcher as Research Tool" in *Qualitative Methods in Human Geography*, eds. J. Eyles and D. Smith, Polity.
4. Mukherjee, Neela 1993. *Participatory Rural Appraisal: Methodology and Application*.

Concept

- Concept  
Publs. Co., New Delhi.
- 5 Mukherjee, Neela 2002. *Participatory Learning and Action: with 100 Field Methods*. Concept Publs. Co., New Delhi
  6. Robinson A., 1998: "*Thinking Straight and Writing That Way*", in *Writing Empirical Research Reports: A Basic Guide for Students of the Social and Behavioral Sciences*, eds. by F. Pryczak and R. Bruce Pryczak, Publishing: Los Angeles.
  7. Special Issue on "Doing Fieldwork" *The Geographical Review* 91:1-2 (2001).
  8. Stoddard R. H., 1982: *Field Techniques and Research Methods in Geography*, Kendall/Hunt.

**DLF23411**

**GENERIC ELECTIVES II  
VI – SEMESTER  
Geography VI: REGIONAL GEOGRAPHY OF INDIA**

**Course outcome**

- CO 1. Identify the characteristics of size and extent of India
- CO 2. Understand the classification and characteristics of multipurpose river
- CO 3. Identify the classification and characteristics of Population density and distribution
- CO 4. Learn in details with examples power resources of India
- CO 5. Specify the characteristics of Transportation modes

**UNITS**

**No. of Hours**

- |  |    |
|--|----|
| 1. Location, size and extent of India – Relief features- Drainage system – Climate   | 15 |
| 2. Irrigation – Types, multipurpose river valley projects – DVC, Bhakra- Nangal, Alamatti  | 10 |
| 3. Population – Size and Growth since 1901, Population Density and Distribution, Literacy, Sex Ratio.  | 10 |
| 4. Resource Base –Livestock (cattle & fisheries),Power (Coal,& hydroelectricity) Minerals (iron ore and bauxite).  | 10 |
| 5. Economy – Agriculture (Rice, Wheat, Sugarcane, Tea, Cotton); Industries (Cotton Textile, Iron-Steel, Automobile), Transportation Modes (Road and Rail). | 15 |

**Reference:**

1. Hussain M., 1992: *Geography of India*, Tata McGraw Hill Education.
2. Mamoria C. B., 1980: *Economic and Commercial Geography of India*, Shiva Lal Agarwala.
3. Miller F. P., Vandome A. F. and McBrewster J., 2009: *Geography of India: Indo- Gangetic Plain, Thar Desert, Major Rivers of India, Climate of India, Geology of India*, Alphascript Publishing
4. Nag P. and Sengupta S., 1992: *Geography of India*, Concept Publishing
- Pichamuthu C. S., 1967: *Physical Geography of India*, National Book Trust.
- 7 Sharma T. C. and Coutinho O., 1997: *Economic and Commercial Geography of India*, Vikas Publishing.
- 8 Singh Gopal, 1976: *A Geography of India*, Atma Ram.
- 7 Spate O. H. K. and Learmonth A. T. A., 1967: *India and Pakistan: A General and Regional Geography*,

**DLF23711**

**GENERIC ELECTIVES - II**

**VI – SEMESTER**

**Practical VI: COMPUTER MAPPING**

<b>UNIT Hours</b>		<b>No.</b>	<b>of</b>
5.	Introduction to Computer : Generation of Computers, Hardware and Software Components		20
6.	Computer graphics : Creating Data base in computer, creation of Line, Bar and Pie diagrams. Thematic Maps - Choro chromatic and Schematic Maps		20
7.	GPS - Meaning, Function and its applications.		10
8.	Tour report / Factory visit		10

**References:**

1. Singh L.R. : Fundamentals of Practical Geography, Sharadha Pustaka Bhavan, Alahabad, 2006
2. Dr. M.A. Siddaqui : Introduction to Geographical Information System, Sharadha Pustaka Bhavan, Alahabad, 2006
3. Chang : Introduction to GIS, Tata McGraw Hill W, New Delhi.

**DEPARTMENT OF GEOGRAPHY  
MODEL QUESTION PAPER FOR CBCS SCHEME  
B.A GEOGRAPHY  
(For I, II, III, IV, V AND VI semesters)**

**Time: 3 Hours**

**Max. Marks: 70**

**Part-A**

**I. Answer any five of the following questions. Answer should not exceed 50 words  
5x2=10**

- 1).....
- 2).....
- 3).....
- 4).....
- 5).....
- 6).....
- 7).....

**Part-B**

**II. Answer any Six of the following questions. Answer should not exceed 100 words  
6x5=30**

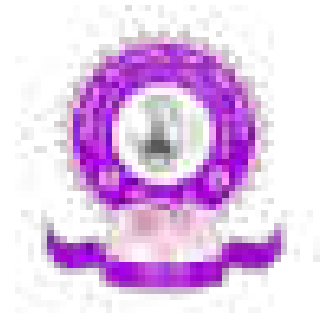
- 8).....
- 9).....
- 10).....
- 11).....
- 12).....
- 13).....
- 14).....
- 15).....

**Part –C**

**III. Answer any Three of the following questions. 3x10=30**

- 16).....
- 17).....
  
- 18).....
- 19).....
- 20).....

.....



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

***DEPARTMENT OF HINDI***

**LANGUAGE - HINDI**

**SYLLABUS**

**NEP**

**2021-22**

**2022-23 Onwards**

NEP SCHEME OF STUDY & ASSESSMENT  
INSTRUCTION  
B-COM/BBA/BCA  
HINDI LANGUAGE -AECC

PROGRAMME- B-COM/BBA/BCA  
PROGRAMME CODE: BCOM -04031/BBA 04031/BCA 04031

Semester	Course No.	Course code	Title of the course	Course type	Credits Pattern L:T:P	Total credits	Teaching Hours/Week	Assessment				Duration of Exam
								C1	C2	C3	TO	
I	C1	FCA04031	Gadyakividhiya aurVyakarna	AECC	2 : 1 : 0	03	04	20	20	60	100	2 ½
		FBA04031										
		FAA04031										
II	C2	FCB04031	Hindi KahaniSangraha urMidiyalekan	AECC	2 :1:0	03	04	20	20	60	100	2 ½
		FBB04031										
		FAB04031										
III	C3	FCC04031	Hindi KavitaSangra Our SarkariPatrachar ,ParibhashikSha bdawali	AECC	2 :1:0	03	04	20	20	60	100	2 ½
		FBC04031										
		FAC04031										
IV	C4	FCD04031	Hindi NatakTathaCom puter aur Hindi	AECC	2 :1:0	03	04	20	20	60	100	2 ½
		FBD04031										
		FAD04031										



Programme: Bachelor of commerce  
Bachelor of Business Administration  
Bachelor of Computer Application

Programme outcome:

After the completion of the Graduation Student are able to:

- PO1-Motivated for their higher education
- PO2-Write resume, letter of application and business letters
- PO3- Improve Spoken and written communication

Programme: Bachelor of commerce  
Bachelor of Business Administration  
Bachelor of Computer Application

Programme specific outcome:

After the completion of the Graduation Student are able to:

- PSO1- Improve Spoken and written communication
- PSO2-Develop writing skills
- PSO-3- Avail job opportunity in translation

OOTY ROAD, MYSURU-25

FCA04031/ FCA 04031/ FAA 040 31

B-COM/BBA/BCA

**I Semester**  
**Language Hindi-AECC**  
**Hindi GadyakividhiyaaurVyakarna**

64hrs (4hrs/week)

3 Credits4-hrs

**Course out come**

After successful completion of this course students are able to

**CO1.**Deliberate in details with application, if applicable, short stores of 20<sup>th</sup> century

**CO2.** Deliberate in details with application, if applicable, gadya by manojaguptha

**CO3.** Understand the classification and characteristics of gadya by manojaguptha

**CO4.** Understand in details with application, if applicable, Hindi vyakaran

**CO5.** Learn the details of Hindi vyakaran

**CO6.** Specify in details with application, if applicable, Hindi vyakaran

UNIT -1 Hindi gadyavidhiyokaprichaya

UNIT –II Gadyachayan-Manoj gutpa-pustha se pratham 1-5 tak

UNIT –III Gadyachayan-Manoj gutpa-pustha se pratham 6-7 tak

UNIT –IV Hindi Vyakaran :Portions Prescribed :

1.Shabdabhed; a) Vyuthpatthikidristi se

b) Uthpatthikidrishti se

c) Roopantarkidrishti se

2.Sangya : Paribhashaaurbhed

3. Sangyakeroopantar:

a) Ling - Paribhashaaurbhed

Ling parivarthankeniyam

b) Vachan – Paribhashaaurbhed – Vachanparivarthankeniyam

c) Karak – Paribhashaaurbhed

4. Sarvanaam : Paribhashaaurbhed

5. Visheshan – Paribhashaaurbhed

6. Kriya-Paribhashaaurbhed – Paribhashaaurbhed

## Reference

- 1) Saral Hindi Vyakaran –Pb. PrabhathPrakashan, # 4/19, Asaf Ali road,New Delhi-02
- 2) Parishkrith Hindi Vyakaran - BadarinathKapur
- 3) Abhinav Hindi Vyakaran - Prof.N.Nagappa, Pb. Rajpal&sons, New Delhi
- 4) Shikshaarhi Hindi Vyakaran - Prof.N.Nagappa, Pb. Rajpal&sons, New Delhi
- 5) Sankshipta Hindi Vyakaran - Kamathaprasad Guru, NagariPracharini Sabha, kaashi.
- 6) Vyavaharik Hindi VyakaranTathaRachana –Dr.HardevBahari, Lokabharathiprakashan, Allahabad -1

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OOTY ROAD, MYSURU-25

**FCB04031/ FCB 04031/ FAB 040 31**  
**B-COM/BBA/BCA**

**II Semester**  
**Language Hindi-AECC**  
**Hindi KahanisangrahaurMidiyalekan**

**64hrs (4hrs/week)**

**3 Credits 4-hrs**

**Course out come**

After successful completion of this course students are able to

**CO1** . Specify in details with application, if applicable, Midiyalekan

**CO2** . Understand the details of kahani of 20th cenyury

**CO3** . Learn in details with application, if applicable, kahani of 20th cenyury

**CO4** . Identify the classification and characteristics of Midiyalekan

**CO5**. Deliberate the details of Hindi vyakaran

**CO6**. Understand in details with application, if applicable, Midiyalekan

UNIT -1 Hindi kahanikavikaskra

UNIT -II kathasachayan-Dr.shivasharana kowshik-prathan1-5 tak

UNIT -III kathasachayan-Dr.shivasharanakowshik-prathan 6-10 tak

UNIT -IV Samacharsankalan our lekan

Report lekan

Sakshatkar

:

Reference

- 1) VyavasaikSampreshan –Dr.Anup ChandraBhayaniPb. Rajpal&sons, New Delhi-6
- 1) KaryalayAlekhanaurTippan – KarnatakMahila Hindi SevaSamithi, Chamarajpet,Bangalore.
- 2) Prashasanik Hindi – Ed. Ramdarash Mishra and amswaroopShastry
- 3) VanijyaPatraVyavahar,Anuvad,NibandhtathaSankshiptikaran – A V Narti, GnanodayPrakashan , Dharwad.

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

**FCC04031/ FCC 04031/ FAC 04031**

**B-COM/BBA/BCA**

**III Semester**

**Language Hindi-AECC**

**Hindi KavitaSangra Our SarkariPatrachar ,ParibhashikShabdawali**

**60hrs (4hrs/week)**

**3 Credits**

**Course out come**

After successful completion of this course students are able to

**CO 1.** Deliberate the classification and characteristics of modern Hindi kavya

**CO2 .** Deliberate the characteristics of modern Hindi kavya

**CO3 .** Understand the details modern Hindi kavya

**CO4 .**Understand in details with application, if applicable, Hindi SarkariPatrachar

**CO5.** Learn the details of Hindi ParibhashikShabdawali

**CO6.** Specify in details with application, if applicable, HindiSarkariPatrachar

UNIT -1 Hindi kavitakaudbhavaaurVikas .

UNIT -II Aadhunik Hindi kavita- sampa -VedgyaAacharya Ramakrishna Prakashan, Nahe  
Delhi.

Unit- III - Aadhunik Hindi kavitasampa- vedagnyaAacharya Ramakrishna PrakashanNahe  
Delhi

UNIT -IV SarkariPatrachar,SamanyaSarkariPatra,Karyalaygyapana,Gyapana,Paripatra

ArdhaSarkariPatra,ParibhashikShabdawali.

Reference

1.Media Aayaam- Prathiman, Dr. Pruthviraj Pandey, JayabharathiPrakashan, Maya Press  
Road ,Allahabad-3

2. PatrkaritakivividhVidiya- Dr. Ramkumar Srivastava, Jaya BharataPrakashan, Maya Press  
Road, Allahabad

3.[https://hi. Wikipedia.org/Wiki/\(dYm\)](https://hi.wikipedia.org/wiki/(dYm))

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

**FCC04031/ FCC 04031/ FAC 040 31**

**B-COM/BBA/BCA  
IV Semester  
Language Hindi-AECC**

**Hindi NatakTathaComputer aur Hindi**

**60hrs (4hrs/wee**

**3 Credits**

**Course out come**

After successful completion of this course students are able to

**CO 1.** Deliberate the classification and characteristics of HindiNatak

**CO2 .** Deliberate the characteristics of HindiNatak

**CO3 .** Understand the details HindiNatak

**Co4 .**Understand in details with application, if applicable, Computer aur Hindi

**CO5.** Learn the details of Computer aur Hindi

**CO6.** Specify in details with application, if applicable, Computer aur Hindi

UNIT – I Hindi NatakkaUdbhavaurVikas, TatvaAvamSwaroop.

UNIT -II GokarnaJagdish Chandra Mathur ,Radha Krishna Prakashan ,Nava Delhi.

UNIT -IIINatakkaSangramAdhyayan.

UNIT -IV Computer aur Hindi, Computer aur Hindi BhashameinSambandha,

Computer mein Hindi BhashakaVikas, Hindi Bhashamein Computer

ProdyogikikaSwaroop .

Reference

1.Dr. Anup Chandra BhayaniPb. Rajpal&sons, New Delhi-6

2.Internet kedouramein Hindi- Dr. BasavarajkeBaaraker .

3.<https://hi>. Wikipedia

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**DEPARTMENT OF HINDI**  
**Division of marks and Model Question Paper**  
**AECC**  
**LANGUAGE HINDI I ,TO IV SEMESTERS of B.COM / BBA / BCA**

Time : 2 ½Hrs

Max. Marks :60

**QUESTION PAPER PATTERN**

<b>On.NO</b>	<b>Particulars</b>			<b>Marks</b>	<b>Total</b>
	<b><u>SECTION-A</u></b>				
<b>I</b>	<b>Objective Type Questions (Compulsory)</b>		<b>10 out of10</b>	<b>1</b>	<b>10</b>
<b>II</b>	<b>Reference to Context</b>		<b>2out of 4</b>	<b>5</b>	<b>10</b>
	<b><u>SECTION-B</u></b>				
<b>III</b>	<b>Short Answer Questions</b>		<b>4 out of 7</b>	<b>05</b>	<b>20</b>
	<b><u>SECTION-C</u></b>				
<b>IV</b>	<b>Essay type Answer Questions</b>		<b>2out of 4</b>	<b>10</b>	<b>20</b>
		<b>Total</b>			<b>60</b>
<b>Internal</b>	<b>IA Test</b>			<b>20</b>	<b>40</b>
<b>Assessment</b>	<b>Assignment</b>			<b>20</b>	
		<b>Total</b>			<b>100</b>

**INTERNAL ASSESSMENT - 40 MARK**

NEP SYLLBUS FOR UG PROGRAMMES

DEPARTMENT OF HINDI

Division of marks and Model Question Paper

**AECC**

LANGUAGE HINDI I to IV SEMESTERS of B.COM / BBA / BCA

Time : 2 ½ Hrs

Max. Marks : 60

- I) 10 objective type questions on Vyakaran /prayojanmoolak Hindi / Anuvad as the case may be, 01 mark each 01x10
- II) Two short answer questions with internal choice on Vyakaran /prayojanmoolak Hindi / Anuvad as the case may be, 5 marks each 05 x 2 = 10
- III) One Annotation question – four out of seven on the prescribed text book 05 marks each 05 x 4 = 20
- IV) Total Main questions with internal choice on the prescribed text book 10 marks each 10 x 2 = 20

QUESTION PAPER PATTERN

SECTION-A

- Main -I Objective type questions 01 x 10 =10
- Main -II
- Qn. 1. .... 02 x 05 = 10
- 2
- 3
- 4

SECTION-B

- Main - III 02 x05 = 20
- Qn. 1,2,3,4,5,6,7

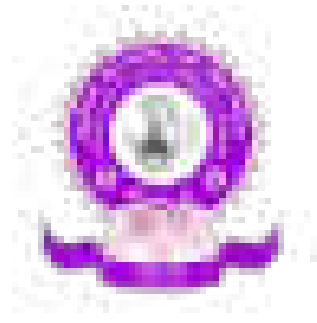
SECTION-C

- Main- IV
- Qn.1,2,3,4 02 x 10 = 20

INTERNAL ASSESSMENT - 40 MARKS

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

***DEPARTMENT OF HINDI***

**LANGUAGE - HINDI**

**SYLLABUS**

**NEP**

**2021-22**

**2022-23 Onwards**

## SCHEME OF STUDY &amp; ASSESSMENT

**INSTRUCTION**  
**LANGUAGE HINDI**  
NEP AECC

PROGRAMME- BA

PROGRAMME CODE: BA EG 31/HP 32/KG33/HE 34/JP 35

Semester	Course No.	Course code	Title of the course	Course type	Credits Pattern L:T:P	Total credits	Teaching Hours/Week	Assessment				Duration of Exam
								C1	C2	C3	TO	
I	C1	FHA04034 FHA04035	Hindi Kahani sahetya Aur Vyakarna	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
II	C2	FHB04034 FHB04035	Hindi Lagu upanyasa Our prayojan mulak Hindi	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
III	C3	FHC04034 FHC04035	Hindi Nibandha Sangraha Aur Anuvada Kala	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
IV	C4	FHD04034 FHD04035	Hindi Khanda-kavya Tatha Patra-Lekhan Aur Alekan	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½

## SCHEME OF STUDY &amp; ASSESSMENT

## INSTRUCTION

**Language Hindi**

NEP AECC

PROGRAMME: BSC

Semester	Course No	Course code	Title of the course	Course type	Credits Pattern L:T: P	Total credits	Teaching Hrs/week	Assessment				Duration of Exam
								C1	C2	C3	TO	
I	C1	FSA04032 FSA04035 FSA04036 FSA04040 FSA04041	Hindi Kahani sahetya Aur Vyakarna	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
II	C2	FSB04032 FSB04035 FSB04036 FSB04040 FSB04041	Hindi Lagu upanyasa Aur prayojan mulak Hindi	AECC	2 :1:0	03	4	20	20	60	100	2 ½
III	C3	FSC04032 FSC04035 FSC04036 FSC04040 FSC04041	Hindi Nibandha Sangraha Aur Anuvada Kala	AECC	2 :1:0	03	4	20	20	60	100	2 ½
IV	C4	FSD04032 FSD04035 FSD04036 FSD04040 FSD04041	Hindi Khanda-kavya Tatha Patra-Lekhan Aur Alekan	AECC	2 :1:0	03	4	20	20	60	100	2 ½

PROGRAMME CODE: BSC PC-31;PM -32; PE -33;CSM-34; PCS-35;BTZ -36;CBT -37;CZ -38;BZ -39;BTBC -40;MBBT -41;MBBC -42;

**INSTRUCTION  
LANGUAGE HINDI  
NEP AECC**

PROGRAMME- BVOC

PROGRAMME CODE: BVOC FP/SD/AN 030

Semester	Course No.	Course code	Title of the course	Course type	Credits Pattern L:T:P	Total credits	Teaching Hrs/week	Assessment				Duration of Exam
								C1	C2	C3	TO	
I	C1	FHA04034 FHA04035	Hindi Kahani sahetya Aur Vyakarna	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
II	C2	FHB04034 FHB04035	Hindi Lagu upanyasa Our prayojan mulak Hindi	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
III	C3	FHC04034 FHC04035	Hindi Nibandha Sangraha Aur Anuvada Kala	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½
IV	C4	FHD04034 FHD04035	Hindi Khanda-kavya Tatha Patra-Lekhan Aur Alekan	AECC	2 : 1 : 0	03	4	20	20	60	100	2 ½

**Programme: Bachelor of Vocation**

Economics and Geography  
History and political science  
Kannada and Geography  
History and English  
Journalism and English

**Programme outcome:**

After the completion of the graduation student are able to:

- PO1-Understand culture and heritage
- PO2- Manage business affairs
- PO3-Create interest in literature
- PO4 -Report and edit public events effectively
- PO5-Develop reading writing communication and reasoning skills

**Programme specific outcome:**

After the completion of the Graduation Student are able to:

- PSO1-Understand basic knowledge of Hindi grammar
- PSO-2-Understand the History of short stories and how they are related with the society at large
- PSO3-Avail job opportunity in translation

**Programme: Bachelor of Science (Natural science& Physical science)**

Physics and Chemistry  
Physics and Mathematics  
PhysicsandElectronics  
Computer ScienceandMathematics  
Physicsand Computer Science  
Bio-Technology andZoology  
Chemistry and Bio-Technology  
Chemistryand Zoology  
BotanyandZoology  
Bio-TechnologyandBio-Chemistry  
Micro-BiologyandBio-Technology  
Micro-BiologyandBio-Chemistry

**Programme outcome:**

After the completion of the graduation student are able to:

- PO1-Inculcate human values
- PO2-Avail job opportunities in translation
- PO3- Create interest in literature

**Programme specific outcome:**

After the completion of the Graduation Student are able to:

- PSO1- Get information about the History ancient medieval and modern Hindi literature
- PSO2-Develop research aptitude

**Programme: Bachelor of Vocation  
Food processing and Engineering  
Software Development**

**Programme outcome:**

After the completion of the graduation student are able to:

PO1- Understand culture and heritage

PO2- Manage business affairs

PO3- Create interest in literature

POS4- To familiarize students with basic Hindi

POS5 -To enable them to develop listening & speaking skills

**Programme specific outcome:**

After the completion of the Graduation Student are able to:

PSO1- Improve Spoken and written communication

PSO2-Develop writing skills

PSO-3- Avail job opportunity in translation

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

BA EG 31/HP 32/KG33/HE 34/JP 35

BSC PC-31;PM -32; PE -33;CSM-34; PCS-35;BTZ -36;CBT -37;CZ -38;BZ -39;BTBC -40;MBBT -41;MBBC -42;

BVOC - 030

**BA/BSC/BVOC**

**I Semester**

**Language Hindi**

HindiKahan sahetya aur Vyakarna

64hrs (4hrs/week)

**3 credits,4-hrs**

***Course out come***

After successful completion of this course students are able to

**CO1** . Identify in details with examples kahani of 20th century

**CO2**. Write down in depth kahani of 20th century

**CO3** . Deliberate in depth kahani of 20th century

**CO4** . Specify the classification and characteristics of Hindi vyakaran

**CO5**. Identify the characteristics of Hindi vyakaran

UNIT-1: Kahani Ka saidanthik Adyayan

UNIT-II: Kahani kirita-Dr.usha patak ,Dr,achala pande,( prescribed Lessons – 1-,4,)

UNIT-III: Kahani kirita-Dr.usha patak ,Dr,achala pande,( prescribed Lessons – 5-,8,)

UNIT-IV : Hindi Vyakaran :Portions Prescribed :

1.Shabdabhed; a) Vyuthpatthi ki dristi se

b) Uthpatthi ki drishti se

c) Roopantar ki drishti se

2.Sangya : Paribhasha aur bhed

3. Sangya ke roopantar:

a) Ling - Paribhasha aur bhed

Ling parivarthan ke niyam

b) Vachan – Paribhasha aur bhed – Vachan parivarthan ke niyam

c) Karak – Paribhasha aur bhed

4. Sarvanaam : Paribhasha aur bhed

5. Visheshan – Paribhasha aur bhed

6. Kriya-Paribhasha aur bhed – Paribhasha aur bhed

7.Kal,prathya our upasrga  
Reference

1. Saral Hindi Vyakaran –Pb. Prabhath Prakashan, # 4/19, Asaf Ali road,New Delhi-02
2. Parishkrith Hindi Vyakaran - Badarinath Kapur
3. Abhinav Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
4. Shikshaarathi Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal &sons, New Delhi
5. Sankshipta Hindi Vyakaran - Kamatha prasad Guru, Nagari Pracharini Sabha, kaashi.
6. Vyavaharik Hindi Vyakaran Tatha Rachana –Dr. Hardev Bahari, Lokabharathi prakashan, Allahabad -1

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

BA EG 31/HP 32/KG33/HE 34/JP 35

**BSC PC-31;PM -32; PE -33;CSM-34; PCS-35;BTZ -36;CBT -37;CZ -38;BZ -39;BTBC -40;MBBT  
-41;MBBC -42;  
BVOC - 030**

**BA/BSC/BVOC**

**II Semester**

**Language Hindi**

**Hindi Lagu Upanyasa Aur Prayojan Mulak Hindi**

**64hrs (4hrs/week)**

**3 credits,4-hrs**

**Course out comes**

After successful completion of this course students are able to

**CO1.**Learn in details with examples Novel- by kamaleshwra

**CO2**Understand in details with examples Novel-by kamaleshwra

**CO3.**Understand the details of Novel-by kamaleshwra

**CO4.** Identify the classification and characteristics of Prayojan Mulak Hindi

**CO5.** Write down the characteristics of Prayojan Mulak Hindi

UNIT I: Hindi upanyasa ka vikasa krma

UNIT II : Kamaleshwra ka sahityaika yogadan

UNIT III : Kamaleshwra ki kali Andhi upanyas ka kathyagata visleshan

UNIT - IV: Prayojan Mulak Hindi

Portions prescribed :

Alekan, Tippani, Sankshepana, prativedana, presa vigyapana

Reference

1. Saral Hindi Vyakaran –Pb. Prabhath Prakashan, # 4/19, Asaf Ali road, New Delhi-02

2 .Parishkrith Hindi Vyakaran - Badarinath Kapur

3. Abhinav Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal & sons, New Delhi

4. Shikshaarathi Hindi Vyakaran - Prof. N.Nagappa, Pb. Rajpal & sons, New Delhi

5. Sankshipta Hindi Vyakaran - Kamatha prasad Guru, Nagari Pracharini Sabha, kaashi.

6 .Vyavaharik Hindi Vyakaran Tatha Rachana –Dr. Hardev Bahari, Lokabharathi prakashan,

Allaha

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

BA EG 31/HP 32/KG33/HE 34/JP 35  
BSC PC-31;PM -32; PE -33;CSM-34; PCS-35;BTZ -36;CBT -37;CZ -38;BZ -39;BTBC -40;MBBT -  
41;MBBC -42;  
BVOC - 030

**BA/BSC/BVOC  
III Semester  
Language Hindi  
Hindi Nibandha Sangraha Aur Anuvada Kala**

**64hrs (4hrs/week)**

**3 credits, 4-hrs**

**Course out comes**

After successful completion of this course students are able to

- CO1.**Learn in details with examples Nibandha - by Vithi- Sampa
- CO2**Understand in details with examples Nibandha - by Vithi- Sampa
- CO3.**Understand the details of Nibandha - by Vithi- Sampa
- CO4.** Identify the classification and characteristics of Anuvad Kala
- CO5.** Write down the characteristics ofAnuvad Kala

UNIT I:Nibandhon ka Saidhantik Adhyayan.

UNIT II: Nibandhon ka Adhyayan, Nibandha Vithi- Sampa .Rita Roof,  
Malik and kampani,Jaipur

UNIT III : Nibandhon ka adhyay Avam Vishleshan.

UNIT - IV: Anuvad Kala

Portions prescribed :

Anuvad Kala hai ya Vigyan ,Anuvad ki Paribhasha, Anuvad ka Mahatva.

**References**

1. Nibandha Vithi- Sampa .Rita Roof, Malik and kampani,Jaipur
- 2 .Anuvad Kala Siddhant aur Prayog Kailasha Chandra Bhatiya.
3. <https://hi.Wikipedia.org/Wiki/{dYm}>
4. <https://hi.Wikipedia.org/Wiki/{hYXr- HhmZr}> \*\*\*\*\*

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

BA EG 31/HP 32/KG33/HE 34/JP 35

BSC PC-31;PM -32; PE -33;CSM-34; PCS-35;BTZ -36;CBT -37;CZ -38;BZ -39;BTBC -40;MBBT -41;MBBC -42;

BVOC - 030

**BA/BSC/BVOC**

**IV Semester**

**Language Hindi**

**Hindi Khanda-kavya Tatha Patra-Lekhan Aur Alekan**

**64hrs (4hrs/week)**

**3 credits, 4-hrs**

**Course out comes**

After successful completion of this course students are able to

**CO1.**Learn in details with examples Hindi Khanda Kavya- by Dr Shobha Nath Pathak

**CO2**Understand in details with examples Khanda Kavya Ekalavya- by Dr Shobha Nath Pathak

**CO3.**Understand the details of Ekalavya - by Dr Shobha Nath Pathak

**CO4.** Identify the classification and characteristics of Patra-Lekhan Aur Alekan

**CO5.** Write down the characteristics of Patra-Lekhan Aur Alekan

UNIT I: Hindi Khanda Kavya ka Vikas kram.

UNIT II: Ekalavya ka Aalochanatmak Adhyayan, Dr Shobha Nath Pathak ,  
Rajpal and sons, Naya Delhi.

UNIT III : Khanda ka Kavya-Sowshtava.

UNIT - IV: Patra-Lekhan Aur Alekan

Portions prescribed :

Patra lekhan ke Aadhar, Patralekan ke prakar , Oupacharik aur Anowpacharik Patra, Sarkari Patra -Namuna, Aalekhan ki padhathi, visheshataen our Namuna ,Aalekhan ke gun

**References**

1. karyalay Aalekhan aur Tippani Prakashan Karnataka Mahila Hindi Seva Samiti ,Bangalore

2 .Anuvad Kala Siddhant aur Prayog Kailasha Chandra BhatiyaVyavsayik Sampreshan- Anupam Chand Bhayani-prakashik- Rajyapal and sons Delhi

3.Rajbhasha Hindi Rajkiy Patra Vyavhar -Dr. Ghanshyam Agrawal ,Jayabharathi Prakashan Maya Press Road Allahabad

4.Prayojanmulak Hindi Paribhashik Shabdawali Tippan Prarupan ,Dr. Madhu Dhawan - Jayabharathi Prakashan, Maya press Road, Allahabad.

5. [https://hi.Wikipedia.org/wiki/{dYm}](https://hi.wikipedia.org/wiki/{dYm})

6.[https://www.\\*hindisahitya\\*.com/development-of-hindi-story-\(hYXr-HhmZr-Hm-\(dH](https://www.*hindisahitya*.com/development-of-hindi-story-(hYXr-HhmZr-Hm-(dH)

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)**  
**OOTY ROAD, MYSURU-25**

NEP SYLLBUS FOR UG PROGRAMMES

**DEPARTMENT OF HINDI**

**Division of marks and Model Question Paper**

**LANGUAGE HINDI I TO IV SEMESTERS of BA / BSC/BVOC**

Time : 2 ½ Hrs

Max. Marks :60

**QUESTION PAPER PATTERN**

<b>On.NO</b>	<b>Particulars</b>			<b>Marks</b>	<b>Total</b>
	<b><u>SECTION-A</u></b>				
<b>I</b>	<b>Objective Type Questions (Compulsory)</b>		<b>10 out of 10</b>	<b>1</b>	<b>10</b>
<b>II</b>	<b>Reference to Context</b>		<b>2 out of 4</b>	<b>5</b>	<b>10</b>
	<b><u>SECTION-B</u></b>				
<b>III</b>	<b>Short Answer Questions</b>		<b>4 out of 7</b>	<b>05</b>	<b>20</b>
	<b><u>SECTION-C</u></b>				
<b>IV</b>	<b>Essay type Answer Questions</b>		<b>2 out of 4</b>	<b>10</b>	<b>20</b>
		<b>Total</b>			<b>60</b>
<b>Internal</b>	<b>IA Test</b>			<b>20</b>	<b>40</b>
<b>Assessment</b>	<b>Assignment</b>			<b>20</b>	
		<b>Total</b>			<b>100</b>

**INTERNAL ASSESSMENT - 40 MARKS**

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)**  
**OOTY ROAD, MYSURU-25**

NEP SYLLBUS FOR UG PROGRAMMES

**DEPARTMENT OF HINDI**

**Division of marks and Model Question Paper**

**LANGUAGE HINDI I , & II SEMESTERS of BA / BSC/ BVOC**

Time : 2 ½ Hrs

Max. Marks : 60

I) 10 objective type questions on Vyakaran /prayojan moolak Hindi / Anuvad as the

case may be, 01 mark each

01x10

II) Two short answer questions with internal choice on Vyakaran /prayojan moolak

Hindi / Anuvad as the case may be, 5 marks each

05 x 2 = 10

III) One Annotation question – four out of seven on the prescribed text book 05 marks  
each 05 x 4 = 20

IV) Total Main questions with internal choice on the prescribed text book 10 marks each

10 x 2 = 20

**QUESTION PAPER PATTERN**

**SECTION-A**

Main -I Objective type questions

01 x 10 = 10

Main -II

Qn. 1. ....

02 x 05 = 10

2

3

4

**SECTION-B**

Main - III

02 x 05 = 20

Qn. 1,2,3,4,5,6,7

**SECTION-C**

Main- IV

Qn.1,2,3,4

02 x 10 = 20

**INTERNAL ASSESSMENT - 40 MARKS**

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

**ENC 05001 /CDC 05001 /ECC 05001**

**B-COM/BBA/BCA**

**III Semester**

**Language Hindi-AECC**

**Hindi Kavya aur Anuvada Paribhashik Shabdavali**

**60hrs (4hrs/week)**

**3 Credits**

**Course out come**

After successful completion of this course students are able to

**CO 1.** Deliberate the classification and characteristics of medieval and modern hindi kavya

**CO2 .** Deliberate the characteristics of medieval and modern hindi kavya

**CO3 .** Understand the details of Kaber by saakhe

**Co4 .** Identify the characteristics of Hemala by ramadhare simha dinakar

**Co5 .** Learn in depth preyatham by suryakanta threepati niral

**Co6 .** Understand the characteristics of Hindi Anuvada

**Co7 .** Understand in depth Hindi Anuvada

**Co8 .** Identify in details with examples Hindi Anuvada

**UNIT -1 KAVYAGANGA (Prescribed Lessons 1,2,5,8,11,12,13,14,16,19)**

Kaber

Thulse Das

Bihare Lal

Maithilisharan Gupta

Surya Kanth Tripathi Niral

sumitranandan pant

Subhadra Kumari Chauhan

Ramkumar Verma

Ramdhari Simha Dinkar

Kuvempu

**UNIT 2 -Anuvad tatha Paribhashik Shabdavali**

**Portions Prescribed :**

1. Anuvad ki Paribhashayen , Adhunik jagat mein Anuvad ka mahatva

Anuvadak kee Yogyathayen , Anuvad kala hai yaa vignan ?

2. Anuvad ke prakar:

3. Shabdanuvad

4. Bhavanuvad

5. Kavyanuvad

6..Saranuvad

7.Angreji / Kannad se Hindi me Anuvad – vice versa (passages)

8.Paribhashik Shabdavali

#### UNIT-3 Kaavya ke Activities

1. Bhakti kaal ke alag alag shaakhaon ke pravartak kaviyon ka parichay karana
2. Nirgun aur sugun bhakti ka antar spasht karna aur dohon ka patan karaana.
3. Braj, avadhi, aur khadi boli shabdon ka parichay, prayog aur Ucchaaran karaana.
4. Hindi ke gyaanpeeth puraskrut kaviyon ki rachnaaon ki charcha karna.
5. Hindi mein Anoodith kannad kavitaon ka parichay karaana.

#### UNIT- 4 Anuvaad ke Activities

1. Shabdhanuvaad, bhaavanuvaad, aadi swaroop aur antar ka parichay karaana.
2. Aaj ke Bhoomandalikrut sandarbh mein anuvaad ki Avashyakta par charcha karna.
3. Hindi ke vaakyon ko kannad aur angrezi mein anuvaad karne ki kala sikhaana.
4. Paaribhaashik shabdavali ka prayog karna.
5. Anuvaad karte samay honewaali trutiyon par vishesh dhyaan dilaana

#### Reference

- 1) Anuvad Vignan – Bholanath Thiwari Pb. Shabdaker, Delhi -110092
- 2) Anuvad Kala Kuch Vichar –Anuvad Prakash Khemani , S.Chand & co. Delhi.
- 3) Anuvad Siddhant aur Samasyayen- R.N. Srivastava and K.K.Goswami
- 4) Alok Prakashan , Delhi Anuvad Patrika Ank, Pb. Anuvad Sahitya Parishad , New Delhi

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

**END 05001 /CDD 05001 /ECD 05001**

**B-COM/BBA/BCA  
IV Semester  
Language Hindi-AECC**

**Hindi Upanyas Tatha Vanijya Hindi**

**60hrs (4hrs/wee**

**3 Credits**

**Course out come**

After successful completion of this course students are able to

- Co1.** Learn in details with examples Novel-Gaban by Premchand
- CO2.** Understand in details with examples Novel-Gaban by Premchand
- CO3.** Understand the details of Novel-Gaban by Premchand
- CO4.** Identify the classification and characteristics of Vanijya Hindi
- CO5.** Learn the classification and characteristics of Vanijya Hindi
- CO6.** Identify in details with application, if applicable, Vanijya Hindi

UNIT 1 - Gaban(sankshith)

UNIT 2 - Vanijya Hindi

Portions Prescribed :

- 1) a. Patra Vyavahar ka Samanya Parichay tatha Mahatva  
b. Patron ke prakar
- 2) Vyavasaik patra Vyavahar :
  - a. Bank Sambandhi Patra
  - b. Beema Sambandhi Patra
  - c. Pooch-Taach Sambandhi Patra
  - d. Shikayati Sambandhi Patra
  - e. Naukari Sambandhi Patra
  - f. Pari patra
  - g. Agency Sambandhi Patra
- 3) Alekhan - Uttam Alekhan ke gun
- 4) Sampreshan - uske Prakar
- 5) Sankshiptikaran - Sankshipt Lekhan ke Pradhan gun aur udaaharan



### UNIT-3 Upanyaas ke Activities

1. samaaj mein gareeb varg par hone waale shoshan aur unki asahaayata ka laabha utaane vaale uccha varg ki sameeksha karna.
2. upanyaas samraat premchand ke saahitya mein vyakt yathaartatha ko spasht karna.
3. upanyaas aur lambi kahani ka antar samjhana.
4. upanyaas ke chaaritrik visheshta ki charcha karna.
5. 5upanyas mein vyakt urdu, faarsi, aadi shabdon ko pehchaanne ki or agrasar karaana.

### UNIT- 4 Vaanijya Hindi ke Activities

1. vaanijya patron ke vibhinn prakaaron ko samjhana
2. vaanijya patron ke daanche par vishesh dhyan dena
3. Aalekh ki kala aur swarup ka parichay karaana.
4. sampreshan kala ka mahatva samjhana
5. Aadhunik samaaj mein sankshiptikaran ki Avashyakata par joor dena

### Reference

- 1) Vyavasaik Sampreshan –Dr. Anup Chandra Bhayani Pb. Rajpal &sons, New Delhi-6
- 2) Karyalay Alekhan aur Tippan – Karnatak Mahila Hindi Seva Samithi, Chamarajpet, Bangalore.
- 3) Prashasanik Hindi – Ed. Ramdarash Mishra and amswaroop Shastry
- 4) Vanijya Patra Vyavahar, Anuvad, Nibandh tatha Sankshiptikaran – A V Narti, Gnanoday Prakashan , Dharwad.

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Division of marks and Model Question Paper

Language HINDI I ,II , & III SEMESTERS of B.COM / BBA / BCA

Time : 3 Hrs

Max. Marks : 70

- I) Total Main questions with internal choice on the prescribed text book 10 marks each  
10 x 2 = 20
- II) One Annotation question – three out of five on the prescribed text book 05 marks  
each 05 x 3 = 15
- III) Two short answer questions with internal choice on Vyakaran /prayojan moolak  
Hindi / Anuvad as the case may be, 10 marks each 10 x 2 = 20
- IV) 15 objective type questions on Vyakaran /prayojan moolak Hindi / Anuvad as the  
case may be, 01 mark each 01 x 15 = 15

MODEL QUESTION PAPER

- Qn.1. .... OR ..... 01 x 10 = 10
- Qn.2. ....OR ..... 01 x 10 = 10
- Qn. 3. Annotate three out of six 05 x 03 = 15
- Qn.4. ....OR..... 01 x 10 = 10
- Qn.5. ....OR..... 01 x 10 = 10
- Qn.6. Objective type questions 01 x 15 = 15

INTERNAL ASSESSMENT - 30 MARKS

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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
**(Autonomous)**  
**B N ROAD, MYSURU- 570 025**

**DEPARTMENT OF HISTORY**

**Curriculum for**  
**I and II year BA Degree under NEP**  
**And**  
**III year BA Degree under CBCS**

**2022-2023**



Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

## BA Semester 1

### Paper No.1.1 DSC-1

Title of the Course: **Introduction to Ancient World Civilizations**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I - Mesopotamian, Egyptian and Chinese Civilizations</b>	<b>13/14</b>
<p><b>Introduction: Geographical Formation and Early Man</b></p> <p>Origin and Stages of the Earth – Geological Formation of World – Evolution of Human Species – From Archaic Man to Homo Sapiens – Homo Sapiens: Out of Africa and Spread all over the World</p>	<b>02</b>
<p><b>Chapter No : 1 Mesopotamian civilisation</b></p> <p>Geographical Background - From Neolithic to Bronze Age - Bronze Age in Mesopotamia</p> <p><b>Sumerians</b> – Race - Political History of the Sumerians - Kings and Governments of Sumer</p> <p><b>The Akkadians</b> - Old Babylonian Empire - Hammurabi and his Code - The Kassite domination - Attacks from the Hittites - The New Babylonian Empire - King Nebuchadnezzar and the Days of Babylonian Glory - The Decline of Babylon</p> <p><b>The Assyrian Empire</b> - The reforms of Tiglathpileser III - Decline of Assyrians - The decline of Mesopotamian civilization</p> <p>Social condition - Economic Condition --Theocratic State - Cultural contributions of Mesopotamians - Religion - Law – Education - Language and Writing– Literature - Art and Architecture - Hanging Garden - Science and Mathematics – Astronomy - Development of Calendar – Medicine</p>	<b>04</b>
<p><b>Chapter No: 2 Egyptian Civilization</b></p> <p>Egypt – The Gift of Nile - Cultural Transition from Neolithic to Bronze Age</p> <p>Political History of Egyptian Civilization - Intermediate Periods - The Archaic Period (3100-2700 BCE) - The Old Kingdom (2770 -2180 BCE) - Middle Kingdom (2200-1630BCE) - New Kingdom (1630-1075 BCE) – The invasion of the Hyksos -The New Kingdom or the Period of Empire (1560-1087 BCE) - The downfall of</p>	<b>04</b>

<p>Egypt</p> <p>Social Condition - Economic Condition – Agriculture – Industry – Trade - Cultural contributions of Egyptians - Writing and Literature – Games – Education - Religion - Akhenaton and his Monotheism - Art and Architecture</p>	
<p><b>Chapter No: 3 Chinese Civilization</b></p> <p>Early dynasties – The State – Decline of Ancient China – Economy and Society – Occupations – Art and Crafts – Ancestor Worship and Oracles – Script – Solar-Lunar Calendar - Literature</p>	<b>04</b>
<p><b>Unit II - Greek, Roman Civilizations</b></p>	<b>13/14</b>
<p><b>Chapter No : 4 Greek Civilization</b></p> <p>Geographical influences on the Greek - Aegean culture - The Early Greek Civilizations - The Minoan Civilization - The Mycenaean Civilization - The Dark Age - The Archaic and Classical Period</p> <p>City-States - Polity – Socio-Economic Background - Class Conflict between Aristocracy and Peasantry: Process of Reforms - Transition to Democracy - Conflict with Persia: Delian League (478 BCE) - The Peloponnesian War (431-404 BCE) - The End of the Classical Period</p> <p>Social Conditions - Slavery in Ancient Greece: Economy and Society - Position of Women</p> <p>Economic Conditions – Agriculture – Crafts - Maritime Commerce – Taxation</p> <p>Cultural contributions of Ancient Greece – Philosophy - Literature and Drama - Scientific Approach – Mathematics – Medicine - Astronomy – Religion - Olympic Games - Art and Architecture</p>	<b>05</b>
<p><b>Chapter No : 5 Roman Civilization (Early Part)</b></p> <p>The Impact of Geography - The Earliest Inhabitants of Italy - Etruscans - Decline of Etruscans - The Greeks in Italy</p> <p>The founding of Rome City - Rome under Monarchy - The Assembly and the Senate - The Roman Republic - The Roman Expansion</p> <p>Political Structure and Society during the Roman Republic - Effects of the Roman Expansion on commoners - Struggle between Patricians and Plebeians - The Assemblies - The Conflict of Orders – Patricians and Plebeians - Last Hundred Years of the Republic - Anti-Rome upheavals - Professional Army and War Lords - Rise of Dictatorship in Rome – Julius Caesar</p>	<b>04</b>

<p><b>Chapter No: 6 Roman Principate and Empire</b>  Augustus Caesar and His Successors - The Third Century Crisis (235-284 CE) - Division of Roman Empire – Diocletian and Constantine - The decline of the Western Roman Empire</p> <p>Social Condition of the early Roman Empire - Social Structure of the Later Roman Empire - Status of Roman Women – Slavery -Economic Condition - Judicial System</p> <p>Cultural Contributions – Language – Philosophy and Literature - Religion in Ancient Rome - Judaism - Christianity - Art and Architecture - Sculpture - Painting - Coins and medals</p>	<b>05</b>
<p><b>Unit III – Iranian, Early American and African Civilizations</b></p>	<b>13/14</b>
<p><b>Chapter No:7 Iranian Civilization</b>  Early History - Achaemenid Empire – Sassanid Empire – Economic and social Life – Religion – Art and Culture</p>	<b>05</b>
<p><b>Chapter No: 8 Early American Civilizations</b>  Mayan Civilization – Astronomy – Calendar Making -The Aztecs -The Incas – The Olmec – Culture – Religion – Art - Decline</p>	<b>04</b>
<p><b>Chapter No : 9 Early African Civilizations</b>  The Kingdom of Kush – Kingdoms of Nubia and Aksum – Sudanic Kingdoms – Civilizations of the Bantu Peoples – Kingdom of Kongo- Lunda Empire – Kingdom of Mwenemutepa – Coastal Regions of East Africa</p>	<b>04</b>

### Suggested Readings

1. Austin, M. M., The Hellenistic World from Alexander to the Roman conquest, Cambridge, 1981.
2. Algaze, Guillermo., Ancient Mesopotamia at the dawn of Civilisation: The Evolution of an Urban Landscape, University of Chicago Press, Chicago, 2009.
3. Badian, E., Studies in Greek and Roman History, Oxford University Press, 1964.
4. Badian, Ernst., Roman Imperialism in the Late Republic, Oxford, 1967.
5. Edward MacNall Burns and others, World Civilisations, Vol. A, GOYL SaaB Publishers & Distributors, Delhi, 2011.
6. Ferrero, Guglielmo., Characters and Events of Roman History, Barnes & Noble Books, New York, 1909.
7. Keith Bradley and Paul Cartledge, ed., The Cambridge World History of Slavery, vol. 1, Cambridge University Press, New York, 2011.
8. Nissen, Hans J., The Early History of the Ancient Near East, 9000-2000 BC, University of Chicago Press, Chicago, 1988.
9. Pollock, Susan., Ancient Mesopotamia: the Eden that never was, Cambridge University Press, Cambridge, 1999.



10. Potter, David S, ed., A Companion to the Roman Empire, Blackwell, Oxford and London, 2006.
11. Sharma. S.R., A Brief Survey of Human History, Hind Kitabs Ltd, Bombay, 1963.
12. Rakesh Kumar, Ancient and Medieval World, From Evolution of Humans to the Crisis of Feudalism, Sage Publications India Pvt Ltd, New Delhi, 2018.
13. Roux, George., Ancient Iraq, Penguin, London, 1992
14. Scarre, C., and Brian M. Fagan., Ancient Civilisations, Routledge, New York, 2016.
15. Sharma. S.R., A Brief Survey of Human History, Hind Kitabs Ltd, Bombay, 1963.
16. Shaw, Ian, ed., The Oxford History of Ancient Egypt, Oxford University Press, 2000.
17. Trigger, Bruce G., Understanding Early Civilisations, Cambridge University Press, 2003.
18. Wenke, Robert, The Ancient Egyptian State: The Origins of Egyptian Culture, c8000- 2000 BCE, Cambridge University Press, Cambridge, 2009

### **Pedagogy**

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries

**Assessment:****Weightage for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>



Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

## BA Semester 1

### Paper No. 1.2 DSC-2

Title of the Course: **History of Ancient India (From Earliest Times to 1206 CE)**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I Pre Historic Culture to Nandas</b>	<b>13/14</b>
<b>Introduction</b> Survey of Sources - Archaeological and literary sources Geographical Features and Natural Environment -The Geological Formation of India – Physical India since the Coming of Man – Climate – Natural Vegetation and Wildlife	<b>02</b>
<b>Chapter No:1 Pre Historic Cultures in India</b> Early Man in India – Hominid Fossils – Paleolithic Ages – Earliest Stone Tools - The Homo Sapiens (Modern Man) in India – Mesolithic Cultures - New Developments in Technology and Economy –Rock Art – Neolithic Revolution and Neolithic Cultural Regional Patterns - Animal Domestication – Beginning of Food Production in India and the Evidence from Mehrgarh – Growth of Villages from Baluchistan to Western Uttar Pradesh and Gujarat - Important sites- Bhimbetka, Daimabad, Nevasa, Isampur, Adichanallur , Chandravalli	<b>03</b>
<b>Chapter No: 2 The Indus Civilisation</b> Towards „Urban Revolution“ – Origin and Chronology of the Indus Civilisation - Early Indus Cultures – Distribution and Morphological Features of Mature Harappan Settlements – Extent and Population – Agriculture and Subsistence – Craft Production – The Cities and Towns – Trade – Culture: Writing, Art, Religion – Social and Political Framework – Later Harappan Phase – End of the Indus Civilisation	<b>03</b>
<b>Chapter No: 3 The Vedic and Later Vedic Age</b> Archaeological sources - Vedas as a Historical Source – Tribes and Wars – Lineage, Clan, tribe – Varna in the Rig Vedic Period – Religion: Sacrifices to the Gods – Coronation Rituals – Rajasuya and Ashwamedha - Later Vedic Age – The Emergence of Monarchy – Varna Hierarchy - Polity in Vedic Period -Gana-Samudaya- Sabha, Samiti and Vidata.	<b>03</b>

<b>Chapter No : 4 The Age of Mahajanapadas to the Nandas</b> Economic Background – Urbanisation – Political History - Mahajanapadas - Republican States and their functioning- Kosala – Political Conflicts and the Growth of the Magadhan Empire -The Nandas – Foreign Invasions on India – Persians and Macedonians - Alexander’s Invasion The Religious Revolution - The Intellectual Ferment – Ajivikas – Jainism – Buddhism – Brahminism	<b>03</b>
<b>Unit–II The Age of Empire</b>	<b>13/14</b>
<b>Chapter No : 5 The Mauryan Empire</b> Sources - Chandragupta Maurya - Ashoka – Ashoka’s Dhamma – Political Philosophy of Mauryans – Arthashastra of Kautilya – The Nature and Structure of the Mauryan Empire - Central and Provincial Administration - Revenue and Finance – Internal and Foreign Trade – Industries – Social Conditions – Ashoka’s Inscriptions – Language – Literature – Art and Architecture	<b>07</b>
<b>Chapter No: 6 Post - Mauryan India: 200 BCE – 300 CE</b> The Political History of North India – The Shungas – Kanvas - Indo-Greeks – The Shaka-Pahlavas or Scytho-Parthians –The Kushanas – Kanishka –Gandhara Art - The ShakaKshatrapas of Western India – The Shatavahana Empire in the Deccan	<b>04</b>
<b>Chapter No: 7 The Sangam Age</b> The three Kingdoms - The Cheras, Cholas, and Pandyas – Sangam Polity – The Sangam Government – Central and Local Self Government	<b>03</b>
<b>Unit –III Guptas and their Successors</b>	<b>13/14</b>
<b>Chapter No: 8 The Guptas and Their Successors ( CE 300–CE 750)</b> Rise of the Central Ganga Valley – Rise of the Gupta Dynasty – Chandragupta I - Samudragupta, - Chandragupta II – Administrative Structure – Central and Provincial Administration Political Development in Deccan and North India: The Vakatakas and the Vardhanas – Harshavardhana- Polity and Administration - Central and Provincial Administration Political Development in South India: Pallavas – Mahendra Varma, Narasimha Varma – Cholas - Raja Rajachola, Rajendra chola, local self-government - Art and Architecture of Pallavas and Cholas  Greater India- India and the World - Indian cultural influences on different parts of the World	<b>9</b>
<b>Chapter No : 9 The Rajputs</b> Gurjara – Pratiharas - Chauhans–Solankis – Paramaras –Chandellas - Polity and Administration	<b>03</b>

<b>Maps for Study :</b>  i. Mauryan Empire under Ashoka ii. Kushana Empire under Kanishka iii. Gupta Empire under Samudragupta iv. Vardhana Empire under Harshavardhana	<b>01</b>
<b>Important Historical Places:</b> 1.Sanganakallu 2. Lothal 3.Kalibangan 4.Bimbetka 5. Harappa 6. Mahenjodharo 7. Purushapura 8.Gandhara 9. Allahabad 10.Kanauj 11. Shravanabelagola 12. Kausambi 12.Rajagriha 13.Ujjaini 14.Pataliputra 15.Bodhagaya 16. Delhi 17.Nalanda 18. Tarain 19.Kalibangan 20.Prayaga.	<b>01</b>

### Suggested Readings

1. Irfan Habib - People's History of India Series (Vols 1- 7)
2. Upinder Singh - A History of Ancient and Early Medieval India
3. Chakrabarti Dilip K - A History of Indian Archaeology from beginning to 1947
4. S. Piggott - Prehistoric India
5. R.S. Sharma - Ancient India
6. RomilaThapar - Ancient India
7. D.D. Kosambi - The Culture and Civilisation of Ancient India in Historical Outline.
8. K.A. NilakantaSastri - A History of South India
9. V. N. HariRao - History of India Vol. I
10. S. R. Sharma - Comprehensive History of India
11. V. A. Smith - The Oxford History of India
12. R.S. Tripathi - History of Ancient India

### Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

**Assessment:****Weightage for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>



## BA Semester 1

### Open Elective

#### Paper No.1.3 OE -1

<b>Course Title: Cultural Heritage of India</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): Cultural Heritage of India**

#### **Course Outcomes (COs):**

At the end of the course the student should be able to:

- Provide an insight about an extensive survey of heritage of India
- Familiarize oneself with Indian history and culture
- Expertize to analyse further development of culture of India
- Analyse the factor responsible for origin and decline of culture
- Provide the opportunity to understand the process of cultural development

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

<b>Course Outcomes (COs) /Program Outcomes (POs)</b>	<b>DSC 1</b>	<b>DSC 2</b>	<b>DSC 3</b>	<b>DSC 4</b>	<b>DSC 5</b>	<b>DSC 6</b>	<b>OE 1</b>	<b>OE 2</b>	<b>SEC 1</b>	<b>SEC 2</b>
Disciplinary Knowledge							X			
Communication Skills										
Critical Thinking							X			
Problem Solving							X			
Analytical Reasoning							X			
Cooperation and Team Work							X			
Reflective Thinking							X			
Self-motivated Learning							X			
Diversity Management and Inclusive Approach							X			
Moral and Ethical Awareness Reasoning							X			
Lifelong Learning							X			

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark “X” in the intersection cell if a course outcome addresses a particular program outcome.

## BA Semester 1

### Open Elective

#### Paper No.1.3 OE -1

Title of the Course: **Cultural Heritage of India**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit -I Introduction</b>	13/14
<b>Chapter No: 1 Cultural Heritage</b> Meaning – Definitions – Concepts – Characteristics – Types of Indian Cultural Heritage – Tangible and Intangible - Oral and Living Traditions – Significance of Cultural Heritage in Human Life – Cultural Zones of India.	05
<b>Chapter No: 2 Fairs, Festivals, Rituals:</b> Ethnic Indian Cultural Construct – Significance and Historical background of Fairs, Festivals and Religious Rituals – Regional – Folk – Tribal – National – Monsoon Fairs - Animal Fairs – Jatres: Mylarlinga, Mudukutore, Suttur – Dasara, Baisaki, Deepavali, Onam, Nagarapanchami, Bangalore Karaga	05
<b>Chapter No: 3 Pilgrimage Centres of India</b> – Kashi – Mathura– Rameshwara – Bodh Gaya– Shravanabelagola — BandeNavazDarga – Amrithsara – Velangani	03
<b>Unit – II Legends, Narratives and Cultural Ethos</b>	13/14
<b>Chapter No: 4 Meaning – Significance – Forms and Traditions of Legends</b> – Puranic Legends – Tradition of Cultural Heritage: Ramayana and Mahabharata – Ancient Fables of Ethical and Moral Values: Panchatantra and Jataka Stories- MatnagaJataka	04
<b>Chapter No: 5 Traditional Performing Arts</b> - Indian Aesthetics – Important Sources: Bharata’s Natyashastra, Nandikeshwara’s Abhinaya Darpana - Srikumara’s Shilparatnaand - Kitab –i- Navaras by Ibrahim Adil Shah II – Indian Classical Dances: Bharatanatyam – Kathakali – Mohiniyattam – Kuchipudi – Odissi – Sattriya – Manipuri Dance <b>Folk Dances and Theatre</b> –Important Folk Dances: Lavani, Garba, Ghoomar, Changlo, Giddha, Kalbelia <b>Theatre:</b> Sanskrit Plays – Kutiyattam as a specimen of Oral and Intangible Cultural Heritage <b>Oral Tradition and Performing Arts</b> – Bhajan, ,Harikatha, Vedic Chants, Gurbani-	06

Yakshagan, Bootaaradane – <b>Puppetry</b>	
<b>Chapter No: 6 Indian Classical Music –Sources</b> - Matanga Muni’s Brihaddeshi– Two Major Traditions: Hindustani and Carnatic Music -Tradition in Indian Music: Gharana System – Historically Important Personalities of Indian Classical Music: Amir Khusrow, Sarangdev, Tansen, Mohammad Shah “Rangeela”, Purandaradasa and Kanakadasa– , M.S. Subbulakshmi – Music Fusions: East and West	<b>04</b>
<b>Unit – III Architecture and Built Heritage</b>	<b>13/14</b>
<b>Chapter No. 7 Indian Architecture</b> – The Beginnings – Indus Valley: Town Planning - Vedic Architecture - Mauryan Architecture: Characteristics, Palaces and Pillars – Stupa Architecture – Important Stupas – Rock Cut -Architecture: Caves and Temples – Temple Architecture: Nagara, Dravida and Vesara Styles– Mughal Architecture – Colonial Architecture	<b>6</b>
<b>Chapter No.8 Important Monuments of North India</b> (Study of Historical and Cultural Sites through maps) Nalanda, Ajanta, Ellora, Prayaga, Dwaraka, Sun Temple -Konark, Khajuraho, Agra –TajMahal, Delhi – Red Fort,	<b>04</b>
<b>Chapter No.9 Important Monuments of South India</b> - Shore Temple (Mahabalipuram), Sannati, Aihole, Badami, Pattadakal, Hampi, Kanchi, Nagarjunakonda, Amaravati, Thiruvananthapuram	<b>04</b>
<b>Historical Places</b> 1. Pushkar 2. Prayaga 3. Shraavanabelagola 4. Ajmer 5. Amritsar 6. Delhi 7. Kashi 8. Nalanda 9. Ajanta 10. Dwarka 11. Puri 12. Konark 13. Khajuraho 14. Tiruvananthapuram 15. Ellor 16. Mahabalipuram 17. Pattadakallu 18. Hampi 19. Kanchi 20. Nagarjunakonda	<b>01</b>

**Note: Historical Tour and Preparation of Project Report based on field work is Mandatory**

### **Suggested Readings**

1. K.T Acharya - Indian food: A Historical Companion, oxford University Press, 1998.
2. Banga, I. (ed). - The City in Indian History : Urban Demography, Society and Politics, Delhi, Manohar, 1991
3. A.L Basham - The wonder that was India. Picador Publisher, Indian ed. 2014
4. N.K Bose - “Culture Zones of India” in culture and Society in India, Asia publishing House 49
5. S.Narayan - Indian Classical Dances, Shubhi Publications, 2005.s
6. Prakash, H.S - Shiva - Traditional Theatres, Incredible India Series, New Delhi, 2007
7. S. Radhakrishnan - “Culture of India” in the Annals of the American Academy of Political and Social Science, Vol 233, India Speaking (May 1944).pp 18-21.
8. K. Thapiyal , S. Shukla - Sindhu Sabhyataien, Lucknow,2003 The Director General Survey of India (ed.), Guide Books: World Heritage Series, New Delhi

9. Shashi Tiwari - Origin of Environmental Science from Vedas. A Research paper presented at the National Seminar on "Science and Technology" in Ancient Indian Text, Special Centre for Sanskrit Studies. JNU, 9-10th, January, 2010
10. Raman Varadara - Glimpses of Indian Heritage, Popular Prakashan Private Ltd., Bombay, 1989
11. Varapande, M.L - History of Indian Folk Theatre (Lok Ranga Panorama of Indian Folk Theatre) Abhinav Publications, 1992
12. V. Vasudev - Fairs and Festivals, Incredible India series, 2007
13. A. Sundara (Ed.) - Kannada Vishaya Vishvakosha Ithihasa mattu Puratatva
14. H. Tipperudraswamy - Karnataka Samskruti Sameekshe
15. Janapada Vishya Viswakosha Vol- I and II Prasaranga University of Mysore
16. Rangacharya - The Natya shastra, English translation with critical Notes, New Delhi, Munshiram Manoharlal Publishers Pvt ltd.

### **Pedagogy**

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries

**Assessment:****Weightage for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>

## BA Semester 1

### Open Elective

#### Paper No.1.3 OE -1

<b>Course Title: Introduction to Archaeology</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): Introduction to Archaeology**

#### **Course Outcomes (COs):**

At the end of the course the student should be able to:

- Understand the concept of Archaeology as an ancillary for study of history
- Study the various features of Archaeology in understanding history
- Familiarize with the scope of Archaeology.
- Understand the various tools and techniques imbibed in Archaeology
- Study various schools of disciplines of Archaeology.

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

<b>Course Outcomes (COs) /Program Outcomes (POs)</b>	<b>DSC 1</b>	<b>DSC 2</b>	<b>DSC 3</b>	<b>DSC 4</b>	<b>DSC 5</b>	<b>DSC 6</b>	<b>OE 1</b>	<b>OE 2</b>	<b>SEC 1</b>	<b>SEC 2</b>
Disciplinary Knowledge							X			
Communication Skills										
Critical Thinking							X			
Problem Solving							X			
Analytical Reasoning							X			
Cooperation and Team Work							X			
Reflective Thinking							X			
Self-motivated Learning							X			
Diversity Management and Inclusive Approach							X			
Moral and Ethical Awareness Reasoning							X			
Lifelong Learning							X			

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.



## BA Semester 1

### Open Elective

#### Paper No.1.3 OE -1

Title of the Course: **Introduction to Archaeology**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit – 1 Introduction</b>	<b>13/14</b>
<b>Chapter No: 1 Definition of Archeology - its Aims and Scope : difference between History and Archeology</b>	<b>04</b>
<b>Chapter No: 2 Kinds of Archaeology – Ethno -Marine and Salvage</b>	<b>04</b>
<b>Unit – II Archaeology by Period</b>	<b>13/14</b>
<b>Chapter No: 3 Lower Paleolithic – Middle Paleolithic – Upper Paleolithic – Mesolithic – Neolithic - Chalcolithic – Bronze age – Iron Age.</b>	<b>06</b>
<b>Chapter No: 4. Archaeology in India – William Jones, James Princep, Alexander Cunningham, John Marshall, Sir Mortimer Wheeler, Allchin, H. D. Sankalia, S.R.Rao. M. H. Krishna.</b>	<b>06</b>
<b>Chapter No: 5 Archaeological Survey of India – Department of Archaeology Government of Karnataka</b>	<b>02</b>
<b>Unit – III Exploration, Excavation and Analysis</b>	<b>13/14</b>
<b>Chapter No: 6 Identification of a site – field survey – sampling techniques –Application of Scientific methods.</b>	<b>06</b>
<b>Chapter No: 7. Methods of Excavation – vertical and horizontal – Trenching - Gridding</b>	<b>04</b>
<b>Chapter No: 8 Excavation of burial mounds – Open Stripping – Quadrant method – Excavation of pits – Excavation of a typical site</b>	<b>04</b>
<b>Chapter No: 9 Visit to Local Archaeological Sites and Preparation of Field Study Report for Assignment is Mandatory.</b>	<b>06</b>

## Suggested Readings

1. Agrawal D.P - Archaeology in India
2. Aiken M.J - Science based dating in archaeology
3. Allchin Bridget
4. & Raymond Allchin - Rise of Civilisation in India and Pakistan
5. Atkinson RJC - Field Archaeology
6. Basker .P - Techniques of Archaeological Excavation
7. Chakrabartha D.K - A History of Indian Archaeology from the Beginning to 1947
8. Chakrabartha D.K - Theoretical Perspectives in Indian Archaeology
9. Gosha .A - Encyclopedia of Indian Archaeology
10. Rajan .K - Archaeology, Principles and Methods
11. Raman K.V - Principles and Methods in Archaeology
12. Dr.Srinivas V Padigar - Principles of Archaeology.
13. Dr Srinivas V Padigar - Puratattva Parichaya-(Kan)
14. Sundara (Ed.) - Kannada Vishaya Vishvakosha Ithihasa mattu Puratattva
15. Srikanta Shastri - Puratattva Shodane

## Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

## Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

**Assessment:****Weightage for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>

## BA Semester 2

### Paper No.2.1 DSC-3

<b>Course Title: Introduction to Medieval World Civilization</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): Introduction to Medieval World Civilization**

#### **Course Outcomes (COs):**

At the end of the course the student should be able to:

- Understand the geographic limitations and advantages that contributed to the rise of different civilizations in the Medieval world.
- Get information on the development of religious traditions and organizations in the Medieval world.
- Understand the growth of Feudalism and European towns in the middleages.
- Indicate the causes and impact of the Crusades in the Medieval Europe.
- Derive the influences of Oriental Civilizations on Medieval Europe.
- Illuminate the aspects of Economy and its development in Medieval Western Europe.

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

<b>Course Outcomes (COs) /Program Outcomes (POs)</b>	<b>DSC 1</b>	<b>DSC 2</b>	<b>DSC 3</b>	<b>DSC 4</b>	<b>DSC 5</b>	<b>DSC 6</b>	<b>OE 1</b>	<b>OE 2</b>	<b>SEC 1</b>	<b>SEC 2</b>
Disciplinary Knowledge			X							
Communication Skills										
Critical Thinking			X							
Problem Solving			X							
Analytical Reasoning			X							
Cooperation and Team Work			X							
Reflective Thinking			X							
Self-motivated Learning			X							

Diversity Management and Inclusive Approach			X							
Moral and Ethical Awareness Reasoning			X							
Lifelong Learning			X							

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

## BA Semester 2

### Paper No.2.1 DSC-3

Title of the Course: **Introduction to Medieval World Civilization**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit I – Arab and Persian Civilizations</b>	<b>13/14</b>
<p><b>Introduction to Medieval World Civilizations</b></p> <p>Introduction – „Medieval“ – Terminology and Periodization – Transitions and Historical Debates</p>	<b>02</b>
<p><b>Chapter No : 1 Arab Civilization</b></p> <p>Introduction - Geographical Background - Arab on the Eve of the rise of Islam - Birth of Islam – Origin and Spread of Islam - The Doctrines of Islam</p> <p>The Caliphate State / The Arab Empire - Rashidun Caliphs - The Umayyad Caliphate -The Abbasid Caliphate -The Fatimid Caliphate -The end of Arab Empire</p> <p>Arab contributions to Medieval World - Islamic Religious Traditions - Scholarship and Learning –Mathematics –Chemistry-Medicine-Paper and Bookmaking -Adab Literature –Philosophy -Art and Architecture</p>	04
<p><b>Chapter No: 2 Persian Civilization (Iranian Civilization)</b></p> <p>Introduction – Early History - Muslim Conquest of Persia - During Muhammad’s life -First invasion of Mesopotamia (633) -Second invasion of Mesopotamia (634–636) - Conquest of Mesopotamia (636–638) - Persian Raids in Mesopotamia (638–641) - Conquest of Persia (642–651) - Second and last Muslim invasion - Persian rebellion and reconquest</p> <p>Persia under Muslim rule – Administration – Religion - Language of Persia – Urbanisation</p>	04

<p><b>Chapter No: 3 Persian Civilization - Safavid Dynasty - Shah Abbas the Great - Shah and his Achievements – Political - Shah and his Achievements - Cultural</b></p> <p>Persia’s Contribution to Medieval World - Political Ideas and Institutions - State and Polity –The Third Force (Ghulam) - Emergence of a Clerical Aristocracy - Islamic Jurisprudence</p> <p>Persia,,s Cultural Contributions - Fine Arts - Carpet Weaving – The Art of the Book Making – Ceramics – Literature – Architecture</p>	04
<b>Unit II European Civilizations</b>	13/14
<p><b>Chapter No : 4 The Middle Ages in Europe (Political and Social Development)</b> – Introduction - Successors Kingdoms to the Western Roman Empire -Germanic Foundations of Early Medieval Europe - Germanic Kingdoms in Western Europe</p> <p>Europe in the Early Middle Ages (Political and Economic Institutions of Medieval Europe) - The Rise of Frankish Empire - Merovingian Period – Carolingian Period - Charlemagne (768-814) - New States in Response to Invasions - Otto the Great (936-973) - The Holy Roman Empire</p>	05
<p><b>Chapter No : 5 The Age of Feudalism in Europe</b> - Origin or Development of Feudalism - Feudal Polity and Economy - Decline of Feudalism</p>	04
<p><b>Chapter No: 6 Religious Developments in Medieval Europe</b> - Sainly and Virgin Mary Cults - Monasticism in Europe - Organization of the Church and Growth of Papacy - Struggle between Secular and Spiritual Authority</p>	04
<b>Unit –III The Middle Ages in Europe</b>	13/14
<p><b>Chapter No: 7 Byzantine Empire</b> - Constantine (306-337 CE) - Justinian (482-565 CE) - Decline of Byzantine Empire - Achievements of the Byzantium Empire - Effective Diplomacy - Trade and Commerce – Agriculture – Religious Reforms - Revival of Greek Classical Literature - Architecture and Art</p>	04
<p><b>Chapter No: 8 Crusades</b></p> <p>Introduction - The Crusades - Causes for the Crusades - Pope’s call for Crusade – Crusades 1<sup>st</sup> to 9<sup>th</sup> - Crusades and Their Impact - Influences of Oriental Civilisation on Medieval Europe - Byzantine Influences of Medieval European Civilization - Islamic Influences on Medieval European Civilization</p>	04
<p><b>Chapter No : 9 Growth of Economy and Culture in Medieval Western Europe</b></p> <p>Growth of European Towns - Growth of Middle Class - Early Medieval European Economy - The Economy of Western Europe in the High Middle Ages - The first Agricultural Revolution - Expansion of Trade and Commerce in</p>	06

Medieval Europe - Guild System	
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Contributions of Medieval Europe - Intellectual and Cultural Life in Medieval Europe - Medieval European universities - Acquisition of classical and Islamic knowledge - Growth of Western Scientific and Speculative Thought – Scholasticism - Literature – Drama – Music - Art and Architecture	
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### **Suggested Readings**

1. Arthur Hassall, (ed), General History of Europe, Oxford, 1901.
2. Edward MacNall Burns and others, World Civilisations, Vol. A, GOYL SaaB Publishers & Distributors, Delhi, 2011.
3. Holt. P.M., Ann K.S.Lambton and Bernard Lewis, The Cambridge History of Islam, Vol.1, Cambridge University Press, 1970.
4. Israel Smith Clare, Medieval History of the World, vol. I and II, Arihant Publishing House, Jaipur, 2008.
5. Lars Brown worth, Lost to the West – The Forgotten Byzantine Empire, Random House Inc., New York, 2009.
6. Rahman A, Islam on Science and Technology.
7. Rakesh Kumar, Ancient and Medieval World, From Evolution of Humans to the Crisis of Feudalism, Sage Publications India Pvt Ltd, New Delhi, 2018.
8. Ferrero, Guglielmo., Characters and Events of Roman History, Barnes & Noble Books, New York, 1909

### **Pedagogy**

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries



**Assessment:**

**Weight age for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>

## BA Semester 2

### Paper No. 2.2 DSC-4

<b>Course Title: History of Medieval India (1206 to 1761)</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): History of Medieval India (1206 to 1761)**

#### **Course Outcomes (COs):**

At the end of the course the student should be able to:

- The students will get the knowledge of the political history of Delhi Sultanate, Mughals and Marathas.
- To analyze the changes in state and society under the Delhi Sultanates with respect to their administrative structure and theory of state/kingship of the Delhi Sultanate.
- Understand the critical historiographical approaches on the State and also the Decline of the Delhi Sultans and Mughal Empire.
- To understand the significance of the Bhakti and Sufi Movements and their impact on the socio-cultural sphere.
- To understand the fusion of art, architecture, literature, language and fine arts in medieval India under Islamic and Hindu styles.

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

<b>Course Outcomes (COs) /Program Outcomes (POs)</b>	<b>DSC 1</b>	<b>DSC 2</b>	<b>DSC 3</b>	<b>DSC 4</b>	<b>DSC 5</b>	<b>DSC 6</b>	<b>OE 1</b>	<b>OE 2</b>	<b>SEC 1</b>	<b>SEC 2</b>
Disciplinary Knowledge				X						
Communication Skills										
Critical Thinking				X						
Problem Solving				X						
Analytical Reasoning				X						
Cooperation and Team Work				X						
Reflective Thinking				X						
Self-motivated Learning				X						
Diversity Management and Inclusive Approach				X						
Moral and Ethical Awareness Reasoning				X						
Lifelong Learning				X						

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

## BA Semester 2

### Paper No. 2.2 DSC-4

Title of the Course: **History of Medieval India (1206 to 1761)**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit -I Arabs, Turks and Delhi Sultanate</b>	<b>15/14</b>
<b>Chapter No: 1 Sources of Medieval Indian History</b> Sources– Literary, Foreign Accounts and Archaeological sources	<b>02</b>
<b>Chapter No: 2 Advent of Arabs and Turks in Medieval India</b> Political condition of India in the Beginning of 8 <sup>th</sup> Century- Arab Invasion – Muhammad Bin Qasim - Rise of Turks – Condition of India during the invasions of Muhammad of Ghazni and Ghori and their Impact – Tarain Wars	<b>04</b>
<b>Chapter No: 3 Foundation of the Delhi Sultanate</b> Qutub ud din Aibak - Era of Balban - Early Life and accession, The Mongols and the problems of the north west- Theory of kingship, achievements  Khalji Dynasty - Alauddin Khalji – Conquests - Administrative measures - Price control and Market regulations  Mohammad-bin-Tughlaq - Experiments and Reforms - Firoz Shah Tughlaq - Firoz,,s concept of benevolence and People,,s Welfare - Administrative reforms  The Later Tughlaqs - Decline of the Delhi Sultanates - Timur’’s invasion (1398 A.D) - The Saiyyids and the Lodis – Babur’’s Invasion- First Battle of Panipat	<b>08</b>
<b>Chapter no: 4 - State-Polity, Society and Economy under the Delhi Sultanates</b> Central and Provincial Administration - Economy - Tax policy Trade and industries - Society – Social manners and Customs - Slavery under the Delhi Sultans	<b>02</b>
<b>Unit II – The Mughal Empire</b>	<b>13/14</b>

<p><b>Chapter No: 5 The foundation of the Mughal Empire</b></p> <p>-Babar and Humayun - Revival of Afghan Power - Sher Shah Suri and his Successors-The Second Battle of Panipat and triumph of the Mughals- Hemu and Bairam Khan–Akbar’s rise and consolidation of power - Conquests, Rajput Policy, Religious Policy- (Din-Ilahi)- Revenue Administration, Evolution of Mansabdari system- Jagirdari Crisis - Jahangir, Shah Jahan and Aurangzeb - Military exploits, Religious Policy, Deccan policy- Revolts and reaction</p>	<b>06</b>
<p><b>Chapter No: 6 Administration and Economy under the Mughals</b></p> <p>Mughal Administration – Central, Provincial, Local – Theory of Kingship – Mansabdari System – Jagirdari System – Sources of Revenue – Military – Judicial System – Mughal Nobility and Bureaucracy – Deccan Policy of the Mughals - Development in Trade</p>	<b>04</b>
<p><b>Chapter No: 7 Society and Culture under the Mughals</b></p> <p>Social structure under Mughals – Muslim Nobles – Indian Muslims – Hindus – Condition of Women – Feudalistic Society – Religion and Celebration - Mughal Interaction with Europeans - Development of Science, literature, art, architecture and painting</p>	<b>04</b>
<p><b>Unit – III Bhakti and Sufi Movements</b></p>	<b>10/08</b>
<p><b>Chapter No. 8 Bhakti and Sufi Movements in India</b></p> <p>The Bhakti Movement in South India and North India – Alvars – Nayanars Basavanna – Kabir – Ravi Das – Guru Nanak – Causes for the popularity of the Movement – Impact of the Bhakti Movement - The Sufi Movement - Shaik Nizamudin Auliya – Salim Chisti</p>	<b>06</b>
<p><b>Chapter No.9 The Marathas</b></p> <p>Rise of the Maratha Power under Shivaji - Swarajya and Peshwas - Third Battle of panipat 1761</p>	<b>04</b>
<p><b>Maps for Study:</b></p> <ul style="list-style-type: none"> <li>i) Khilji empire Under Allauddin Khilji</li> <li>ii) Tuglaq Empire Under Mummmad Bin Tuglaq</li> <li>iii) Mughal empire Under Akbar</li> <li>iv) Martha empire Under Peshwas/ Shivaji</li> </ul>	<b>01</b>

Delhi, Agra, Panipat, Fatehpur-Sikri, Chittor, Gwalior,  
Udaipur, Kalinjar, Surat, Kanauj, Amarkot, Ayodhya, Ranthamboor, Devagiri,  
Dwarasamudra, Madurai, Srinagar, Sasaram, Raigar, Warangal, Poona, Lahore

**Suggested Readings**

1. A.L Srivastava: Delhi Sultanate , Shiv Lal Agarwal & Co., Agra, Reprint, 2017
2. A.L. Srivastva : The Mughal Empire (Shiv Lal Agarwal & Co., Agra, Reprint, 2017)
3. Sharma S.R, The Crescent in India (Agra 1933)
4. Srivastava A.L, Medieval Indian Culture (Agra 1975)
5. Sharma L.P, The Sultanate of Delhi (Delhi, 1996)
6. Edwards S.M & Garratt, Mughal Rule in India (New Delhi 1974)
7. Banerjee A.C, A New History of Medieval India (New Delhi 1983)
8. Lane Poole S, Medieval India under Muhammadan Rule (London)
9. Majumdar R.C (ed), History and Culture of the Indian people, Vol.V & VI (Bhavan's Series)
10. Majumdar R.C (ed), Bharatiya Janateya Ithihasa Mattu Samskriti (Bhavan's Series)
11. Sathish Chandra, History of Medieval India, Vol 1 and Vol 2.
12. Irfan Habib, Medieval India.
13. B.N.S Yadav : Society and Culture in North India in the 12th century. .Raka Prakashan, Prayagraj, 2012
14. B.P. Majumdar: Socio-Economic History of Northern India, Firma K. L. Mukhopadhyay(1960)
15. Herman Kulke (ed.) The State in India (1000-1700), OUP, 199516. Ishwari Prasad : Medieval India 4th ed., Digitized 2006
16. J.N Sarkar: Life and Times of Shivaji, Orient Blackswan Pvt. Ltd., New Delhi, 2010
17. K.N Chitnis: Socio- Economic History of Medieval India, Atlantic Publishers, 2018
18. Majumdar, Raychaudhary & Dutta : An Advanced History of India, Laxmi Publications, 2016
19. Mohammad Habib and K.A. Nizami,( Ed). : Comprehensive History of India, Vol. V, The Delhi Sultanate, PPH, 1992
20. R.C.Majumdar & others (ed.): The History and Culture of the Indian People Vol. 6, the Delhi Sultanate, Bhartiya Vidya Bhawan, 2006
21. R.P Tripathi : Rise and fall of the Mughal Empire Surjeet Publications, 2012
22. S.R. Sharma : The Crescent in India: A Study in Medieval History, Bhartiya Kala Prakashan, 2005
23. Ishwari Prasad : A Short History of Muslim Rule in India, Surjeet Publications, 2018
24. Mehata J.L : Advanced Study in the History of Medieval India Volumes
25. Satish Chandra - Medieval India From Sultanate to the Mughals

### **Pedagogy**

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries

### **Assessment:**

#### **Weightage for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>

## BA Semester 2

### Open Elective

#### Paper No.2.3 OE -2

Course Title: <b>Cultural Heritage of Karnataka</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### Course Pre-requisite(s): Cultural Heritage of Karnataka

#### Course Outcomes (COs):

At the end of the course the student should be able to:

- Understand the concept of cultural heritage of Karnataka
- Study various cultural factors which influence the flow of culture
- Familiarize the factors which influenced in influencing culture and society
- Analyze the factors responsible for formation of pluralistic society
- Understand the concept “Unity in diversity”

#### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) /Program Outcomes (POs)	DSC 1	DSC 2	DSC 3	DSC 4	DSC 5	DSC 6	OE 1	OE 2	SEC 1	SEC 2
Disciplinary Knowledge								X		
Communication Skills										
Critical Thinking								X		
Problem Solving								X		
Analytical Reasoning								X		
Cooperation and Team Work								X		
Reflective Thinking								X		
Self-motivated Learning								X		
Diversity Management and Inclusive Approach								X		
Moral and Ethical Awareness Reasoning								X		
Lifelong Learning								X		



Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

**BA Semester 2**

**Open Elective**

**Paper No.2.3 OE -2**

**Title of the Course: Cultural Heritage of Karnataka**

Course1		Course2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1		39/42 Hrs
<b>Unit-I Introduction</b>		<b>13/14</b>
<b>Chapter No: 1 Cultural Heritage</b> – Meaning – Definitions – Concepts – Characteristics – Types of Indian Cultural Heritage – Tangible and Intangible - Oral and Living Traditions – Significance of Cultural Heritage in Human Life – Cultural Zones of Karnataka.		03
<b>Chapter No: 2 Fairs, Festivals, Rituals:</b> Ethnic Indian Cultural Construct – Significance and Historical background of Fairs, Festivals and Religious Rituals – Regional – Folk – Tribal– Monsoon Fairs - Animal Fairs – Jatres: Mylarlinga, Mudukutore, Suttur - Dasara, Deepavali, Nagarapanchami, Bangalore Karaga		04
<b>Chapter No: 3 Pilgrimage Centres of Karnataka</b> –Nanjanagudu, Malemadeshwara Betta, Dharmasthala, Shravanabelagola, Karkala, Moodabidare, Kukke Subramanya, Horanadu		04
<b>Unit – II Legends, Narratives and Cultural Ethos</b>		<b>13/14</b>
<b>Chapter No: 4 Meaning – Significance – Forms and Traditions of Legends</b> – Puranic Legends – Tradition of Cultural Heritage: Ramayana and Mahabharata – Ancient Fables of Ethical and Moral Values: Panchatantra and Vaddakatha, MylaraKavya, JunjappaKavya, Malemadeshwara Mahatme etc.		04
<b>Chapter No:5 Traditional Performing Arts-Dravidian Aesthetics</b> – Important Sources: Matanga Muni’s Brihaddeshi and others. <b>Folk Dances and Theatre –Important Folk Dances:</b> Lavani, Kolata, Doddataetc <b>Oral Tradition and Performing Arts</b> –Bhajane, ,Harikatha, Yakshagana, Bootaaradane – <b>Puppetry</b>		05
<b>Chapter No: 6 Karnataka Classical Music –Sources</b> - Matanga Muni’s Brihaddeshi– Two Major Traditions: Hindustani and Carnatic Music- Purandaradasa and Kanakadasa		04
<b>Unit – III Architecture and Built Heritage</b>		<b>13/14</b>
<b>Chapter No: 7 Karnataka Architecture</b> – The Beginnings – Influence of Mauryan Art and Architecture– Inscriptions - Introduction of Stupa Architecture – Important Stupas – Rock Cut Architecture: Caves and Temples – Temple Architecture: Nagara,		05

Dravida and Vesara Styles– Islamic Architecture – Colonial Architecture	
<b>Chapter No.8 Important Monuments of North Karnataka</b> (Study of Historical and Cultural Sites through maps)Sannati, Badami, Ihole, Pattadakallu, Hampi, Keladi etc.	04
<b>Chapter No: 9 Important Monuments of South Karnataka</b> - Rajaghatta , Halebidu, Beluru, Somanathapura, Talakadu, Shravanabelagola, Nandi etc	04

**Note: Historical Tour and Preparation of Project Report based on field work is Mandatory**

### **Suggested Readings**

1. S.Settar - Prakrita Jagadvalaya
2. A. Sundara (Ed.) - Kannada VishayaVishvakosha Ithihasa mattu Puratatva
3. K.R Basavaraja - History and Culture of Karnataka
4. P.B.Desai - A History of Karnataka
5. A.Sundara(Ed) - Karnataka Charitre, Vol- I
6. B.SurendraRao(Ed.) - Karnataka CharitreVol - II
7. S.Settar - Halagannada;Bhashe, BhashaVikasa,Bhasha Bandhavya
8. M.Chidananda Murthy - Karnataka Shasanagala Samskrutika Adhyayana
9. S. Rajashekara - Karnataka Architecture
10. K.A.NilakantaSastri - A History of South India
11. .H. Tipperudraswamy - Karnataka Samskruti Sameekshe

### **Pedagogy**

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries

**Assessment:**

**Weightage for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>

## BA Semester 2

### Open Elective

#### Paper No.2.3 OE -2

<b>Course Title: Manuscriptology</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): Manuscriptology**

#### **Course Outcomes (COs):**

At the end of the course the student should be able to:

- Understand the importance of manuscripts
- Study manuscripts as an ancillary for study of history
- Understand the concept of cataloguing of manuscripts
- Practice the science of conservation and preservation of manuscripts
- Visit libraries and Archives to study conservation and preservation

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) /Program Outcomes (POs)	DSC 1	DSC 2	DSC 3	DSC 4	DSC 5	DSC 6	OE 1	OE 2	SEC 1	SEC 2
Disciplinary Knowledge								X		
Communication Skills										
Critical Thinking								X		
Problem Solving								X		
Analytical Reasoning								X		
Cooperation and Team Work								X		
Reflective Thinking								X		
Self-motivated Learning								X		
Diversity Management and Inclusive Approach								X		
Moral and Ethical Awareness Reasoning								X		
Lifelong Learning								X		

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark „X in the intersection cell if a course outcome addresses a particular program outcome.

## BA Semester 2

### Open Elective

#### Paper No.2.3 OE -2

Title of the Course: **Manuscriptology**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit – 1 Introduction</b>	13/14
<b>Chapter No: 1</b> Meaning – Definition – Characteristics - Scope and Importance	04
<b>Chapter No: 2 Types of Manuscripts</b> - Methods of Study- Writing Materials- Palm Leaf, Kadttas (Black Book)	05
<b>Unit – II Collection</b>	13/14
<b>Chapter No: 3</b> History of Manuscriptlogy	05
<b>Chapter No: 4</b> Introduction of Indian Manuscriptlogy	04
<b>Chapter No:5</b> Manuscripts in Kannada, Tigalari, Samskrita, Pali,Tamil/ Grantha, Tulu, Nandinagari and Modi	05
<b>Unit – 3 Editing</b>	13/14
<b>Chapter No: 6</b> Collection of Manuscripts- Oriental Research Institute, Mysore, Melkote	03
<b>Chapter No: 7.</b> Process of Editing	05
<b>Chapter No: 8.</b> Preservation of Manuscripts – Regional Conservation Laboratory	06
<b>Chapter No: 9</b> Visit to Oriental Research Institute and Regional Conservation Laboratory, Mysore, Academy of Sanskrit Research Center, Melukote. <b>Visit to Oriental Research Centers – Preparation Filed Study Report for Assignment is Mandatory.</b>	05

### **Suggested Readings**

- |  |   |                                     |
|--|---|-------------------------------------|
| 1. Chinthahar Chakravathi                    | - | Study of Manuscriptology            |
| 2. M.V Seetharamiah &<br>M. Chidanada murthy | - | Hastiprati Sastra                   |
| 3. N. Geethacharya                           | - | Hastiprati Sastra Adhyayana         |
| 4. Sitharam Jahagirdar<br>Parichaya          | - | Kannada Grantha Sampadhana Sastra   |
| 5. S. Jagannath                              | - | Grantha Sampadana Shastra           |
| 6. Devarakondareddy                          | - | Lipiya Huttu mattu Belavanige       |
| 7. Madhavana Katti                           | - | Lipishastra Pravesha                |
| 8. B.S Sanaya<br>Soochi                      | - | Kannada Hasta Prathigala Micro film |
| 9. T.V Venkatalachala Sastri                 | - | Halaya Honnu                        |
| 10. A.K Sasthri                              | - | Sringeri Kadathagalu                |
| 11. S. Shankarappa Toranagallu               | - | Lipi Niguda                         |

### **Pedagogy**

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries



**Assessment:**  
**Weightage for assessments (in percentage)**

<b>Formative Assessment</b>		
	<b>Internal Assessment</b>	<b>Theory Part Semester End Examination</b>
Internal Test	10	60
Assignment / Book Review	10	
Seminar with Group Discussion	10	
Viva Voice	10	
<b>Total</b>	<b>40</b>	
<b>Grand Total</b>		<b>100</b>

## II BA – III Semester

### Paper No.3.1 DSC -5 Rise of Modern West (1600-1871)

<b>Course Title: Rise of Modern West (1600-1871)</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): Rise of Modern West (1600-1871)**

Course Outcomes (COs):

#### **At the end of the course the student should be able to:**

- Understand how the geographical discoveries impact on the economy, polity and society of Western countries.
- Students would have developed an understanding of the significant transformations in European polity and society between sixteenth to nineteenth century.
- They would have explored various themes like capitalism, mercantilism, Renaissance and Reformation.
- Understand how scientific view helps western countries to achieve scientific revolution and Industrial Revolution
- Understand how the liberal and democratic ideas helped to achieve all round developments in western world.

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program**

##### **Outcomes (POs 1-12)**

Course Outcomes (COs) /Program Outcomes (POs)	DSC 5	DSC 6	DSC 7	DSC 8	OE 3	OE 4	SEC 1	SEC 2
Disciplinary Knowledge	X							
Communication Skills								
Critical Thinking	X							
Problem Solving	X							
Analytical Reasoning	X							
Cooperation and TeamWork	X							
Reflective Thinking	X							
Self-motivated Learning	X							
Diversity Management and Inclusive Approach	X							
Moral and Ethical Awareness Reasoning	X							
Lifelong Learning	X							

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark "X in the intersection cell if a course outcome addresses a particular program outcome.

## II BA – III Semester

### Paper No.3.1 DSC -5

Title of the Course: **Rise of Modern West (1600-1871)**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I</b>	<b>13/14</b>
<b>Chapter No : 1 Europe Expands and Divides The Overseas Discoveries and Conquests of Portugal and Spain</b>	<b>04</b>
<b>Chapter No: 2 Transition from Feudalism to Capitalism</b> Capitalism – Mercantilism and the Commercial Revolution	<b>04</b>
<b>Chapter No: 3 Early Colonial Expansion and Overseas Trade Motives</b> Beginning of the Era of Colonization – Mining and Plantation – Africans Slaves	<b>03</b>
<b>Unit -II</b>	<b>13/14</b>
<b>Chapter No : 4 Renaissance and Reformation</b> Meaning of Renaissance – Spread of Renaissance – Renaissance of Art, Architecture – Music – Literature – Science – Reformations and Counter Reformation	<b>05</b>
<b>Chapter No : 5 The New Absolute Monarchies</b> Emergence of Nation States – Theories of Government – Divine Right of Kings – Absolutism in Various States- Spain –Portugal- England – France – Austria - Russia	<b>04</b>
<b>Chapter No: 6 Scientific Revolution and The Age of Enlightenment</b> Emergence of Scientific View of the World – Promotion of Science – The work of Early Scientists – Growth of Chemistry, Geology and Biology. The Age of Enlightenment – Major Events of Enlightenment – Classism and Romanticism - Humanitarianism – Nationalism – Enlightened Despotism	<b>05</b>
<b>Unit - III</b>	<b>13/14</b>
<b>Chapter No:7 The Growth of Liberalism and Democracy</b> Basic Features of Liberalism – Growth of Liberalism The Rise of Democracy – Democratic Struggle in Various Countries – Public Opinion and Polity	<b>05</b>

<b>Chapter No: 8 Industrial Revolution</b> Scientific and Technological background to Industrialised Revolution – The Factory System – Stages and effects of Industrial Revolution – Socialist Movements – Labour Movements	<b>04</b>
<b>Chapter No : 9 Consolidation of Large Nation States</b> Unification of Italy – The Founding of the German Empire	<b>04</b>
<b>Historical Places :</b> 1.Vienna 2. Munich 3. Manchester 4. Rome 5. Madrid 6. Lisbon 7. Milan 8.Papacy 9. Bologna 10. Florence 11.Latvia 12. Lithuania 13.Romenia 14. Paris 15. Berlin 16.London 17. Frankfort 18. Saint. Petersburg 19.Malta 20. Amsterdam	

### Suggested Readings

1. Wells H.G : An Outline History of the World  
: A Short History of the World
2. Hayes et.al : World History
3. Savelle Max (Ed.) : A History of World Civilization (2Vols.)
4. Davies : World History
5. Ketelby C.D.M. : A History of Modern Time
6. Palmer R.R.and J.Colton : A History of Modern World
7. Grant and Temperley : Europe in the Nineteenth and Twentieth Century
8. Fisher H.A.L. : A History of Europe
9. Thomson David : Europe since Napoleon
10. Hoskins H.L. : European Imperialism in Africa
11. Edword MacNall Burns : World Civilization (3 Vols.)

### Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

## II BA- III Semester

### Paper No.3.2 DSC-6 History of Modern India 1761-1947

<b>Course Title: History of Modern India 1761-1947</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): History of Modern India 1761-1947**

#### Course Outcomes (COs):

At the end of the course the student should be able to:

- The Students will be able to trace the British colonial expansion in the political contacts of 18<sup>th</sup> century India. They will learn about the changes in society, politics, religion and economy during the period. They will also acquire knowledge about the freedom struggle
- The contents of the syllabus are designed to cover core issues pertaining to vast canvass of nationalist history so that the student at the under graduate level is equipped to focus upon the core ideas of national movement in its conceptuality.
- To understand India's quest for independence and nation building are interwoven script of history, debated most widely at global level with various angles, indeed, India's national movements has vast and divergent ideological base with inner contradictions.
- Understand how the colonial rule was overthrown by the Indian nationalists.
- Identify the various phases of National Movement
- Understand the Gandhian Era.
- Appreciate the ideals and values of Gandhi that resulted in freedom.

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) /Program Outcomes (POs)	DSC 5	DSC 6	DSC 7	DSC 8	OE 3	OE 3	SEC 1	SEC 2
Disciplinary Knowledge		X						
Communication Skills								
Critical Thinking		X						
Problem Solving		X						
Analytical Reasoning		X						
Cooperation and TeamWork		X						
Reflective Thinking		X						
Self-motivated Learning		X						
Diversity Management and Inclusive Approach		X						
Moral and Ethical Awareness Reasoning		X						
Lifelong Learning		X						

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark "X" in the intersection cell if a course outcome addresses a particular program outcome.

## II BA – III Semester

### Paper No.3.2 DSC-6

Title of the Course: **History of Modern India 1757-1947**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I</b>	<b>13/14</b>
<b>Chapter No : 1 The Arrival of Europeans in India and Rise of British Supremacy</b> The Portuguese – The Dutch – The English – The French – Pattern of European Trade – English East India Company: From Trading Company to Political Power – Anglo – French Struggle for Supremacy: The Carnatic Wars – British Conquest of Bengal – Plassey to Buxar (1757-1765)	<b>03</b>
<b>Chapter No: 2 British Expansion in South and North India – Beyond Indian Frontiers</b> - Conquest of Mysore and the Marathas, 1767-1818 – Anglo-Mysore Wars (during 1767-1799) – Anglo-Maratha Wars (during 1777-1818) – British Expansion in North India – Conquest of Sindh, Punjab and Awadh, 1843-57 – British Expansion Beyond Indian Frontiers – Nepal, Burma and Afghanistan, 1814-42	<b>04</b>
<b>Chapter No: 3 British and their Impact on Indian Economy, Polity, Administration and Society</b> <b>Economy:</b> Economic Model of British East India Company – Changes in Indian Agrarian Structure and Impact on Economy – New Land Revenue Settlements and their Impact - Permanent Settlement – Ryotwari System – Mahalwari System – Economic Impact of British Rule in India <b>Polity:</b> Constitutional Development – Regulating Act 1773, Pitt’s India Act 1784, Charter Acts of 1793, 1813, 1833, 1853 and Government of India Act 1858 – <b>Administration:</b> Indian Administration under the British – The Home Government – The Government of India – The Financial and Revenue Administration – Organisation of the Civil Services, the Army and the Police – Organisation of the Judicial Services – Social and Cultural Policy - Spread of Modern Education	<b>06</b>
<b>Unit - II</b>	<b>13/14</b>
<b>Chapter No : 4 Resistance to the British Rule: Early Uprisings and the Revolt of 1857</b> <b>Revolts in Bengal and Eastern India</b> – Sanyasi – Fakir Rebellion –	<b>05</b>

<p>Munda Rising – Khond Uprising – Santhal Rebellion –  <b>Revolts in Western India</b> – Bhil Uprisings – Waghera Rising –  Ramosi Risings –<b>Revolts in Southern India</b> –The Revolt of the Raja  of Vizianagaram – Revolt of Diwan Velu Thampi – <b>Revolts in  Northern India</b> - Kuka or Namdhari Movement  <b>Revolt of 1857 – Causes</b> – Beginning of Mutiny and the Revolt – The  Strom Centres and the Leaders – Defeat of the Rebels – Causes of  Failure – Significance of the Revolt – Debate regarding the Nature of  the Revolt – Impact of the Revolt – Opinions of Various Historians</p>	
<p><b>Chapter No : 5 Socio Religious Reform Movements</b>  The Brahma Samaj – Arya Samaj – Prarthana Samaj – Derozio and  Young Bengal Movement – Ramakrishna Mission – Satyashodak  Samaj – The Wahabi/Waliullah Movement -Aligarh Movement – Sikh  Sabha Movement – Shri Narayana Guru and SNDP Yogam</p>	<b>03</b>
<p><b>Chapter No: 6 Administrative Changes after 1858</b>  Administration – Changes in the Army – Public Services – Relation  with the Princely States – Administrative Policies – Divide and Rule –  Hostility to Educated Indians – Attitude towards the Zamindars –  Attitude towards Social Reforms –Labour Legislation – Restriction on  the Press – Racial Antagonism</p>	<b>04</b>
<b>Unit - III</b>	<b>13/14</b>
<p><b>Chapter No:7 Growth of New India – The Nationalist Movement, 1858-1918</b>  Factors for the Rise and Growth of National Consciousness –  Predecessors of the Indian National Congress – The Foundation of the  Indian National Congress, 1885 – The „Safety Valve“ Theory – Moderate  Phase (1885-1905) – The Rise of Neo-Nationalism or the Extremism  (1905-14) – Partition of Bengal – Boycott and the Swadeshi Movement  - Ghadar Movement – Home Rule Movement – Rise and Growth of  Communalism - The Muslim League – The Hindu Mahasabha -Lucknow  Session of the Congress (1916)</p>	<b>05</b>
<p><b>Chapter No: 8 Struggle for Swaraj Phase –I (1919-1927)</b>  Beginning of the Gandhian Era – The Rowlatt Bills and the Anti-Rowlatt  Satyagraha - Jallianwalla Bagh Massacre – Khilafat and Non –  Cooperation Movement – The Swarajist Party – Congress Constructive  Programmes – Growth of the Left Movement</p>	<b>03</b>
<p><b>Chapter No : 9 Struggle for Swaraj Phase –II (1927-1947)</b>  Simon Commission and Anti –Simon Commission Agitation – The  Nehru Report and Jinnah’s Fourteen Points – Lahore Session of the  Congress – Poorna Swaraj – Civil Disobedience Movement (1930-31) –  Round Table Conferences and Ambedkar– Poona Pact – Second Civil  Disobedience Movement, 1932-34 – The Government of India Act  1935 - Provincial Elections and formation of Ministries (1937) –  National Movement during the Second World War – The Cripps  Mission and Proposal – Quit India Movement – Subhas Chandra Bose</p>	<b>06</b>

and Indian National Army – Wavell Plan – Simla Conference – Cabinet Mission Plan – The Interim Government – The Constituent Assembly – Attlee’s Declaration – Mountbatten Plan - The Indian Independence Act, July 1947	
<b>Historical Places</b> 1.Calcutta 2. Calicut 3.Pandicharry 4. Basin 5. Lahore 6. Plassey 7. Thirchanapally 8. Hoogly 9.Surat, 8.Dacca 9.Nagpur 10.Madras 11. Delhi 12.Bombay 13. Poona 14. Lucknow 15. Kanpur 16. Banaras 17.Wandiwash 18. Srirangapatna 19. Machalipattanam 20.Gwalior	<b>02</b>

### Suggested Readings

1. Bipan Chandra : Indian Struggle for Independence  
: Freedom Struggle
2. Majumdar R.C : Struggle for Freedom  
: British Paramountacy and Indian Renaissance (Part-1)
3. Bipin Chandra : Rise growth of Nationalism
4. Sekhar Bandyopadya : Nationalist Movement in India
5. B.L. Grover : A new look at Modern Indian History
6. Sailendra Nath Sen : An Advanced History of Modern India
7. A.R. Desai : Social Background of Indian Nationalism
8. Sumit Sarkar : Modern India 1885 – 1947
9. M.N. Gupta : History of the Revolutionary Movement in India
10. Tarachand : History of freedom movement in India Vol.03
11. S.R.Mehrotra : The Emergence of Indian National Congress
12. Stein Burton : The making of Agrarian Policy in British India 1770 – 1900
13. Thompson & Garret : Rise and Fulfilment of British Rule in India
14. A.C. Banerjee : The New History of Modern India(1707- 1947)
15. C.A. Bayle : An illustrated History of Modern India 1600-1947

### Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries



## II BA – III Semester

### Paper No.3.3 OE-3 Freedom Struggle in India (1857-1947)

<b>Course Title: Freedom Struggle in India (1857-1947)</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): Freedom Struggle in India 1857-1947**

Course Outcomes (COs):

At the end of the course the student should be able to:

- Identify the causes that led to the rise of nationalism in India
- Trace the emergence of Indian National Congress
- Understand the various stages of the National Movement in India
- Understand the value of Independence
- Realise the harmful effects of division and disintegration
- Develop a sense of patriotism, cooperation and belongingness

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) / Program Outcomes (POs)	DSC 5	DSC 6	DSC 7	DSC 8	OE 3	OE 3	SEC 1	SEC 2
Disciplinary Knowledge					X			
Communication Skills								
Critical Thinking					X			
Problem Solving					X			
Analytical Reasoning					X			
Cooperation and Team Work					X			
Reflective Thinking					X			
Self-motivated Learning					X			
Diversity Management and Inclusive Approach					X			
Moral and Ethical Awareness Reasoning					X			
Lifelong Learning					X			

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark “X” in the intersection cell if a course outcome addresses a particular program outcome.

## II BA – III Semester

### Paper No.3.3 OE-3

Title of the Course: **Freedom Struggle in India (1857-1947)**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I</b>	<b>13/14</b>
<b>Chapter No : 1 The Rise and Growth of National Consciousness</b> Factors Responsible for the Rise and Growth of Indian Nationalism	<b>04</b>
<b>Chapter No: 2 Emergence of Organised Nationalism</b> Political Associations before Indian National Congress – Background to the Birth of Indian National Congress – Formation of the Indian National Congress – Debates over the origin of the Indian National Congress - Safety Valve Theory – Ambitions of Indian Elite -Need for an All-India Body	<b>04</b>
<b>Chapter No: 3 The Moderate Phase (1885-1905)</b> The Programme and Activities of the Moderates –Dadabai Navaraji - Economic Critique of Imperialism – The Demands of the Moderates – British Reaction to the Congress Demands	<b>03</b>
<b>Unit - II</b>	<b>13/14</b>
<b>Chapter No : 4 Growth of Extremise Nationalism (1905-1918)</b> Impact of Swadeshi Movement on the Congress and the Surat Split - Causes for the Rise of the Extremists – Lal –Bal- Pal- The Partition of Bengal – Anti - Partition Movement – The Swadeshi and the Boycott – Ghadar Movement – Home Rule Movement	<b>03</b>
<b>Chapter No: 5 Emergence of Mahatma Gandhi in Indian Politics and his Ideology</b> Gandhi’s Political Career in South Africa (1893-1914) – Gandhi’s Entry into Indian Politics: Champaran, Ahmedabad and Kheda (1917-18) – Gandhi and his Ideology	<b>04</b>
<b>Chapter No: 6 Struggle for Swaraj Phase –I (1919-1927)</b> The Monagu- Chelmsford Reforms – The Rowlatt Act –Jallianwala Bagh Massacre – The Khilafat and Non-cooperation Movement (1919-1922) – The Swarajists – Swarajist Party – Constructive Programmes of Congress	<b>06</b>
<b>Unit - III -</b>	<b>13/14</b>

<p><b>Chapter No: 7 Rise and Growth of Communalism and Left Movement in India</b>  Factors Responsible for the Rise and Growth of Communalism in India  – Simla Deputation – Formation of the Muslim League – Introduction of Separate Electorates (1909) – Formation of the Hindu Mahasabha – Lucknow Pact (1916) – Formation of the Communist party of India – Congress Socialist Party – Growth of Socialist Ideas in the Indian National Congress – Role of Nehru and Bose</p>	<b>05</b>
<p><b>Chapter No : 8 Struggle for Swaraj Phase –II (1927-1947)</b>  Simon Commission –Nehru Report and Jinnah’s Fourteen Points – The Lahore Session of the Congress – Declaration of Poorna Swaraj – Civil Disobedience Movement 1930-34 – Dandi March – Gandhi Irwin Pact - Round Table Conferences 1930-32 – Communal Award 1932 – Poona Pact and Ambedkar – Gandhi’s Harijan Tour – The Individual Satyagraha, 1940-41 – The Cripps Mission and Proposal – Quit India Movement – Subhaschandra Bose and INA – Wavell Plan – Simla Conference – Cabinet Mission Plan – The Interim Government – The Constituent Assembly – Attlee’s Declaration – Mountbatten Plan -The Indian Independence Act, July 1947</p>	<b>05</b>
<p><b>Chapter No : 9 Important Freedom Fighters</b>  Surendranatha Banerji- Wasudev Balwant Phadke - V.D.Savarkar – Sarojini Naidu - Chandrasehkar Azad – Bhagat Singh – Khudiram Bose – Madam Bhikaji Cama – Kalpana Datta – Mahadev Desai – Gopala Krishna Ghokhale – Motilal Nehru – Babu Jagjivanram – Patabhi Sitaramaiah – Udam Singh</p>	<b>04</b>
<p><b>Historical Places</b>  1.Calcutta 2.Amritsar 3.Jhansi. 4.Dacca 5Champanan 6.ChauriChaura. 7.Kakori, 8.Dandi 9.Sabarmathi10.Wardha 11.Nagpur 12.Madras 13. Delhi 14.Bombay 16. Poona 17. Lucknow 18. Kheda 19. Kanpur 20. Meerut</p>	

### Suggested Readings

1. Bipan Chandra : Indian Struggle for Independence
2. Majumdar R.C : Struggle for Freedom
3. Sekhar Bandopadhyaya : Nationalist Movement in India
4. B.L. Grover : A New look at Modern Indian History
5. Sailendra Nath Sen : An Advanced History of Modern India

A.R. Desai : Social Background of Indian Nationalism

### Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures

- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries

## II BA – III Semester

### Paper No.3.3

#### Introduction to Epigraphy

Course Title: <b>Introduction to Epigraphy</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### Course Pre-requisite(s): Introduction to Epigraphy

##### Course Outcomes (COs):

At the end of the course the student should be able to:

- To understand the definition and importance of Palaeography, Brahmi, Kharosti scripts, dating and Eras
- To identify the writing Materials- Engraving-Forged records-Seals.
- To understand the Evolution and Development of one of the scripts mentioned above with reference to estampages.
- Understanding the differences and similarities of inscriptions of North and South India.
- To learn about Practical Training in taking estampages of stone and copper plate inscriptions.
- To understand the importance of Palaeography, Brahmi and Kharosti scripts, dating and Eras

#### Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	DSC 5	DSC 6	DSC 7	DSC 8	OE 3	OE 3	SEC 1	SEC 2
Disciplinary Knowledge						X		
Communication Skills								
Critical Thinking						X		
Problem Solving						X		
Analytical Reasoning						X		
Cooperation and Team Work						X		
Reflective Thinking						X		
Self-motivated Learning						X		
Diversity Management and Inclusive Approach						X		
Moral and Ethical Awareness Reasoning						X		
Lifelong Learning						X		

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark "X" in the intersection cell if a course outcome addresses a particular program outcome.

## II BA – III Semester

### Paper No.3.3 OE-4

Title of the Course: **Introduction to Epigraphy**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I</b>	<b>13/14</b>
<b>Chapter No : 1</b> Introduction - Definition and importance of Palaeography – origin and antiquity of writing in India	<b>04</b>
<b>Chapter No: 2</b> Evolution and development of Scripts - Indus Valley Script- Kharosthi Script- Brahmi Script.	<b>04</b>
<b>Chapter No: 3</b> Writing materials - Engraving- forged records - Seals.	<b>04</b>
<b>Unit - II</b>	<b>13/14</b>
<b>Chapter No : 4</b> Introduction – Nature – Scope- Importance of Epigraphy	<b>05</b>
<b>Chapter No : 5</b> Types of Inscriptions –the language of Inscriptions - writing Materials - Stone, Copper, Palm leaves, Terracotta.	<b>04</b>
<b>Chapter No: 6</b> Study of Important North Indian Inscriptions 1) Ashoka’s Rock Edict No.13 2) Hatigumpha Inscription of Kharavela 3) Nasik Cave Inscription of Nahapana. 4) Mahrauli Pillar Inscription of Chandraguptha-II 5) Samudraguptha’s Allahabad Pillar Inscription	<b>05</b>
<b>Unit - III</b>	<b>13/14</b>
<b>Chapter No:7</b> Study of Important South Indian Inscriptions 1) Bramhagiri and Maski edicts of Ashoka 2) Halmidi Inscription 3) Aihole Inscription of Pulakeshi -II 4) Uttaramerur Inscription of Parantaka Chola 5) Shravanbelagola Inscription of Bukka I	<b>05</b>
<b>Chapter No: 8</b> Contributions of Important Epigraphists- B.L.Rice - J. F Fleet – D.L.Narasimhachar -M.H.Krishna	<b>04</b>

<p><b>Chapter No : 9</b> Visit to Local Inscription Sites</p> <p>Practical training in taking Estampage of stone or copper plate inscriptions- preparation of Field Study Report for assignment is mandatory.</p> <p><b>Map for study - Locate the Important Inscriptions and its Importance</b></p> <p>1) Besnagar 2) Hathigumpa 3) Junagada 4) Mathura 5) Banavasi 6) Badami, 7)Arjunawada 8) Beluru 9) Kudumiyanmalai 10) Nasik 11) Allahabad 12) Brahamagiri 13) Talagunda 14) Saranatha 15) Maski 16) Sannathi 17) Gujarra 18) Nagarjunakonda 19) Halmidi 20) Shahbazgarhi.</p> <p><b>Note-</b> One Essay Question for Blind Student for 10 Marks</p>	<p><b>04</b></p>
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### Suggested Readings

1. D. C. Sircar : Indian Epigraphy
2. R.B.Pandey : Indian palaeography
3. Gai. G.S : Introduction to Indian epigraphy

### Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

**II BA – IV Semester**

**Paper No.4.1 DSC- 7 History of Karnataka (From Earliest times to 10<sup>th</sup> Century CE)**

Course Title: <b>History of Karnataka (From Earliest times to 10<sup>th</sup> Century CE)</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

**Course Pre-requisite(s): History of Karnataka (From Earliest times to 10<sup>th</sup> Century CE)**

Course Outcomes (COs):

At the end of the course the student should be able to:

- Develop a bird view on the historical development of Polity, economy and culture of Karnataka.
- To understand the cultural transitions of Karnataka from earliest times to 10<sup>th</sup> century CE.
- To understand how the different ruling powers develop a harmony in society through their religious policies.
- Develop a strong cultural understanding of Karnataka’s language, literature and different cultural aspects.
- To identify the makers of Karnataka and how they helped to preserve the continuity of long cultural heritage

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) / Program Outcomes (POs)	DSC 5	DSC 6	DSC 7	DSC 8	OE 4	OE 4	SEC 1	SEC 2
Disciplinary Knowledge			X					
Communication Skills								
Critical Thinking			X					
Problem Solving			X					
Analytical Reasoning			X					
Cooperation and TeamWork			X					
Reflective Thinking			X					
Self-motivated Learning			X					
Diversity Management and Inclusive Approach			X					
Moral and Ethical Awareness Reasoning			X					
Lifelong Learning			X					

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark “X” in the intersection cell if a course outcome addresses a particular program outcome.



## II BA – IV Semester

**Paper No.4.1 DSC- 7**

**Title of the Course: History of Karnataka (From Earliest times to 10<sup>th</sup> Century CE)**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I</b>	<b>13/14</b>
Chapter No : 1 Survey of Sources – Pre Historic Culture – Stages – Tools – Important Sites – Brahmagiri, Sanganakallu – T. Narasipura -Proto Historic Culture – Sannati –Rajaghatta. Early State formation in Karnataka – Vadugas : Non Tamil Political entities – Depicted in Shangam Literature	<b>05</b>
<b>Chapter No: 2</b> The Mauryans in Karnataka – Ashoka – Mauryan influences on Polity of Karnataka – Inscriptions – Royal Edicts	<b>04</b>
<b>Chapter No: 3</b> The Satavahanas – Gautamiputra Satakarni – Polity and Administration	<b>03</b>
<b>Unit - II The Rise of Karnataka</b>	<b>13/14</b>
<b>Chapter No : 4 The Kadambas of Banavasi</b> – Mayuravarma and Kakutsavarma – Polity – Administration – Land Grant Policy	<b>04</b>
<b>Chapter No : 5 The Gangas of Talakadu</b> – Konganivarma – Durvineeta – Sri Purusha – Chavundaraya – Importance of Gangas in Geo-polity of Ancient Karnataka - Polity – Administration – Land Grant Policy	<b>05</b>
<b>Chapter No: 6 The Chalukyas of Badami</b> – Pulakeshi-II Vikramaditya- II - Polity – Administration – Land Grant Policy	<b>05</b>
<b>Unit - III The Age of Empires</b>	<b>13/14</b>
<b>Chapter No:7 The Rastrakutas</b> – Krishna-I – Govinda-III – Amoghavarsha Nrupatunga- Expansion Policy - Polity and Administration	<b>05</b>
<b>Chapter No: 8 The Chalukyas of Kalyana</b> – Tailapa-II – Vikramaditya-VI – Someshwara-III - Polity –Administration	<b>04</b>

<p><b>Chapter No : 9 Minor Dynasties of Ancient Karnataka-</b> The Punnatas - The Nolambas - The Banas</p> <p><b>Maps for Study –</b> Kadamba State during Kakustavarma Ganga State during Durvineeta Badami Chalukyan Empire during Pulikeshi II Rastrakuta Empire under Amoghavarsha Nrupatunga</p> <p><b>Important Historical Places:</b> 1. Talakadu 2. T.Narasipura 3. Kibbanahalli 4. Chandravalli 5. Siddapura 6. Jatingameshwara 7. Manyakheta 8. Badami 9. Pattadakallu 10. Ihole 11. Hemmige 12. Nandi 13. Manne 14. Sannati 15. Shravanabelagola</p>	<p><b>04</b></p>
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### Suggested Readings

1. B. Sheik Ali : The Western Gangas
2. G.R. Rangaswamayya : Dakshina Bharatada Itihasa
3. A. Sundara (Ed.) : Kannada Vishaya Vishvakosha-Ithihasa mattu Puratatva
4. K.R.Basavaraju : History and Culture of Karnataka
5. P.B. Desai : A History of Karnataka
6. A. Sundara (Ed) : Karnataka Charitre -Vol- I
7. B.Surendra Rao (Ed) : Karnataka Charitre -Vol - II
8. K.A.Nilakanta Sastri : A History of South India
9. R.S. Mugali : The Heritage of Karnataka
10. Suryanath Kamat : Karnatakada Sankshipta Itihasa

### Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

## II BA – IV Semester

### Paper No.4.2 DSC-8 History of Modern Europe (1871-1945)

<b>Course Title: History of Modern Europe (1871-1945)</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): History of Modern Europe (1871-1945)**

##### Course Outcomes (COs):

At the end of the course the student should be able to:

- It provides a critical overview of the Europe from 1871 to 1945. It shall also trace the patterns and outcomes of social upheaval throughout Europe in the first half of 19th century.
- To understand the debates on the development and impact of industrial capitalism. The birth of new social movements, political ideas and structures shall be contextualised within developing capitalism of the nineteenth century. And investigates the political, social, and economic developments that shaped and continue to shape the modern age.
- To understand the evolution of the nation state, industrialization and its impact on society and politics.
- To develop an understanding of the significant transformations in European polity and society till the mid nineteenth century.
- Students would be expected to develop on her/his understanding of the social and economic dimensions of the Industrial revolution in eighteenth century Britain to compare and understand the specific case studies of France, Germany and Russia in the nineteenth century.
- Examined changes since the 18<sup>th</sup> century in European social ,economic and political structure, locating Europe’s place in world history its development

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) / Program Outcomes (POs)	DSC 5	DSC 6	DSC 7	DSC 8	OE 4	OE 4	SEC 1	SEC 2
Disciplinary Knowledge				X				
Communication Skills								
Critical Thinking				X				
Problem Solving				X				
Analytical Reasoning				X				
Cooperation and TeamWork				X				
Reflective Thinking				X				
Self-motivated Learning				X				
Diversity Management and Inclusive Approach				X				
Moral and Ethical Awareness Reasoning				X				
Lifelong Learning				X				

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark “X in the intersection cell if a course outcome addresses a particular program outcome.

## II BA – IV Semester

### Paper No.4.2 DSC-8

Title of the Course: **History of Modern Europe (1871-1945)**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I</b>	<b>13/14</b>
<b>Introduction</b>	
<b>Chapter No : 1 The German Empire from 1871 to 1914</b> German Constitution – Domestic and Foreign Policies of Bismark and William Kaiser II	<b>04</b>
<b>Chapter No: 2 III Republic of France</b> Domestic and Foreign Policies of France Colonialism and Imperialism in Asia and Africa in the 19 <sup>th</sup> and 20 <sup>th</sup> Century	<b>04</b>
<b>Chapter No: 3 Eastern Question : Interests of Various Powers in Balkan States</b> <b>Stages:</b> 1.Serbian Independence to Treaty of Paris 2. Paris Treaty to Treaty of Berlin 3. Berlin Treaty of Bucharest 4. Congress of Berlin 5. Balkan Crisis and Wars-Causes – Failures – Consequences - Results	<b>06</b>
<b>Unit - II</b>	<b>13/14</b>
<b>Chapter No : 4 International Diplomacy Before the First World War</b> Power blocks and Alliances : Expansion of European Empires from 1870 to 1914- Three Emperors’ League or Dreikaiserbund – Relations between England and France – Anglo – Russian Alliance of 1907	<b>04</b>
<b>Chapter No : 5 First World War</b> Causes – Course – Results –The Paris Peace Conference and the Treaty of Paris - Treaty of Versailles – Fourteen Points of Woodrow Wilson	<b>04</b>
<b>Chapter No: 6 League of Nations</b> – the Assembly – The Council – Organisations – Achievements and Failures	<b>03</b>
<b>Unit III</b>	<b>13/14</b>
<b>Chapter No:7 Rise of Totalitarianism in Europe</b> <b>Russian Revolution, 1917</b> – Causes and Its Results <b>Rise of Totalitarianism in Russia under Lenin</b> - Economic Change <b>Stalin</b> - New Constitution of Soviet Russia – Foreign Policy	<b>04</b>

<p><b>Chapter No: 8 Failure of Weimar Republic and Rise of Nazism in Germany -</b>          Adolf Hitler - Home and Foreign Policies – Formation of the Greater Germany - Military Organisation – Formation of the Rome-Berlin-Tokyo Axis.  <b>Fascism in Italy</b> – Benito Mussolini – Home and Foreign Policies</p>	<b>05</b>
<p><b>Chapter No : 9 Quest for Security and Road to Second World War</b>          International Issues leading to Second World War - Causes – Course – Results – The Peace treaties  <b>Formation of U.N.O</b> - its Organisation – Achievements - Its Strength and Weaknesses</p>	<b>05</b>
<p><b>Historical Places :</b>          1.Berlin 2. Paris 3. London 4. Sarajevo 5. Rome 6. Belgrade          7. Montenegro 8. Bosnia and Herzegovina 8. Vatican 9. Istanbul          10. Monaco 11. Budapest 12. Prague 13. Lisbon 14.Vienna 15. Munich 16. Milan 17.Serbia 18.Romania 19.Frankfort 20.Mascow</p>	

### Suggested Readings

1. C.D. Hazen : Modern Europe since 1789
2. E. H. Carr : International Relations between to World Wars (1919-1939)
3. R.D. Cornwall : World History in 20<sup>th</sup> Century
4. A.J.P. Taylor : Struggle for Mastery of Europe 1848-1918
5. A.J. Grant & Templeton : Europe in 19<sup>th</sup> and 20<sup>th</sup> Century
6. C.D.M. Ketelby : A History of Modern Times from 1789
7. C.J.H. Hayes : Cultural and Political History of Europe Vol. 1 (1500-1830)
8. George Lichtheim : A Short History of Socialism
9. Peter Mathias : First Industrial Revolution
10. Alec Nove : An Economic History of the USSR
11. Andrew Porter : European Imperialism, 1870-1914(1994)
12. Clyde and Beer : History of the far East
13. Hayes (ed) : World History
14. Durant, Will, : Lesson of History
15. Palmer. R.R and J. Cotton, : A History of the modern world
16. Fisher, H.A.L : A History of Europe
17. Hays, C. J. H, : Contemporary Europe since 1870
18. Grosvenor, Edwin : Contemporary History of the World

### Pedagogy

- Lecture Method – Classroom teaching, classroom discussions and student presentations in class and/or in tutorials.
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

### Suggested Readings

- \* R.R.Diwakar : Karnataka through the ages
- \* P.B.Desai : History of Karnataka
- \* K.Veerathappa : Studies in Karnataka History and Culture.

- |                     |  |
|---------------------|--|
| * James Manor       | : Political change in an Indian State Mysore 1917-1955 |
| * M. Shamarao       | : Modern Mysore (2 vols.)                              |
| * Suryanath U Kamat | : A Concise History of Karnataka                       |

### **Pedagogy**

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### **Modes of Assignment**

- Individual Assignments
- Project Work
- Written Test
- Documentaries

## II BA – IV Semester

### Paper No.4.3 OE-4 Principles and Practice of Museology

<b>Course Title: Principles and Practice of Museology</b>	
Total Contact Hours: 39 to 42	Course Credits: 3
Formative Assessment Marks: 40	Duration of ESA/Exam: 60
Syllabus Authors: BOS (UG)	Summative Assessment Marks: 100

#### **Course Pre-requisite(s): Principles and Practice of Museology**

Course Outcomes (COs):

At the end of the course the student should be able to:

- Understand the concepts of Museum, Museology, Museography
- To identify properly both Cultural and Natural Heritage objects
- Know the acquisition methods, proper collection of objects for cultural centres
- Documentation of Tangible, Intangible and Natural Heritage objects
- Learn how to make museum and cultural centre as a destination of cultural tourism
- Learn how to make museums and other cultural organizations as resource centre for local communities

#### **Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

Course Outcomes (COs) / Program Outcomes (POs)	DSC 5	DSC 6	DSC 7	DSC 8	OE 4	OE 4	SEC 1	SEC 2
Disciplinary Knowledge						X		
Communication Skills								
Critical Thinking						X		
Problem Solving						X		
Analytical Reasoning						X		
Cooperation and Team Work						X		
Reflective Thinking						X		
Self-motivated Learning						X		
Diversity Management and Inclusive Approach						X		
Moral and Ethical Awareness Reasoning						X		
Lifelong Learning						X		

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark “X” in the intersection cell if a course outcome addresses a particular program outcome.

## II BA – IV Semester

### Paper No.4.3 OE-4

Title of the Course: **Principles and Practice of Museology**

Course 1		Course 2	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	39 or 42	3	39 or 42

Content of Course 1	39/42 Hrs
<b>Unit-I</b>	<b>13/14</b>
<b>Introduction</b>	
<b>Chapter No : 1</b> Definitions and concepts of Museology and Museum	<b>04</b>
<b>Chapter No: 2</b> Origin and development of Museology and Museography	<b>04</b>
<b>Chapter No: 3</b> <b>Functions of Museum</b> – Collection, Documentation - Index and catalogue – numbering the objects	<b>04</b>
<b>Unit - II</b>	<b>13/14</b>
<b>Chapter No: 4</b> <b>A brief history of Museum Movement in India and Abroad.</b>	<b>05</b>
<b>Chapter No : 5</b> <b>Types of Museums - Archaeology Museums- Art museums- History museums- Maritime museums - Military and war museums - Open-air Museums - Industrial museums, Science Museums.</b>	<b>04</b>
<b>Chapter No: 6</b> <b>Indian Legislative Measures Relating to Museums</b> -Treasure Trove Act, Antiquity Registration Act. <b>Role of Professional Organizations</b> – Museums Association of India UNSECO - ICOM. - , ICOMOS	<b>05</b>
<b>Unit -III</b>	<b>13/14</b>
<b>Chapter No:7</b> <b>Important National Museums of India</b> - National Museum, New Delhi - Salarjung Museum Hyderabad - Calcutta Museum – Mathura Museum- Government Museum Chennai	<b>05</b>
<b>Chapter No: 8</b> <b>Regional Museums</b> - Natural History Museum, Mysore - Government Museum, Hassan - Government Museum Bangalore - Manjusha Museum, Dharmasthala - Suttur Museum	<b>04</b>
<b>Chapter No : 9</b> <b>Exhibition Equipments in Museum</b> – Showcase – Pedestals- Audio Visual Equipments –Labeling Visit to nearest Museums Or Preparation Project report on Museums for Assignment is Mandatory	<b>04</b>



<b>Places :</b> 1.New Delhi 2.Calcutta 3.Hydrabad 4. Mumbai 5.Chennai. 6. Bangalore 7. Buvaneaswar 8. Patna 9.Kochi 10. Ahmadabad 11. Poona 12. Mysore 13. Dharmathala 14. Hassan 15.Amritsar 16. Jaipur 17. Madras 18. Dakshina Chitra(Muttukad) 19. Indore 20. Goa	
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### Suggested Readings

1. Grace Morley : Museums To- day, Department of Museology, M.S. University of Baroda. 1968
2. Diwadi.V.P. (Edited) : Museums and Museology: New horizons.
3. Vasant Hari Bedkar, : New Museology for India, National Museum Institute of History of Art, Conservation and Museology, 1985
4. Sviram Murti.C : Directory of Museums, Museology and New Museology, New Delhi 1985
5. Nigam M.L. : Fundamentals of Museology. Navahind Prakashan, 1966.
6. Agrawal, Usha. : Museums in India – a brief directory
7. Seth, Manvi. : Communication and Education in Indian Museums.
8. Roy, Shilpi. : Museum documentation: a potent tool for collection Management
9. Smith Bautista, Susana. : Museums in the Digital Age: Changing Meanings of Places, Community and Culture.
9. Nigam,M.L : Museums in India
10. Nigam,M.L : Fundamentals of Museology
11. Ghosh D.P : A Studies in Museology
12. ,ÀtÚAiíí ©. J, ï. (C£íivÁzÁ) : vÁ,Áíí ,ÁAUÁæ° Á@Aiíí vÁÄs® vÁvÁeUA/vÁÄ

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### Pedagogy

- Lecture Method – Class Room Teaching
- Learning Through Project work
- Collaborative learning strategies
- Use of Resources like Audio- Visual aids, Films, Documentaries
- Visit to Historical Sites, Museums etc.
- ICT Supplemented Teaching
- Seminars / Guest / Special Lectures
- Group Discussions

### Modes of Assignment

- Individual Assignments
- Project Work
- Written Test
- Documentaries

**V SEMESTER**  
**DSE – 1 : HISTORY OF MODERN INDIA (1498-1947)**  
**Credit (L: T: P = 5: 1: 0)**

**Course outcomes:**

- CO1. Understand the detailed picture of the heroic resistance Indian to the company's rule, the battle of Plassey, Buxar and Carnatic wars and their effects
- CO2. Develop the knowledge of Consolidation of the British rule regulating Act 1773, subsidiary alliance, doctrine of lapse and land revenue policies.
- CO3 Indian renaissance and change of administration, the great revolt of 1857. It will inspire students to appreciate and respect national leaders and values of patriotism and nationalism.
- CO 4. Gain knowledge about foundation of Indian National congress. Role of moderates, extremists and Gandhian era., to the students

**Unit 1**

Advent of Europeans –Portuguese-English-French-Anglo-French Rivalry- Conquest of Bengal by the British –Battles of Plassey and Buxar –Robert Clive –Dual Government in Bengal –Anglo – Maratha Wars Rise of Sikhs – Ranjit Singh –Anglo Sikh Wars

**Unit-II**

Consolidation of the British rule- The regulating Act-1773 Pitts's India Act –lord Wellesly – Subsidiary Alliance \_features and significance –doctrine of Lapse-Land Revenue Policies – Zamindari System –Roytwari System –its features

**Unit III**

Rebellion of 1857 –cause and consequences –Queen's proclamation act of 1858 – socio and Religious movements –Causes of the Indian Renaissance – the Brahma Samaj, Arya samaj, Ramakrishna Mission – The Aligarh Movement

**Unit –IV**

Rise and Growth of Nationalism – Foundation of Indian National Congress Moderates and their Achievements – Rise of Extremism – Growth of Revolutionaries Nationalism till 1930 Gadar Movement, Chandrashekar, Azad, Bhagat Singh

**Unit –V**

Gandhi Era – Round Table Conference – Government of India Act of 1935 – Quit India Movement – Partition and Independence and Dr. B. R Ambedkar

**Books For Reference:**

1. Percival Spear: Oxford History of Modern India (1740-1975) (new Delhi)
2. Arthur D. Innes: History of British in India, Lal Pub. New Delhi 1999
3. Ranjit Guha :subaltern studies(10 Vols)
4. A.R Desai Social Background to Indian Nationalism
5. Tharachand History of Freedom Movement

**V SEMESTER**  
**DSE – 2: HISTORY OF MODERN ASIA (1900 – 1995)**  
**Credit (L: T: P = 5: 1: 0)**

**Course outcome**

- CO1. Analyze the progress of Asian countries like China and Japan from insular nations to their present Dynamic position
- CO2. Understand to trace their role in world affairs in the last 3 decades of the 20<sup>th</sup> Century
- CO3. Develop the knowledge about diverse countries of the region and provide an insight into the historical background
- CO4. Evaluate the basics of colonization and decolonization and analyse the areas of conflict in this vital region. Historical background of Iran, Arabs and Jews. Rise and growth of Arab nationalism, Zionist movement,

**Unit I – China: Historical background – Opium Wars**

- 1) The Boxer Rebellion : Causes and results – Boxer Protocol
- 2) Revolution of 1911 – Causes and Consequences – Role of Dr Sun Yat – Sen
- 3) Conflicts between the Kuomintang Nationalists and the Communists

**Unit II – Japan**

- 1) Historical background with reference to Meiji Restoration
- 2) The Anglo – Japanese Alliance – 1902 – Its significance
- 3) Japan's relations with China between 1914 to 1939

**Unit III – Turkey**

- 1) Disintegration of Ottoman Empire
- 2) The Young Turk Movement – achievements of the Young Turk government
- 3) Mustafa Kemal Pasha – Modernization of Turkey

**Unit IV – Iran**

- 1) Historical background
- 2) Pahlavi Regime – Reza Shah Pahlavi
- 3) Mossadeq – The Oil Crisis

**Unit V – Arabs and Jews**

- 1) Rise and Growth of Arab Nationalism
- 2) Zionist Movement: Genesis and growth – Balfour Declaration, Birth of Israel

**Books for Reference:**

- 1) H.M. Vinacke: A History of the far East in Modern time
- 2) W. David M.D. Rise and Growth of Modern China. Himalayan Pub. Bombay 1987
- 3) D.G.E. Hall History of South East Asia
- 4) S.L. Roy : History of Far East and South East Asia (2 Vol)
- 5) K.M. Panikar : Asia and Western Dominance
- 6) Luke: Modern Turkey
- 7) Karan Armstrong : A History of Jerusalem
- 8) Immanuel C.Y. HSU : The rise of Modern China, N.Y. 1995
- 9) George Ienczowsky : Middle East in the World Affairs
- 10) J.C. Michael – The Shaping of Arabs Clyde and Beers: The Far East
- 11) Shaik Ali thers : A short History of Modern Asia (1900 – 19600) Chandramouli Prakashana – 1987
- 12) B.K. Gokhale – History of Modern World, Himalaya Pub. House, New Delhi

**V SEMESTER  
HISTORY OF MODERN EUROPE (1789 – 1945)**

**Course outcome**

CO1.Enrich the knowledge to understand Europe before French revolution.

CO2.Europe of to-day which occupies a place of vital importance in world affairs

CO3.learn the major events that challenged the life style of the people of Europe and their governments

CO4.Acquire knowledge about the age of revolutions and the slogan of liberty equality and fraternity

CO5.Understand the role played by the dictators and causes and impacts of World Wars.

CO6. Know the establishment of UNO and its Aims, Objectives and structures

**Unit I – Revolutionary Phase**

- 1) The French Revolution : Causes and Results
- 2) Napoleon Bonaparte – military achievements – administrative reforms – Continental system

**Unit II – Reactionary Phase**

- 1) The Vienna Congress and its work
- 2) Age of Metternich (1815 – 1848)
- 3) Napoleon III – Internal and External Policy

**Unit III – Unification Movements**

- 1) Italian Unification – Role of Mazzini, Count Cavour and Garibaldi
- 2) German Unification – Bismarck and his wars of unification

**Unit IV – 20<sup>th</sup> Century Europe**

- 1) The First World War – Causes and Consequences
- 2) The Bolshevik Revolution of 1917 – Causes – Role of Lenin
- 3) Rise of Fascism in Italy – Benito Mussolini
- 4) Rise of Nazism in Germany – Adolph Hitler

**Unit V – Europe during the II World War**

- 1) Second World War – Causes and Consequences – Genesis of Cold War
- 2) The UNO – Aims and Objectives – Structure; Organs and their functions

**Books for Reference:**

- 1) Kettelby, C.D.M : A short History Mod Europe Oxford Uni Press. Calcutta 2000
- 2) Gokhale B.K : Modern Europe 1848 – 1960, Himalayan Pub. House Bombay 1987
- 3) Sir Marriott J.A.R : A History of Europe 1815 to 1939. Surjeeth Pub Delhi 1986
- 4) H.A.L Fisher : A History of Europe (2 Vol) Surjeeth Pub. Delhi
- 5) C.D. Hazen : Europe since 1815
- 6) David Thomson : Europe since Napoleon
- 7) Edward Macnall Burns: Western Civilization, History and Culture, WW. Norton and Company inc, New York, 1963
- 8) TCW Blanning – The culture of Power and the The Power of Culture – Oxford Uni. Press – 2003

**VI SEMESTER**  
**INDIA AND THE CONTEMPORARY WORLD (1947 – 2000)**

**Course outcome**

CO1. Gain knowledge about the Birth of Indian Republic, Economic Development under Nehru

CO2 Foreign Policy of India and major crisis in India

CO3. Understand & update knowledge on contemporary, issues and challenges

CO4. understand the concepts of state and power in International relations

CO5. Conceptualize the Relations between India and other countries Alliances.

**Unit I – Emergence of New India**

- 1) Birth of Indian Republic – Adoption of Republican Constitution – its main features
- 2) India under Nehru – Economic Development during First Three five Years Plans

- 3) Formation of Linguistic States
- 4) National Policy of Education (NPE)

### **Unit II – Major Crisis**

- 1) Kashmir Crisis
- 2) Khalistan Movement

### **Unit III – Foreign Policy**

- 1) Features of Foreign Policy
- 2) India's Relations with Pakistan and China
- 3) India and U.S.A
- 4) India and U.S.S.R

### **Unit IV – Cold War (1950 – 1990)**

- 1) Genesis, Truman and Marshall Plans, Berlin blockade, formation of Military Alliances, Cuba Missile Crisis, Re-unification of Germany, Dissolution of USSR and end of Cold War

### **Unit V – Developments in China, Africa and West Asia Since 1950**

- 1) China under Mao and after – Internal Developments
- 2) Struggle against apartheid in South Africa – Nelson Mandela
- 3) Post Second World War Arab – Israel Relations

### **Books for Study and Reference:**

- 1) DGE, Halls: History of south East Asia, Macmillan Pub Ltd. Hampshire 1995
  - 2) Arjun Dev: Contemporary World
  - 3) Shapire J.S : The World in Crisis
  - 4) Petter Heehs. Modern India and the world. Oxford University Delhi 1991
  - 5) V.K.R.V Rao: Nehru Legacy
  - 6) Bipin Chandra: Communalism in modern India New Delhi 1979
  - 7) B.R. Nanda (ed) : India's Foreign Policy
  - 8) William Yale: The Near East
  - 9) V.P. Menon : Transfer of Power
  - 10) Bisweswara Prasad : Contemporary Africa, Asia Pub House, Bombay 1960
  - 11) Colin Legum (ed) : Africa : A Handboo to continent
  - 12) John Edwin Fogg : Latin America. Macmillan. London 1969
  - 13) Brunn, Geoffrey: The World in the 20<sup>th</sup> Century N.Y.
  - 14) Saghata Bose, Ayesha Jalal : Modern South Asia Oxford Uni. Press New Delhi 1999
  - 15) William R Keyler : The Twentieth Century World
  - 16) Daniel R Brower – The World Since 1945 – A Brief History, Pearson Prentice Hall, Delhi – 2005
- Mohammad Anwar – ul Haque – Contemporary World History – NCERT Delhi

**VI SEMESTER**  
**GE – 1: HISTORY OF MODERN INDIA (1757 – 1947)**  
**Credit (L: T: P = 2: 0: 0)**

**Course outcome:**

**Unit 1**

Advent of Europeans –Portuguese-English-French-Anglo-French Rivalry- Conquest of Bengal by the British –Battles of Plassey and Buxar –Robert Clive –Dual Government in Bengal –Anglo – Maratha Wars Rise of Sikhs – Ranjit Singh –Anglo Sikh Wars

**Unit-II**

Consolidation of the British rule- The regulating Act-1773 Pitts’s India Act –lord Wellesly –Subsidiary Alliance \_features and significance –doctrine of Lapse-Land Revenue Policies Rebellion of 1857 –causes and consequences –Queen’s proclamation act of 1858

**Books For Reference:**

1. Percival Spear: Oxford History of Modern India (1740-1975( new Delhi
2. Arthar D .Innes: History of British in India, Lal Pub. New Delhi 1999
3. Ranjit Guha :subaltern studies(10 Vols)
4. A.R Desai Social Background to Indian Nationalism
5. Tharachand History of Freedom Movement

**Pattern of Question Paper**

1. Internal Assessment

Each paper will have an internal assessment component for 30 marks out of the maximum 100 Marks

2. **Theory Examination**

**Max Marks 70**

Theory question paper pattern

Theory question paper for I – IV semester will have Four Parts

**Question Paper Pattern**  
**Theory (6 Credits)**

Time: 3 Hours

Max. Marks: 70



### PART – A

This part consists of **two** questions of 15 marks each and the student will have to answer **one** question **15**  
**x 1 = 15**

### PART – B

**Part – B** consists of five questions of **ten** marks each and the students will have to answer **three** questions **10**  
**x 3 = 30**

### PART – C

This part will have **five** questions of **five** marks and the students will have to answer **three** questions **5 x**  
**3 = 15**

### PART – D

Map question will have **Ten** marks out of which Five marks will be awarded to locating Five places. **Five** marks for writing explanatory note on the places **5 +**  
**5 = 10**

The V & VI semester will have **Three parts** **Part – A** consists **01** question for **15** Marks. **Part – B** consists of **04** questions for **40** Marks and **Part – C** consists of **15** Marks for **03** questions.

## GENERIC ELECTIVES

### Pattern of Question Paper

1. Internal Assessment

Internal assessment component for 15 marks out of the maximum 50 Marks for C1&C2

2. **Theory Examination**

**Max**

**Marks:35**

Theory question paper pattern

Theory question paper for all the V – VI semester will have 3 Parts

### Question Paper Pattern

**Theory (2 Credits)**

**Time: 2.00 Hours**

Max. Marks: 35

### PART – A

This part consists of **five compulsory** questions of 2 marks each and the student will have to answer **one** question

**5 x 2 = 10**

### PART – B

**Part – B** consists of two questions of **Ten** marks each and the students will have to answer **one** question

$$10 \times 1 = 10$$

### **PART – C**

This part will have **Five** questions of Five marks and the students will have to answer **Three** questions

$$5 \times 3 = 15$$



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
**(Autonomous)**  
**B N ROAD, MYSURU- 570 025**

**DEPARTMENT OF JOURNALISM**

**Curriculum for**  
**I and II year BA Degree under NEP**  
**And**  
**III year BA Degree under CBCS**

**2022-2023**

## Syllabus for I & II Semester

EFFECTIVE FROM ACADEMIC YEAR 2021-22

SEPTEMBER 2021

### **BA HONOURS & MASTER'S PROGRAMME IN JOURNALISM AND MASS COMMUNICATION**

**Programme:** Five-year Integrated Master's Programme in Journalism and Mass Communication to be introduced under NEP.

#### Programme Objectives:

- Five-year Integrated Course in Journalism and Mass Communication would aim to facilitate students with all aspects of the field of Journalism. They become more proficient in both theory and practical skills of the media in general.
- The programme would prepare the students 'ready-to-be recruited by media, advertising & corporate houses'. The content of the programme is designed to be dynamic and responsive to rapid changes in most segments of the industry.

#### Learning Outcomes:

- The programme aims to create and reproduce media professionals who would contribute positively to the society.
- The programme aims to facilitate better career opportunities for all those students of this course and get them ready to tackle challenges in the professional setup.
- The programme aims to make a balance between the dynamic working environment and professional ethics in the field of Journalism and Mass Communication.

#### Need for Curriculum Enhancement:

NEP 2020 initiative is intended to facilitate a contribution to being ahead of industry among the students studying in different Universities/Institutions. The need for the curriculum development in Journalism and Mass Communication emerges due to the following reasons:

**Changing Media Resector:** The curriculum has been designed keeping with the industry requirements and include subjects such as Multimedia, Transmedia, Data Film Making, Copying, Blog and Vlogs, Mobile Journalism, Writing for Media, Producing News Content

for Radio and TV, Advertising and Corporate Communications, among several others. The rapid growth in media industry demands highly skilled human resources.

**Credit transfer:** Credit transfer is approved by the UAC and the Government that allows the students to transfer course from their existing university to a new UAC-approved university. The same number of credits in all the Universities in Karnataka is the first step towards the credit-transfer from University to University.

**Skill Enhancement:** The new curriculum focuses more on skills in teaching, research and thereby enhancing the skills of the students. It not only aims at producing responsible communicative professionals but also interacts with a business approach to day-to-day life. The popular like Writing for Media, Photography, Computer Applications for Media etc., further helps in skill development of students.

### **Efficiency**

The goal of *Journalism and Mass Communication* programme is offered with an objective to train and prepare professionally skilled media persons and communication experts. It leads students to a wide range of professionally based skills.

**Importance in Theory and Practice and its application:** The *Journalism and Mass Communication* curriculum focuses on innovative components in theory and practice, which in turn equips students to be skill-oriented media pros.

**Emphasis on NCTE:** The global media industry is in anticipation of ICT based communication experts. To enhance critical and creative thinking amongst students, NCTE tools are incorporated into the teaching methods which include research-led writing, via production through mass channels, and practical production.

**Research-based and research-led teaching:** The Research Projects are introduced in the curriculum to strengthen the research concepts among the budding researchers. The students are encouraged to explore fields of *Journalism and Mass Communication* research such as print, electronic and new media research, global, health and political communication research, folk media, inter-cultural communication and research on divergent issues and so on as per relevance to the relevance of the profession. The students will be required to do research project on a topic of their choice under the supervision of a research guide.

**Issue-Resolving Approaches:** Students will be involved in groups and individual discussions. This will help the students to develop and involve in the process of critical thinking and analyzing. It further helps them in decision-making and stress management and also boost self-confidence.

### **Exit Options and Credit Recommendations**

A Certificate / Diploma / Bachelor Degree or Bachelor Degree with Honours in Journalism and Mass Communication is awarded at the completion of every progressive year.

<b>Exit Option with</b>	<b>Certificate/Diploma/Bachelor Degree</b>
Successful completion of Two year (two semesters) of the first year multidisciplinary undergraduate Degree programme	Certificate in Journalism and Mass Communication
Successful completion of Second year (two semesters) of the first year multidisciplinary undergraduate Degree programme	Diploma in Journalism and Mass Communication
Successful completion of Three year (six semesters) of the first year multidisciplinary undergraduate Degree Programme	Bachelor of Arts Degree in Journalism and Mass Communication
Successful completion of Four year (eight semesters) of the four year multidisciplinary undergraduate Degree Programme	Bachelor of Arts Degree with Honours in Journalism and Mass Communication
Successful completion of Five year (Ten semesters) of the five year multidisciplinary degree programme	Master of Arts Degree With Honours in Journalism and Mass Communication

A student will be allowed to continue only after the exit semester and they can only add after each semester. No entry is given to lateral academic programmes based on the above mentioned career preferences and awards. The validity of the earned credit will be for a maximum period (year) as specified by the academic body of institute (ABC)

### **ACADEMIC COUNCIL OF INSTITUTIONS (ACI) RECOGNIZED**

UCC	Uttarakhand University Council
UVC	Uttar Pradesh University Council
UCC/NUV	Uttarakhand Council (UCC) Based Upon Board
UUC	Uttar Pradesh Council
UVC	Uttarakhand Council

### **Electronic Internal Evaluation and Transfer Fee Application:**

Final marks for each course shall be based on continuous assessment and term end examinations. As per the decision of the Karnataka State Higher Education Council, it is necessary to have written papers of Class Internal Assessment and Semester End examinations respectively, among all the Universities, their affiliated and autonomous colleges. The state level committee deliberated on the same and suggested the following pattern for the UG Marks. The BCU has also approved to follow the same pattern.

## BACC 1: INTRODUCTION TO JOURNALISM

<b>Course Title and Code</b>	BACC 1: Introduction to Journalism (With Foreword)		
<b>Programme Title</b>	Bachelor of Arts in Journalism and Mass Communication		
<b>Credits</b>	Theory - 04	Practical - 04	Total - 08
	Practical - 04		
<b>Course Type</b>	Core	Academic Year	2021-22

Philosophy Theory: 04/week

Practical: 04/week

Total: 8 credits

Theory Marks = 100 = 60 T + 40 IA

Practical Marks = 80 = 50 P + 30 PE

Total Marks = 180

### Course Objectives:

- To introduce the concept of journalism and mass communication
- To familiarize the students with different facets of journalism
- To educate the students about the role of journalism in the development of society

### Learning Outcomes:

At the end of the course, the students should be able to

- To identify the different sectors of journalism and its professional aspects, including career opportunities
- To familiarize and use terms specific to media
- To educate the students about the historical perspectives of Indian journalism
- To educate the students with the current practices in journalism

#### Unit - I

Definition, Meaning, Nature, Scope, Functions and Principles of Journalism, Types of Journalism – Magazine, Business, Environment, Sports, Entertainment, Muckraker, Crime, Journalism, Arts, Glossary of Journalism, Introduction to Mass Media, Types of Mass Media – Traditional, Print Media, Print Media, Electronic Media and New Media.

#### Unit - II

Brief History of Indian Journalism – Evolution & Growth with special reference to James Augustus Baker, James S. G. Buckle, Raja Ram Mohan Roy, Mahendra Gauda, Dr. B.R. Ambedkar, Bal Gangadhar Tilak and Arundhati Bhattacharya, History of Contemporary Newspapers – The Hindu, Times of India, The Tribune, Front Page India and The Statesman.

#### Unit - III

Brief History of Kannada Journalism with special reference to Harshad Shetty, M. Yashwantrao, D.V. Gadgil, Mahesh Deshpande, etc. and P. H. Kulkarni, H.K. Vishwanath Gauda, Chairperson of Press Institute – Bangalore (Thiruvananthapuram, Kalyanasree).

#### Unit - IV

Concept Journalism, Qualification, Duties, Responsibilities of Journalism, Professional Code of Ethics, Role of Press in Democracy, Theories of Press – Authoritarian, Libertarian, Social Responsibility, Soviet Media Theory, Development Media Theory and Democratic Participation



## Theory

### Practical Component:

1. Lecture to the Editor - Publish 2 issues at any of the Local or National level.
2. Make a comparative analysis of any two regional/national newspapers.
3. Compare any two magazines.
4. Analyse the contribution of any professional personality from Unit II.
5. Analyse a news channel of your choice (representational).

### Books for Reference:

1. Theory and Practice of Journalism - B N Adnan
2. Professional Journalism - M T Kulkarni
3. Mass Communication & Journalism in India - Kavid I Khan
4. Adhunik Manochya Panchajanya - Shri J. Bhambhani
5. Professional Journalist's Handbook
6. Mass Communication & Journalism in India - Mulla
7. Kashi Chetana's Prastava - Vinayak Vaidik
8. Panchajanya - Mangalok Kar
9. History of Indian Journalism - S. Manojan
10. Indian Journalism - Madhy. Kulkarni
11. Journalism in India - R. Parthasarathy
12. New History of Indian Journalism - G. H. S. Reddy
13. History of Press, Print and Mass Communication - B. H. Adiga
14. Karnataka Prastava Shiksha Vol. 1, 2, 3 - Karnataka Prastava Academy
15. Indian Journalism - E. M. Srinivasan

## ENR (ENR) 1: WRITING FOR MEDIA

Course Title and Code	ENR 1: Writing for Media		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	1	Semester	I
Course Type	Core	Academic Year	2021-22

Prerequisite: Theory Required  
Total 3 credits  
Theory Marks: 100 = 50 T = 40 LA  
Total Marks = 140

### Course Objectives

- Practising students with writing skills for various media.
- To build student writing training for media writing.
- To equip the students with current trends in media writing.

### Learning Outcomes

- Learning various writing techniques for different media.
- Creating content for various social media platforms.
- Prepare content industry ready.

### Unit I

Print Media: Introduction to Writing for Print Media, Principles & Techniques of Writing for Print Media – Clarity, Brevity, Simplicity, Readability and Accuracy.

Forms of Journalistic Writing – News Writing – Inverted Pyramid, Writing Columns, Articles, Features, Editorials, Letters to the Editor, Reporting from Business.

### Unit II

#### Electronic Media

Radio: Writing for Radio, Language and Orchestration, Writing News Scripts, Preparing Ad Scripts, Radio Industry Skills.

Television: News: Principles and Techniques of TV Writing, Elements of TV Scripting, Language and Orchestration, Writing News Scripts.

### Unit III

New Media: Writing Techniques for New Media, Writing for Social Media (Facebook, Twitter, LinkedIn, Instagram), Introduction to Blogging and Vlogging, Content Trends in Web Journalism.

### Books for Reference

1. History of Indian Architecture. Prof. Bhabhuswati. University of Mysore, mysr.
2. Howard, Hubert. (2002). *All about photography*. New Delhi: National Book Trust.
3. Butler, Leonard. (2005). *Photogrammetrie: The professional approach* (4th Ed). London: Arden Press.
4. Horner, Brian. (2000). *Guide to photogrammetry*. New York: McGraw-Hill.
5. Chapman, Howard. (1994). *From aerial to 3D: Inside photogrammetry*. New York: University of Missouri Press.
6. British Free Photographers Association. (2007). *500 Days: From photography in a changing world*. London: David & Charles.
7. Van Arnhem. (2004). *All about photography*. New Delhi: Central Publishing House.

## BACS 3: COMPUTER APPLICATIONS FOR MEDIA

Course Title and Code	BACS 3: Computer Applications for Media (With Honours)		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	Theory-04 Practical-02	Semester	03
Course Type	Core	Academic Year	2021-22

Prerequisite: Theory - 4 Semesters

Practical - 4 Semesters

Total 8 credits

Theory Marks- 100 = 50 T + 50 SA

Practical Marks 50 = 20 P + 30 PS

Total Marks = 150

Total Marks = 150

### Course Objectives:

- To introduce students to the basics of computers
- To familiarize the students to the applications of computers in print and electronic journalism
- To facilitate the students to learn the practical applications of computers at different levels in media

### Learning Outcomes:

- Students will be equipped with computer related media skills
- Students will get hands on experience on various computer applications
- Students will independently be able to create new media content

### Unit I:

Introduction to Computers, Basic Hardware, Computer and Noncomputer Production, Software for Noncomputer Production, Internet, IIT, PageMaker, Adobe InDesign, Barcode and QR.

### Unit II:

MS Office: Word, Power Point, Excel – Creating Charts, Graphs, Tables, Use of Computers in Reporting, Editing, Publication and Printing

### Unit III:

Web Animation, Technologies of Web Writing, Illustrations and Web Designing, Languages, Programming, Multimedia, Online Newspapers, Web Portal.

### Unit IV:

New Media – Definition and Characteristics, Types of New Media – Website, Blogs, Video, Email, Social Media Marketing & IIT Platforms, Types, Techniques & Software for Blogging & Vlogging, Cyber Crime, Web Cloning.

### Finalist Companies:

1. Eliza is fighting on a topic of your choice.
2. Compare and contrast your interpretation of your choice.
3. A review on any recent (ITT) content of your choice.
4. Present your personal take on either of Eliza's Critics.
5. Prepare a full journal of 2 pages (A2 size).

### Books for Reference:

1. Sussan, R., 2008. *Computers Today: Easy to Use, Easy to Learn*.
2. Howard, M., *Cyberquest: First steps*, ed. Cambridge, MA: MIT Press.
3. Chapman and Chapman, *Digital Multimedia*, Wiley Publications.
4. James C. Frow, *Online Journalism: Principles and Practices: A Guide for the Web 2.0 Generation*, 2010, Elsevier Education.
5. Paul H. Murray, *History on the Internet: The Future of Narratives in Cyberspace*, New York: Free Press, 1997.
6. *Macintosh, Advanced Adobe Photoshop*, Adobe publications.
7. *Hyperquest.com, R., Information Technology and its Future*, India, Mumbai, 2011.
8. Smith, Peter, *Tracking: Post-structuralist Methods for the Social Web*, Indianapolis, Indiana: New Riders Press, 2008.

## UNIT 001: PHOTO JOURNALISM

Course Title and Code	00-3 Photo Journalism		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	03	Semester	II
Course Type	Core	Academic Year	2021-22

Prerequisites:

Theory: 3 Semesters

Total: 3 credits

Theory Marks: 00 = 40 T = 40 LA

Total Marks = 100

### Course Objectives:

- To acquaint students towards photojournalism
- To familiarize the students to techniques of photography and photojournalism
- To give a practical knowledge to the field of photography

### Learning Outcomes:

- Students will get hands on experience on visual communication
- Students will learn the significance of photos in various media
- Students will upgrade their knowledge on various photo editing software

### Unit-I

Concept of Photography, Evolution of Photography, Different Types of Camera- Manual, Digital and Mirror Cameras, Types of Photography - Portrait, Landscape, Travel Photography, Fashion, News Photography, Celebrity Photography

### Unit-II

Meaning of Photo Journalism, Qualifications, Role and Responsibilities of Photo Journalists, Photo Features, Techniques of Photo Editing, Caption Writing, Leading Photo Photographers and Photo Journalists by India

### Unit-III

Mobile Journalism - Using Smartphones for News Reporting, Photo Editing on Smart Phones, Publishing News Content using Smartphones on Digital Platforms, Techniques of Short Film Making

## Books for Reference

1. Allan Pinkus - *Techniques of Photo Investigation*
2. Michael Levy - *Basic Photography*
3. Tom Ang - *Digital Photography - Masterclass*
4. N. Mananath - *Chemical Pathology*
5. *Crimes of R. Murari of Photography*

**APPENDIX****DSCC 3: NEWS REPORTING AND ANALYSIS**

Course Title and Code	<b>DSCC 3: NEWS REPORTING AND ANALYSIS (With Practical)</b>		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	06	Semester	III
Course Type	Core	Academic Year	2022-23

Pedagogy: Theory: 4hrs/week  
 Practical: 4hrs/week  
 Total: 6 credits  
 Theory Marks– 100 = 60 T + 40 IA  
 Practical Marks 50 = 25 T + 25 PR  
**Total Marks = 150**

**COURSE OBJECTIVES:**

1. To introduce the concept of news.
2. To familiarize with reporting methods in general and reporting for print media in particular.
3. To educate about the types and techniques of reporting.

**LEARNING OUTCOME:**

1. To identify events and issues and turn them into news.
2. To make use of the skills and techniques in reporting.
3. Explore career opportunities in reporting.

**Unit-I**

News: Definitions, nature, concepts, elements and values. Sources of news: Types of sources- News Agencies and Internet as a Source. Techniques of news gathering; Structure and components of news story; News writing skills; Finding story ideas; Inverted pyramid and other styles; Leads and types of Leads in news story.

**Unit-II**

Reporter: Organisation of reporting section, Principles of reporting, functions, qualities, and responsibilities. Professional norms and ethics. Cultivation of news sources. Types of reporting: investigative, interpretative, in-depth, and narrative.

**Unit-III**

Types of news events: Speeches, seminars & conferences, press conferences, demonstrations, rallies and agitations. Reporting governmental and non-governmental communications; Covering communal riots and crimes. Interviewing: principles, importance, techniques and types of news interviews, difference between print, television and broadcast interviews.

**Unit-IV**

Specialized reporting: Legislative, court, science and technology, defence, human rights, women and child, health, sports, tourism, education, financial reporting, agriculture, lifestyle, cinema and culture. Civic, business, International reporting, mofussil.

**DSCC3 - NEWS REPORTING AND ANALYSIS(PRACTICAL COMPONENT)**

1. Preparing the events news reports of the College -03
2. Collect five different lead types from different newspapers-05
3. Revise and rewriting special news stories-03
4. Analyze the news stories appeared in newspaper with special interest-03
5. Preparation of press notes & press release-03
6. Press conference reports- 02

(Students is attending the press conference in your place and preparing the news reports)

7. Photographs and Captions-05



(Students have shooting any events in your college and given captions)

Features article: 03

(Students have to write a feature article their own choice topic)

### **Assignments**

1. Analyze at least 5 newsworthy events for news elements
2. Interview any personalities of your choice
3. Write at least 5 news scripts of different types
4. 2 assignments of specialized reporting
5. 2 assignments each of crime, sports and political news

### **Books for Reference:**

1. **Bill Kovach and Tom Rosenstiel**, (2001) *The Elements of Journalism*, Three Rivers Press.
2. **Brooks, B. S., Pinson, J. L., & Wilson, J. G.** (2013). "Writing as a Journalist," chapter 11 in *Working with Words: A handbook for media writers and editors*. Boston; New York: Bedford / St. Martin's.
3. **Deborah Potter**, (2006) *Handbook of Independent Journalism*, Bureau of International-Information Programs, U.S. Department of State.
4. **Brooks, B. S., Kennedy, G., Moen, D. R., & Ranly, D.** (2014). *The inverted pyramid*. In *News reporting and writing* (11th edition). Boston; New York: Bedford / St. Martin's.
5. **Lorenz, Alfred L, and John Vivian.** (1995) *News: Reporting and Writing* Pearson Education POD.
6. **Izard, Ralph S.** (1994) *Fundamentals of News Reporting*, 6th edition. Dubuque, Iowa: Kendall/Hunt.
7. **Melvin Mencher**, (2010), *News Reporting and Writing*, 12th Ed McGraw-Hill, New York.
8. **The Missouri Group.** (2014) *News Reporting and Writing*, 11th edition, Bedford-St. Martin.
9. **Steward, Charles J., and William B. Cash, Jr.** (2003) *Interviewing: Principles and Practices*; Boston: McGraw-Hill.
10. **Tompkins, A.** (2012). *The art of the interview*. In *Aim for the heart: Write, shoot, report and produce for TV and multimedia* (pp. 77-96). Washington, D.C.: CQ Press.
11. **Dainika varadigarike** by Dr. Nagendra.

## DSE/ OE 3 – FEATURE WRITING AND FREELANCING

Course Title and Code	OE 3 – FEATURE WRITING AND FREELANCING		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	03	Semester	III
Course Type	Core	Academic Year	2022-23

Pedagogy: Theory: 3hrs/week  
Total: 3 credits  
Theory Marks– 60 + 40 IA (C1-20+C2-20)  
**Total Marks = 100**

### COURSE OBJECTIVE:

1. To introduce various aspects of Feature Writing.
2. To familiarize with trends in Feature Writing and Freelancing.
3. To impart skills in news / feature writing.

### LEARNING OUTCOME:

1. To write features for print media.
2. To use professional skills in structuring and presenting features.
3. To write with social concern.

**UNIT I** - Feature: Definition and Characteristics – Structure of a Feature, Difference between news, features, articles and columns. Process and techniques of feature writing, feature headlines, Sources of Feature, Feature Syndicates.

**UNIT II** – Types of features, Different feature articles – science feature, news feature, cultural feature, Travel environmental feature, lifestyle feature; Modern trends in feature writing. Reviews and its Types.

**UNIT III** - Freelancing – Meaning, Definition and Scope of Freelancing, Freelancing as a profession, Qualities of a Freelancer, Trends in Freelancing, Legal and ethical aspects of freelancing, Scope of freelancing in print and electronic media, freelancing in online media.

### Books for reference:

1. How to Criticize books- O Hinkle and J Henry
2. Effective Feature Writing – C A Sheenfeld
3. Modern Feature Writing – H F Harrington and Elmer Scott Watson
4. Writing Feature Articles – A Practical Guide to methods and Markets –Hennessey
5. Before My Eyes: Film Criticism and Comment –Kauffmann
6. Beyond the Facts – A Guide to the Art of Feature Writing
7. Freelancing – R K Murthy
8. Suddiyashte Alla – Niranjana Vanalli

## DSCC 4: NEWS PROCESSING AND EDITING

Course Title and Code	<b>DSCC 4: NEWS PROCESSING AND EDITING</b> <b>(With Practical)</b>		
Programme Title	Bachelor of Arts in Journalism and Mass Communication		
Credits	06	Semester	IV
Course Type	Core	Academic Year	2022-23

Pedagogy: Theory: 4hrs/week  
Practical: 4hrs/week  
Total: 6 credits

**COURSE OBJECTIVE:**

1. To introduce the basics of editing and publication.
2. To provide an overview of the editing process.
3. To train in writing and editing techniques.

**LEARNING OUTCOME:**

1. To understand editing and publication process.
2. To write and edit news stories.
3. To design newspaper / magazine pages.

**Unit-I**

Introduction: Editing- Definitions, importance, principles, functions. Types of editing Rewriting; techniques of Editing. Newsroom Setup: Organizational structure and functions of a typical newsroom; Editor; Role and responsibilities of an Editor; Executive Editor; News Editor; Chief Sub-editor, Sub-editor, Sections in editorial. Editing supplements.

**Unit-II**

Editorial Page; Editorial writing and its significance; Types of Editorials; Op-ed Page, Letters to the Editor, Middle; Headlines – functions and types; Photo Editing and Caption Writing; Column writing and types of columns.

**Unit-III**

Concept of Newspaper Design: Types of Newspaper Layouts, Principles of Designing, Style Sheet, Dummy; Front Page Design, Pagination software; Trends in pagination; Translation - Meaning, Principles, Techniques and Types.

**Unit-IV**

Editing in the age of convergence and software application; Importance of design in print media, Visualizing a page; Types of designs; Designing special supplements; Data and Information graphics; Editing and ethics. Style Sheet.

## **PRACTICAL COMPONENT:**

1. Write an editorial on any current issue - 02
2. Write a letter to the editor about any civic issues - 2
3. Translate a news report from a Source Language to Target Language - 02
4. Choose 5 news stories and provide suitable headlines.
5. Capture 5 photographs & caption them.

### **Assignments:**

- 1) Editing at least 5 stories
- 2) Rewriting at least 5 poorly written stories
- 3) Headline writing and caption writing exercises
- 4) Designing news paper and magazine pages
- 5) Editing at least 5 wire service stories; Rewriting poorly drafted copies

### **Books for Reference:**

1. The Elements of Editing: a modern guide for editors and journalists by Arthur Plotnik: Collier Macmillan
2. Outline of Editing by K M Joseph: Anmol Publication
3. Advanced Journalism by Adarsh Kumar Varma: Har-Anand Publications Ltd
4. Words on Words by John M Bremner: Columbia University Press
5. The Glamour of Grammar: A Guide to Magic and Mystery of Practical English by Roy Peter Clark: Little, Brown company
6. Editing and Design by Harold Evans: William Heinemann Ltd
7. News Reporting and Editing by K M Shrivastva: Sterling Publishers Private Limited
8. Computer Application for Journalism by Rahul Singhai: EssEss Publication
9. Editing: A handbook for Journalists by T J S George; IIMC Publication
10. Editing by B N Ahuja and S Schhabra: Surjeet Publication

## DSE (OE) 4: TRANSLATION FOR MEDIA

<b>Course Title and Code</b>	OE-4 Translation for Media		
<b>Programme Title</b>	Bachelor of Arts in Journalism and Mass Communication		
<b>Credits</b>	03	Semester	IV
<b>Course Type</b>	Core	Academic Year	2022-23

Pedagogy:  
Theory: 3 hrs/week  
Total: 3 credits  
Theory Marks– 60 +40 IA(C1-20+C2-20)  
**Total Marks = 100**

### COURSE OBJECTIVE:

1. To examine journalistic discourse.
2. To focus on differences in language use in print media.
3. To follow current print media and practice translating media texts.

### LEARNING OUTCOME:

1. Students will be able to translate print media news items.
2. Differentiate different text types in media such as news, articles, and advertisements.
3. To compare the various discourses in different types of media texts.

**UNIT I** - Translation: Meaning, Definition, Nature, Scope and Significance; Principles and Techniques of Translation; Difference between literary translation and translation for media; Tools for translation.

**UNIT II** – Process of Translation: Source language, Target Language, Co-ordination, Guidelines for Translation; Free, Paraphrasing, Summarized, Semantic and Word to Word Translation. Machine translators.

**UNIT III** – Types of Translation: Legal, Literary, Administrative, Technical, Medical, Business and Scientific Translation; Qualities of a translator; Challenges of translation from English to regional languages and vice versa; Trends in media translations. Print and Electronic Media Translation.

### Books for reference:

1. Understanding Media: Marshall Mchuhan – Pub: Rantidge Classics.
2. Language the Basics: R. L. Tansk
3. Semiotics: The Basics: Divid Chandar – Pub: Foundation Books, New Delhi.
4. Aspects of Language and Translation: Steiner G – Pub: Oxford University Press
5. The Scandals of Translation: Lawrence Venuti
6. Media and Translation – Christina Schaeffineo – Pub: Cambridge Scholars Publishing
7. Good Writing for Journalist – Angela Phillips – Sage Publications.

Bachelor of Arts in (JPE) JOURNALISM, POL-SCIENCE AND ENGLISH I

Programme Outcomes for Bachelor of Arts in Journalism, Pol-Science and English

After completing the graduation in the B A (JPE) the students are able to:

P01. Acquire a functional knowledge of the underlying principles and recent emerging trends of the media industry.

P02. Create and design emerging audio media products

P03. Conceptualize, create, design, and strategies, high-quality media content for various digital platforms.

PO4. Appreciate and demonstrate the ability to produce reliable outcome.

P05. Demonstrate critical reading, writing, and thinking skills.

P06. Locate, evaluate, organize and incorporate information effectively

P07. Develop and carry out research projects

P08. Demonstrate competence in Standard English Language and usage in documentation

### Programme Specific Outcomes

#### Journalism, Political Science and English (JPE)

#### On Completion of BA (JPE) students are able to

PSO1: Gather, analyze and create journalism on contemporary issues for print, broadcast and other digital media.

PSO2: Produce work incorporating diverse groups and perspectives on local, national and international issues.

PSO3: Demonstrate an awareness of journalism as an ethical practice

PSO4: Write and edit clear, graceful, grammatically correct prose

PSO5: Analyze numerical data and utilize databases for multi-layered storytelling

PSO6: Demonstrate preparation for an entry-level position in the profession through a portfolio exhibiting their work.

PSO7: Report day to day activities effectively in written and oral pattern

PSO8: Draft reports and other written matter effectively

## BA Programme in Journalism

2019-20

JPE BA25

Annexure :

Semester	Course	Core	COURSE - CODE	Credits L:T:P	Total Credits	Theory Marks	LA Marks	Total Marks
Fifth	1. Reporting and Editing Techniques	DSE	ELC27025	2:1:2	07	70	30	100
	2. Indian Applied Journalism	DSE	1 L1327025	5:1:0	06			
	3. Introduction to TV and Radio	DSE	ELE27025	5:1:0	06	70	30	100
Sixth	1. Practices of Advertising and Pi		ELD27025	2:1:2	07	70	30	100
	2. Cinema Journalism	DSE	--	5:1:0	06			
	3. Introduction to New Media	DSE	---	5:1:0	06			
<b>Generic Elective Papers</b>								
fifth Semester	1. Development Journalism				02	35	15	50
	2. Photo Journalism	GE	ELF2705	2:0:0				
	3. Documentary Production		--					
Sixth Semester	1. Basics of Journalism		---		02	35	15	50
	2. Media Gender and Human Rights	GE	ELE27025	2:0:0				
	3. Global Media and Politics		—					
Total	Six +one GE= Seven Papers	LIDSC+2DSE+2GE	-	35-H4	39	--	--	70

Semester: 5

Code: DLE 27015

Paper: 1 Reporting and Editing Techniques

Course Out comes:

On completion of the Course, students are able to

CO: 1 Develop skills for news writing

CO: 2 Prepare news copy

CO: 3 sub editing the news materials

CO: 4 translate the news

CO: 5 specialize as fashion reporter.

Unit: 1- Role of Reporter, functions and qualities of reporter. News agencies- types of reporting- press conferences

Unit: 2- Types of leads, interviews, article writing, types of features

Unit:3-Organisational pattern of a news paper-set up of a news room, editorial department, editing-principles of editing, style sheet, jargons, importance of picture, selection of picture, headlines-functions and types o headlines. Design of editorial page, letters to the editors, contents of editorial page.

Unit: 4- Trends in sectional news-supplements-columns and columnists

Unit: 5- Paid news-agenda setting-gate keepers-pressures in news room.

Practical:

1. Internal Assessment
2. Exercise of Record books
3. Discussions on contemporary issues.

References:

1. Baskette and Scissors- The Art of Editing
2. S.N. Chaturvedi- Dynamics of Journalism an Art of Editing
3. Bruce Mlle and Dougals Andrson- News Writing and Reporting for Today's Media
4. F.W. Hodson- Modern News paper Practices
5. Fedler Fred- Reporting for Print Media



Semester: 5

Code: DLE27015

Paper: 2 Introductions to TV and Radio

Course Out comes:

On completion of the Course, students are able to

CO: 1 become news reporters for electronic media

CO: 2 become audio/video editor

CO: 3 develop cinema shooting and script writing skills

CO: 4 become radio/video jockey.

Unit:1- Origin and growth of radio-characteristics of radio, structure of AIR, FM and community stations-broadcast format-stages of radio productions

Unit:2- Writing for radio-broadcast formats-use of voice-sound effects-KR-studio-recording and mixing-sound editing

Unit:3- Origin and growth of TV-characteristics of tv media, types of tv programmes-scripts for TV-studio set up

Unit:4- Types of camera-uses of different lenses-uses of archives-editing skills-mixing and dubbing

References:

1. Mass Communication-Keval J. Kumar
2. Radio and TV journalism- K.M.Srivastava
3. Broadcast journalism-its basic principles-S.C. Bhatt
4. Audio-Visual journalism-B.N.Ahuja
5. TV media and Radio Voice-Dr.Nagendra

Semester: 5

Code: ISLE

Paper: 3 Indian Applied Journalism

Course Out comes:

On completion of the Course, students are able to

CO: 1 become news reporters

CO: 2 become circulation manager

CO: 3 become script writer

CO: 4 become stringer

Unit: 1 Evolution of printing- history of Indian Printing press- William Bolts- Bengal Gazette- J.A. Hickey

Unit: 2 Birth of Indian journalism- James Silk Buckingham- Raja Ram Mohan Roy- Balagangadhar Tilak

Unit: 3 Freedom Movement and Press- Gandhi, Nehru, Annie Besant and Ambedkar as pioneers of Indian journalism

Unit: 4 Brief history of English Publications- the Times of India- the Hindu- the Indian Express- Hindustan Times.

Students Presentations:

- 3 1. Cartoons on Indian press during the freedom movement- Indo-Pak divide and emergency rule.
2. Growth of regional press- Samyukta Karnataka- Mohare Hanumatha Roy- D.V. Gundappa- Patil Puttappa- Hermon Mongling-Mangalore Samachar- Amrutha Bazara Patrike- Free Press Journal

References:

1. History of Indian Journalism by Nadig Krishnamurthy
2. Journalism in India by Parthasarthy Rangaswamy
3. Social History of Media from Gutenberg to the Internet by Briggs A and Burke P
4. History of Press laws and Communication by B.N. Abuja
5. Indian journalism by K.M.Srivatsava

Semester: 6

Code: DLF 27015

Paper: I. Practice of Advertising and Public Relations

Course Out comes:

On completion of the Course, students are able to

CO: 1 set up advertising agency

CO: 2 prepare the advertising copy for print

CO: 3 become Script writer-marketing research

CO: 4 become PRO and event campaigner

Unit: 1- Introduction to Advertising, meaning, history and functions o Advertising-Theories, models-Apex bodies Like-AA-AI and ASCI

Unit: 2- Types of Advertising and new trends, ethics and tools for advertising, types of media for advertising, Advertising department and Ad agency structure.

Unit: 3- Introduction to PR, Definition, growth of PR, functions, principles and tools of PR, structure of PR department

Unit: 4- Types of PR, corporate communication, apex bodies like-IPRA, PRSI, PSPF and their codes.

References:

1. Advertising made simple- Frank Jefkins
2. Advertising Theory and Practices- Chunawalla •
3. Public Relations Techniques- Jefkins Frank Butterworth
4. Hand book of Public Relations- Heath Robert
5. Effective Public Relations- Cutlip S.M. and Center A.H.
6. Public Relations in India- Kaul El/ and Noya Prakash

Semester: 6

Code: DLF27215

Paper: 2 Introduction to new Media

Course Out comes:

On completion of the Course, students arc able to

CO: 1 become as Video Journalist

CO: 2 become cinema story writer

CO: 3 become Audio and video editor

CO: 4 become sound mixer and film maker.

CO: 5 become digital content editor

Unit: 1- Definition of new media, Basics- information society and new media- virtual culture and digital journalism-online communities

Unit:2- cyber security-privacy, new media ethics- web writing-linear and non-writing- visual and content. design-website planning and visual design

Unit:3- Original and growth of blogging, creating a blog, video blog, photo blog, and micro blog, video, podcast

Unit:4- User general content and web 2.0-digital art scripting and screening-cyber security

References:

1 Understanding digital culture- Vincent Miller

2. What is new media?-Lev -Manovich

3. Understanding new media- Siopera Eugenia

4. Who Controls the Internet- Goldsmith Jack and Tim W

5. New media and new technologies- Lister Covey and Griddings Grant

Semester: 6

Code: DLF27415

Paper: 3 Cinema Journalism

Course Out comes:

On completion of the Course, students are able to

CO: 1 work as cinema journalist

CO: 2 work as camera crew

CO: 3 work in cinema industry as assistant

CO: 4 find the job in TV media

CO: 5 work as script writer in cinema

Unit I Language of Cinema - visual Language- Shot, Scene- Montage Language of Cinema  
types of Sound- use of Colors- Differences between story, plot and screenplay

Unit II Film Form - German Expressionism - Italian Neorealism- French New Wave- Classical  
Hollywood Cinema

Unit III Third Cinema - Non Fiction Cinema - Feminist Film Theory - Film Authorship.

Unit IV Hindi Cinema 1950s Cinema and the Nation- The Indian New-Wave -Globalization  
and Indian Cinema- The multiplex Era.

Recommended Screenings:

1. Rear Window by Alfred Hitchcock (Language of Cinema)
2. Battle ship Potempkin by Sergei Eisenstein (Language of Cinema)
3. Man with a Movie Camera by Dziga Vertov
4. Germany Year Zero by Roberto Rossellini (Italian Neo Realism)
5. Double Indemnity by Billy Wilder (German Expressionism and Film Noir)
6. . Aakrosh by Govind Nihalani (Indian New wave)
7. Father Panchali by Satyajit Ray

Nishant by ShyamBenegal

:References:

1. "The Ontology of the Photographic Image" by Andre Bazin,
2. From his book What is Cinema by Berekeley,
3. "A Dialectic Approach to Film .Form" by Sergei Eisenstein
4. Film Form: Essays in Film Theory (Edited and Translated) by Jay Leyda)
- S. "Classical Hollywood Cinema: Narrational Principles and Procedures" by David Bordwell.#

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
B.N. ROAD, MYSORE-25

DEPARTMENT OF JOURNALISM  
MODEL QUESTION PAPER  
B,AJOURNALISM  
I, II, III, IV, V&VI Semester  
(CBCS Scheme)

Time: 3 Hours

Max. Marks — 70

Q: I- Write any five questions. Each question carries two marks. 2X5=10

2

3

4

67

Q: TT - Write any four questions. Each question carries five marks. 5)(4=20

2

34

6

Q: III - Write any four questions. Each question carries ten marks. 10X4=40

3

6

**Generic Elective Paper**  
**Semester: 5**  
**Code: DLF27215:**  
**Paper: I- Development Journalism**

Course Out comes:

On completion of the Course, students are able to

- CO: 1 set up the commercial studio
- CO: 2 become an armature photo journalist
- CO: 3 become visual composer and editor
- CO: 4 set up community radio
- CO: 5 provide cable services

Unit:1- Concept, meaning of development, models of development, evolution of development journalism-communication for social change

Unit:2- Development news and features, writing headline and captions, innovative leads, research and planning- print and broad cast development journalism

Unit:3- Visual and documentation-folk media, community radio for development, niche newspapers and magazines, Development communication agencies and web sites

Unit:4- Mass media as a tool for development, role of development agencies, and NGO, using new media technologies for development-devcom.-SITE, Krishi Darshan, KHeda, cyber media and e-governance

References:

1. Manual of Development Journalism- Alan Chalkley

Z. Development Communication and media Debate- Mridala Niel-ion

3. Television and Social change in rural India-Kirk Johnson

4. Everybody loves a good drought- P. Sainath•

Generic Elective Paper

Semester: 5

Code: DLE27615

Paper: 2 - Media Gender and Human Rights

Course Out comes:

On completion of the Course, students are able to

CO: 1 become as Social activist

CO: 2 appear for competitive examinations

CO: 3 know the media impacts on the communities

CO: 4 gain knowledge on media culture

Unit: 1-Media and the Social world- media impact on society- democratic policy and mass media- media and cultural change- grass roots media

Unit:2- Gender conceptual framework- feminist theory- media and gender- media and masculinity-media power- media and social differences- genres- romances- television-soap opera- sports

Unit:3- Media and Human Rights- Theoretical perspectives- universal declaration of human rights-case studies.

References:

1. Street John- Mass media, politics and democracy

2. Balnaves Mark, StephanieDonald and Bria Shoe Smith- Media Theories and Approaches: A global Perspective

3. The media Reader: Continuity, and transformation 4, Mc Quill Denis- Mass Communication theory



- 5, Berger Arthur Asia- Media and Society: A critical Perspective
6. Nicholas Joe and Price John- Advanced Studies in Media
7. Rajagopal Arvind- The Indian Public Sphere: Readings in Media History
8. Bannerjee Menon and Priyameds- Human Rights Gender and Environnmer

Generic Elective Paper

Semester: 5

Code: DLE27,I15

Paper: 3 Photo Journalism

Course Out comes:

On completion of the Course, students are able to

CO: I set up own studio

CO: 2 work as camera crew in cinema/TV industry

CO: 3 work as photographer in print and electronic media

CO: 4 become a freelance photographer

Unit: 1-History, definition.-birth of camera, modernization of Photography, uses in media, digital photography.

Unit:2- Equipments of photography camera- lenses- tripods- monopods-camera bags- digital storage.

Unit:3- Lighting-types of lighting-Recommended equipments for outdoor — introduction to indoor lighting and photographing

Unit:4- Types of photography- news photography- sports photography- the basics of photojournalism- importance of context in photo journalism-

1

Unit:5- Editing photo- editing softwares-correcting imperfect images-

References:

1. The photography Book by Editors of Phaidon press.
2. All about photography by Ashok Dilwali
3. Practical Photography by O.P. Sharma
4. The photographers Guide to Light by Freeman John Collins and Brown
5. Lonely Planet's Best Ever Photography Tips by Richard I' Anson

Generic Elective Paper

Semester: 6

Code:

Paper: 1 Basics of Journalism

Course Out comes:

On completion of the Course, students are able to

CO: 1 set up own publication

CO: 2 work as stringer in local media industry

CO: 3 work as freelancer

CO: 4 become a reporter

Unit 1 —News meaning, definition, nature- Hard news and Soft news -parts of a news

Unit 2 structure of news- SW's and 1H-inverted pyramid- sources of news - Principles of clear writing

Unit 3 — Branches of journalism- Yellow- Penny press- tabloid press- electronic - online and Citizen Journalism

Unit 4 - Role of Media in a Democracy- Responsibility to Society -Ethics of journalism

References

1. News writing and reporting for today's media- Bruce D. hide and Douglas A. Anderson. 2. News writer's Handbook- M.L. Stein,Susan Paterno Sc R. Christopher Burnett.
3. An Introduction to Journalism- Blackwell
- 4 Mass Media in a Changing World -George Rodrnann
5. An introduction to Journalism- Carole Flemming and Emma Hemmingway.

O. The Newspaper's Handbook - Richard Feeble.

Generic Elective Paper

Semester: 6

Code: DLF

Paper: 2 Documentary Productions

Course Out comes:

On completion of the Course, students are able to

CO: 1 Become as documentary artist

CO: 2 work as assistant in cinema industry

CO: 3 work as short movie maker

CO: 4 become as visual editor

Unit 1: Understanding the Documentary- Six Modes of Documentary-1.Representational, 2.Participatory, 3.Expository, d. Observational, 5.Performative, 6.Reflexive, -Defining the Subject/Social Actor/Participant Voice in the Documentary- Different Posturing of the Narration, Participant, Filmmaker, & Audience Camcorder.

Unit 2: Pre-Production -Researching the Documentary- Library, Archives, location, life stories, ethnography- Writing concept- telling a story- Writing a Treatment-Proposal and Budgeting- Structure and scripting the documentary- Issues of Funding and Issues of Primary and Secondary Audience

Unit 3: Production Documentary- Sound Documentary- Cinematography —Technologies and Techniques- Shooting Schedule - Call list Production Team- Meetings-Checklist -Crowd Funding

Unit 4: Post Production- Grammar of editing Transitions -Sound Effects -Visual Effects-Aspect Ratio-Language, Duration and marketing of DVD and issues of piracy.

Suggested Practical Exercise: Making a short documentary for 5-10 minutes

Suggested Screenings:

1. Michael Moore: Roger and Me
2. Nanook of the North by Robert J Flaherty
3. Bombay Our City by Anand Patwardhan
4. Black Audio Collective City of Photos by Nishtha Jain

References:

1. "Documentary" in Geoffrey by Charles Musser
2. "The Truth about Non Fiction" and "Towards a Poetics of Documentary" by Michael Renov
3. How to Write a Documentary Double Take by PSBT DOX magazine by Trisha Das
4. Introduction to Documentary by Nichols, Bill

Generic Elective Paper

Semester: 6

Code: DLF

Paper: 3 Global Media and Politics

Course Out comes:

On completion of the Course, students are able to

- CO: 1 Become as documentary artist
- CO: 2 work as assistant in cinema industry
- CO: 3 work as short movie maker
- CO: 4 become as visual editor

Unit I: Media and international communication- Radio and international communication- a brief overview Propaganda in the inter-war years-Nazi Propaganda

Unit II: Media and super power - Media during the Cold War- Radio Liberty, Voice of American Communication — NWICO- McBride Commission and UNESCO - Third World concerns.

Unit III: Global Conflict and World Wars- Media Coverage post 1990- Rise of Al Jazeera-CNN's satellite transmission- embedded Journalism

Unit IV: Media and Cultural Globalization- Cultural Imperialism-Cultural politics-media hegemony and Global cultures.

Unit V: Media and the Global market- technological developments- Media conglomerates- Ted Turner-Rupert Murdoch -Zee TV as a Pan Indian Channel- Hollywood Entertainment.

Internal Assessment: The internal assessment will be based on assignments, group discussions.

References:

1. International Communication: Continuity and Change by Daya Kishan Thussu.
2. War, Media and Propaganda--A Global Perspective by Yahya R. Karnatipour and Nancy Snow.
3. Communication and Society, Today and Tomorrow "Many Voices One World" Unesco Publication, Rowman and Littlefield publishers, 2004.
4. Journalism after 9/11 by Barbie Zelizer and Stuart
5. War and the media: Reporting conflict 24x7 by Daya Kishan Thussu

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE  
(AUTONOMOUS)  
B.N. ROAD, MYSORE-25

DEPARTMENT OF JOURNALISM  
MODEL QUESTION PAPER FOR GENERIC ELECTIVE PAPERS  
V&VI Semesters  
(CBCS Scheme)

Max. Marks — 35

: I - Write any three questions. Each question carries five marks. 5X3 15

3

4

Q: III - Write any two questions. Each question carries ten marks. 10X2=20

3

## Syllabus for Practical

20 Marks for test  
20 marks for practical Records  
10 marks for viva

Practical Paper — Total Marks — 20 4 Questions of 5 Marks each = 20

Any One Paper

Semester: 5

Code: DLE 27015

Paper: -I Reporting and Editing Techniques

Practical contents:

1. Types of News writing-05
2. Two copies editing
3. Creation of .Eheadline=10
4. Structuring dummy editorial page
5. Two editorial writing
6. Ten captions writing

Semester: 5

Code: DLE27015

Paper: 2 Introductions to TV and Radio

Semester: .5

Code: DLE

Paper: 3 Indian Applied Journalism

Any One Paper

Semester: 6

Code: DLF 27015

Paper: 1 Practice of Advertising and Public Relations

Practical contents:

1. Press Release

2. Preparing posters
3. Preparing brochures
4. Radio scripting writing
5. TV script writing
6. Planning and designing PR campaign

Semester: 6

Code: DLF27215

Paper: 2 Introduction to new Media

Semester: 6

Code: D1\_127415

Paper: 3 Cinema Journalism

#### Guidelines

1. Colleges must show practical and tutorial classes in the timetable.
2. In practical !tutorial class make batches of 20 students each.





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eÉJ,ïJ,ï PÀ-Á, ªÁtÂdâ °ÁUÀÆ  
«eÁÕξÀPÁ-ÉÃdÄ (,ÁéAiÀÄvÀÛ)  
HngÀ,ÉÛ, ªÉÄÊ,ÀÆgÀÄ-25

## PÀξÀβqÀ «"sÁUÀ

2021-22ξÉAiÀÄ ±ÉÊPÀëtÂPÀ ,Á°ªAzÀ

gÁ¶ÖçÃAiÀÄ ²PÀët ªÃw-2020gÀ CξÀéAiÀÄ  
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PÀξÀβqÀ "sÁµÉ °ÁUÀÄ LaÒPÀ PÀξÀβqÀ

ZÀÄvÀÄªÀiÁð,À ¥ÀzÀβw

NEP

gÁ¶ÖçÃAiÄÄ ²PÄët ¢Ãw- 2020  
¥ÄzÄ« vÄgÄUÄwUÄ¼Ä  
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PÄ£ÄßqÄ "sÁµÁ ¥ÄwæPÉUÄ¼ÄÄ  
¥ÄæxÄªÄÄ ZÄvÄÄªÄiÁð,Ä  
(©.J./©PÁA/©.©.J./©.J¹i./©¹J/©.ªÉÇÃPì)

ZAVÄÄ <sup>a</sup> ÄiÄÄ Ä	PÉÆÄ, iö ÄSÉä	PÉÆÄ, iö PÉÆÄ qi	¥ÄwæPÉUÄ¼ Ä ²Ä¶ðPÉ	PÉÆÄ, iöjÄw	PÉær miUÄ ¼Ä «£Ää, Ä L:T:P	PÉærmiUÄ¼Ä ÄSÉä	"ÉÆÄzsÄÄÄ UÄÄMÉUÄ¼ÄÄ / ÄÄÄÄPÉi	ªÄiË®äªÄiÄ¥ÄÄÄ «£Ää, Ä			
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**COMBINATIONWISE COURSE CODE**

**BA—EG- FHA01031,HP- FHA01032,KG- FHA01033,HE- FHA01034,  
JP- FHA01035**

**BSc—PC- FSA01031,PM- FSA01032,PE- FSA01033,CsM- FSA01034,  
ECs- FSA01035,BtZ- FSA01036,CBt- FSA01037,CZ- FSA01038,BZ- FSA01039  
BtBC- FSA01040,MbBt- FSA01041,MBBC- FSA01042**

**B.VOC- FP- FPA010B,SD- SDA010B,ANI- ANA010B**

**ᵃÄÄPÄÛ DAIÉÄÌ PÄËÄßqÄ ᵑÄwæPÉ**  
**ᵑÄæxÄᵃÄÄ ZÄvÄÄᵃÄiÄð,Ä**  
**(©PÄÄ/©.©.J./©.J¹i./©¹J)**

ZÄvÄÄᵃÄiÄÄÄ	PÉÆÄ,ïö,ÄASÉä	PÉÆÄ,ïö PÉÆÄqï	ᵑÄwæPÉ UÄ¼Ä ᵃÄηðPÉ	PÉÆÄ,ïöjÄw	PÉærmï UÄ¼Ä «ÉÄ,Ä L:T:P	PÉærmïUÄ¼Ä,ÄASÉä	"ÉÆÄzsÄÉÄ UÄÄmÉUÄ¼ÄÄ/	ᵃÄiÉ®ᵃÄiÄᵑÄÉÄ «ÉÄ,Ä			
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**PÄqÄØAiÄÄ PÄËÄßqÄ ᵑÄwæPÉ**  
**ᵑÄæxÄᵃÄÄ ZÄvÄÄᵃÄiÄð,Ä**  
**(PÄËÄßqÉÄvÄgÄjUÉ)**

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**ᶦÄÄPÄÛ DAIÉÄ ÌPÀÈÀßqÀ ₣ÀwæPÉ**  
**çéwÄAiÄÄZÄvÄÄᶦÄiÄð,Ä**  
 (©PÁA/©.©.J./©.J¹i./©¹J)

ZÄvÄÄᶦÄiÄð,Ä	PÉÆÄ,ìð ÄASÉä	PÉÆÄ,ìð PÉÆÄqì	₣ÀwæPÉÜ Ä¼Ä ²Ä¹ðPÉ	PÉÆÄ,ìðjÄw	PÉær mìUÄ ¼Ä «ÆÄä, Ä L:T:P	PÉærmiUÄ¼Ä,ÄASÉä	ÆÆÄzsÄÆÄ UÄAmÉUÄ¼ÄÄ /	ᶦÄiÉ©äᶦÄiÄ₣ÄÆÄ «ÆÄä,Ä			
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**PÄqÄØAiÄÄ PÄÈÀßqÄ ₣ÀwæPÉ**  
**çéwÄAiÄÄ ZÄvÄÄᶦÄiÄð,Ä**  
**(PÄÈÀßqÉÄvÄgÄjUÉ)**

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**LaÑPÀ ΠΑΕΑΒqÀ ¥ÀwæPÉUÀ¼ÄÄ**  
**¥ÀæxÀªÄÄ ªÄÄvÄÄÛ çéwÃAiÄÄ**

**ZÀvÄÄªAiÄð,À**

ZÀvÄÄªAiÄ	PÉÆÄj ÄASEÄ	PÉÆÄj PÉÆÄqÀ	¥ÀwæPÉUÀ¼Ä ²Ä¶ðPÉ	PÉÆÄjðjÄw	PÉær miUÀ ¼Ä «£Ää Ä L:T:P	PÉærmiUÀ¼Ä ÄASEÄ	"ÉÆÄzsÄ£Ä UÀAmÉUÀ¼ÄÄ /	ªAiÈ®ªAiÄ¥Ä£Ä «£Ää,Ä			
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II	C3  OPT KAN	FHB500  QP 10214	¥ÀwæPÉ-3 DzsÀÄªPÀ ¥ÀÆªÀðPÀξÀß qÀ »vÀªZÀjvÉæ (17ξÉÄ ±ÀvÀªÀiÁξÄçA zÀ 19ξÉÄ ±ÀvÀªÀiÁξÄzÀ ªÀgÉUÉ)	DSC	3:0:0	3	3	20	20	60	100
II	C4  OPT KAN	FHB500  QP 10215	¥ÀwæPÉ-4 DzsÀÄªPÀPÀξ ÀßqÀ »vÀªZÀjvÉæ (20ξÉÄ ±ÀvÀªÀiÁξÄçA zÀ)	DSC	3:0:0	3	3	20	20	60	100

**¥ÀæxÀªÄ ZÀvÀªªÀiÁð,À ©.J – 2021-22 ξÉÄ,À°ξÀ  
PÀξÀßqÀ "sÁµÁ ¥ÀoÀªPÀæªÄ  
PÀ-Á 1j – 1  
(JËi.E.!, ¥ÀoÀªPÀæªÄ: 2021-22)**

**WÀIPÀ -1 PÀξÀßqÀ ξÁqÄÄ - ξÄÄr aAvÀξÉ**

1. C) PÀξÀßqÀªÉÄª¥Àª ξÁqÄÄ ZÉ-ÁèAiÄÄÛ - (««zsÀ  
PÀªÀUÀ½AzÀ DAiÄÄÝ ¥ÀzÀªUÀ¼ÄÄ)

D) æÉÆªÄvÀªª - PÉ J,Ëª,ÁgË CªªÄÄzi

2. PÀξÀßqÀªÉÄ ξÀξÀß zsÀªÄð - dAiÄÄzÉÄ« vÁ-Ä

°UÁqÉ \*



3. vÀÉÀßÉÀÄß w½zÀÄPÉÆ¼ÄÏ´ÉÄPÁzÀ PÀÉÁðIPÀ - ¥ÁnÃ®  
¥ÄÄIÖ¥Äà

**WÀIPÀ – 2 “Á®á**

- 1. IÄvÀÄ ,ÀA°ÁgÀ - qÁ. §AdUÉgÉ dAiÀÄ¥ÄæPÁ±ï
- 2. gÁªÄÄgÁªÄtgÀ AiÄÄÄzÀP - PÄÄªÉA¥ÄÄ
- 3. PÉÄ¼ÄzÀ PÁtzÀ ,ÀAUÀwUÀ¼ÄÄ - ¹zÀP°AUÀAiÄÄä

**WÀIPÀ – 3 ¥ÄæPÄÈw**

- 1. C. ªÄÄAPÄÄwªÄÄäÉÀ PÀUÀÎ (DAiÄÄÝ JAIÄ ¥ÄzÀåUÀ¼ÄÄ -  
r.«.f \*  
D. °ÄÆªÄÄ °ÉÆgÁ¼ÄÄªÄªÄÄ ,ÀÆAiÄÄðÉÀ PÀqÉUÉ -  
ZÀÉÀß«ÄgÀ PÀt« \*
- 2. MAn,À®UÀ - PÄÈ¥ÁPÀgÀ ,ÉÄÉÁª
- 3. °ÉÆ¼ÉUÀ¼ÄªÄÄÆ®PÀ PÀÉÁðIPÀ - gÁ°ªÄÄvï  
vÄjÄPÉgÉ

**WÀIPÀ – 4 ÀAQÄtö**

- 1. C. UÁªÉÄðAmï °ÄÄqÄÄV °ÉÆ°zÀ ZÉAzÀzÀ ¥ÉÆÄµÁPÄÄ -  
qÁ. Ä©vÁ §ÉÁßr  
D. ªÉÄÊ®ÄUÀ®ÄèUÀ¼ÄÄ - ,ÄÄPÀÉÁä  
ªÄiÁgÄÄw
- 2. |Vä KeÉAmï ªÄÄvÄÄÛ UÁAçü eÉÆÄUÀw - ªÄÄAdªÄÄä  
eÉÆÄUÀw  
(ªgÀÆ¥ÄuÉ: CgÄÄuï eÉÆÄ¼ÄzÀ PÀÆrèV)
- 3. vÉÄ®,ÀAUÀzÀ °ÉAUÀ,ÀjUÉ ,À´ÁA! - qÁ. «ÉÄAiÄiÄ

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**¥ÄæxªªÄ ZÀvÄÄªÄiÁð,À ©.J – 2021-22 ÉÉÄ ,Á°ÉÀ  
PÀÉÀßqÀ “sÁµÁ ¥ÄoÄåPÄæªÄÄ  
ªÄtÄdå 1j – 1  
(JËi.E.¡. ¥ÄoÄåPÄæªÄÄ: 2021-22)**

**WÀIPÀ -1 PÀÉÀßqÀ ÉÁqÄÄ - ÉÄÄr aAvÀÉÉ**

2. C) PÀÈÀßqÁÁ¨ÉAiÀÄ »jªÉÄ (PÀªÀÈÀ) - ¨ÉÈÀUÀ¯i  
gÁªÄgÁªi

D) PÀÈÁðIPÀ gÁeÉÆåÃvÀiªÀ (PÀªÀÈÀ) - PÉ J,ï  
ÈÀgÁªÀªÀ,Áé«Ä

2. «ÃgÁªÀiÁÈÀå(PÀxÉ) - ¨ÉIUÉÃj PÀÈµÀÚ±ªÀÄð

3. PÀÈÁðIPÀ EIÖ ºÉ,ÀgÀÄ PÉÆIÖ ºÄÄAvÀæ (¯ÉÃRÈÀ) -  
PÀªªÉAªÄÄ

### WÀIPÀ – 2 ,ÀA,Àløw

1. C)CªÄÄä DZÁgÀ ÈÁÈÄÄ(PÀªÀÈÀ) - PÉ.J,ï. º,Ágï  
CªªÄÄzi

D)J®Ä©ÈÀ ºÄAzÀgÀzÉÆ¼ÀUÉ(PÀªÀÈÀ) -  
ªÄÄÆqÁßPÀÆqÀÄ aÈÀß,Áé«Ä \*

2. ºÀ§âUÀ¼ÄÄ (ªÄæ§AzsÀ) - ªÉÆæ. r.PÉ.  
gÁeÉÃAzÀæ

3. ÈªÄÄä ,ÀA,ÀløwAiÀÄ ºÉªÉÄä ,Á®zÀÄ(¯ÉÃRÈÀ) - PÉ.  
ªªgÁªªÄPÁgÁAvÀ

### WÀIPÀ – 3 eÁUÀwÃPÀgÀt

2. C. VgÀtÂ «,ÁÛgÀ ÈÉÆÃqÀªÄÄä (vÀvÀéªÀzÀ) -  
²±ÄÄÈÁ¼À ±ÀjÃªsÀ

D. ÈÀÈÀß ±Á¯É (PÀªÀÈÀ) - d.ÈÁ. vÉÃd²æÃ

2. ºÄª º,Àªj (PÀxÉ) - «ªÉÃPÀ±ÁÈÀ¨ÁUï

3. eÁUÀwÃPÀgÀt ºÄAvÀÄÛ ,ÀA,Àløw(¯ÉÃRÈÀ) -  
gÀAUÁgÉrØ PÉÆÃrgÁªªÄgÀ

### WÀIPÀ – 4 ,ÀAQÄtð

1. C. çQì®èzÀ ºÁqÀÄ(PÀªÀÈÀ) – qÁ.  
ZÉÈÀßtÚªªªPÁgÀ

D. ªÀÆtðvÉAiÀÄ ªÀgÀªÄ PÀ¯É(ZÈªÀçUÀ¼ÄÄ) - PÉ.1.  
ªªªª

2. PÀÄtÂAiÀÄªªªÀ PÀÄgÀÄqÀ PÁAZÁt (PÀxÈÀ) - ªÉÆæ .f.  
ZÀAzÀæ±ÉÃRgÀ

3. ºÀiÈ®åUÀ¼À ªÁ®ÈÉ(¯ÉÃRÈÀ) - qÁ. J|eÉ C§ÄÝ¯i  
PÀ¯ÁA

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**ΨΑϷΑ<sup>α</sup>ΑÄ ZÄvÄÄ<sup>α</sup>ÀiÁð,À ©.J'ì / ©.ªÉÇÄPì  
 2021-22 ξÉÄ,Á°ξÀ PÀξÀßqÀ "sÁµÁ  
 ΨÀοÀåPÀæ<sup>α</sup>ÄÄ  
 «eÁÕξÀ 'j –1 Jξì.E.ì. ΨÀοÀåPÀæ<sup>α</sup>ÄÄ**

**WÀIPÀ -1 PÀξÀßqÀ ξÁqÄÄ ξÄÄr aAvÄξÉ**

- 1. C. PÀξÀßqÀ ΨÄzÀUÉÆ¼ì - f.ì gÁdgAvÄßA
- D) "ÉAQ ©çÝzÉ <sup>α</sup>ÄÄξÉUÉ - PÀAiÀiÁåqÀ  
QkÕtÚ gÉÉ
- 2. °ÉÆ→Ä,À¼ÄξÀ zÀ¼ÄΨÄw - <sup>α</sup>ÀiÁ'Û  
<sup>α</sup>ÉAPÀmÉÄ±À CAiÄÄåAUÁgì
- 3. PÀξÀßqÀ,ÄA<sup>α</sup>ÄzsÀðξÉ - r.Dgì.  
ξÁUÀgÁdÄ \*

**WÀIPÀ – 2 "sÄÆ«Ä**

- 1. C. °ÉÆξÀß ©vÉÛÄ<sup>α</sup>ÄÄ °ÉÆ®PÉ®è -  
dξÄΨÄzÀ
- D. "sÄÆ«ÄVÄvÄ - PÉ.J,ì.  
ξÄgÀ'Ä°Ä,Áé«Ä \*
- 2. PÉAΨÄÄ vtÄ - <sup>α</sup>Ä,ÄÄzÉÄzÄæ
- 3. §Ä¯ÉÆÛÄdgì,ÄA,Àìøw - ξÁUÉÄ±ì  
°ÉUÀqÉ

**WÀIPÀ – 3 <sup>α</sup>ÉÉeÁÕPÀ <sup>α</sup>ÄÄξÉÆÄzsÄ<sup>α</sup>ÄÄð**

- 1.C. MAzÉÄ MAzÄÄ "Áj °ÉÆgÀ§ß - ©.n.  
®°vÀξÁAiÄÄPì
- D. PÄvÉÛ <sup>α</sup>ÄÄvÄÄÛ zsÄ<sup>α</sup>ÄÄð -  
¹zÄÝ°AUÄAiÄÄå
- 2. <sup>α</sup>ÉÉZÁjPÀ ΨÄæeÉÕUÉ CqÉvÀqÉUÄ¼ÄÄ -  
JZì. ξÄgÀ'Ä°ÄAiÄÄå \*
- 3. ξÄ<sup>α</sup>ÄÄä C¼ÄvÉAiÄÄξÄÄß «ÄÄgÀ¯ÁgÄzÀ zÉÄ<sup>α</sup>ÄgÄÄ  
- PÉ. <sup>2α</sup>ÄgÁ<sup>α</sup>ÄÄ PÁgÄAvÄ

**WÀIPÀ – 4,ÄAQÄtð**

2. C. ZÀjvÉæAiÉÄAzÀgÉ - JZi.J,ï.

C£ÄÄ¥ÄªÄÄ

D. JgÀqÄÄ ¯ÉÆÄIUÀ¼ÄÄ -

aÄªÄÄ£Ä°Ä½î gÄªÉÄÄ±ï ¯Ä§Ä

2. E°è AiÄiÁgÄÆªÄÄRågÄ®è,AiÄiÁgÄÆ CªÄÄRågÄ®è

- PÄÈ¥ÁPÄgÄ,ÉÄ£Áα

3. ,ËAzÀAiÄÄðªÄÄvÄÄÛªÉÄÊstÚ

- gªÄÄ

ªÄÄ£ÉÆÄ°ÄgÄ ¯ÉÆÄ»AiÄiÁ

(C£ÄÄ; PÉ« ,ÄÄ§ätÚ)

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**¥ÄæxÄªÄ ZÄvÄÄªÄiÁð,Ä ©¹J – 2021-22 £ÉÄ,Á°£Ä**

**PÄ£ÄßqÄ ¯sÁµÁ ¥ÄoÄåPÄæªÄÄ**

**UÄtPÄ ¹j – 1 J£i.E.¡. ¥ÄoÄåPÄæªÄÄ**

**WÄIPÄ -1 . PÄ£ÄßqÄ £ÁqÄÄ £ÄÄr aAvÄ£É**

¥ÉÊ C) PÄ£ÄßrUÄgÄ vÁ¬Ä

- JA. UÉÆÄ«AzÄ

D) PÄ£ÄßqÄ £ÄÄr

- D£ÄAzÄ PÄAzÄ

2. PÄ£ÄðIPÄ: EIÖ °É,ÄgÄÄ PÉÆIÖªÄÄvÄæ PÄªÉA¥ÄÄ

-

3. PÄ£ÄßqÄªÄÄ£Ä,ÄÄi £ÁAiÄÄPÄ

-°Á.ªÄiÁ.

**WÄIPÄ – 2 DPÄ±Ä**

1. C. DPÄ±Ä

- ,ÄgÄdÆ PÄIlgÄ

D.ªÉÆÄqÄUÄ¼Ä,ÁªÄÄ

- CUAæ°ÁgÄ

PÄÈµÄÜªÄÄÆwð

2. DPÄ±ÄPÉI ¯ÄªÄ ¥ÄgÄZÉªÄÄ°ÄªÄzi PÄÄAkÖ

- ¯ÉÆÄ¼ÄÄªÄgÄÄ

3. G¯ÁiªÄÈ¶ÖAiÄÄ gÉÆÄZÄPÄ ¯ÉÆÄPÄ ±ÉÊ®d

- n. J,ï.

**WÄIPÄ – 3 vÄgÄÄtä**

1. C.  $\xi\eta\alpha^{\alpha}\lambda\alpha\zeta\alpha\gamma\epsilon\ \kappa\lambda\alpha\alpha\ \{\alpha\epsilon\alpha\iota\epsilon\alpha\}$  -  $\alpha\upsilon\alpha\alpha\lambda\alpha\alpha\zeta\alpha$   
 $\varphi\alpha\upsilon\epsilon\alpha\epsilon\alpha\alpha\iota$   
 D.  $\text{J}\text{R}\text{e}^{\alpha}\text{A}\text{1}\text{4}\text{E}\text{R}\text{e}^{\alpha}\text{A}\text{1}\text{4}\text{E}\text{R}\text{e}^{\alpha}\text{A}\text{1}\text{4}\text{A}\alpha$  -  $\varphi\alpha\alpha.w.\lambda\alpha$
2.  $\text{MA}\zeta\alpha\alpha\ \text{S}\alpha\text{,}\alpha\text{V}\ \varphi\alpha\upsilon\alpha\alpha\epsilon$  - « $\lambda\alpha\alpha\iota\alpha\iota\alpha$   
 $\text{MP}\alpha\alpha\iota\alpha\zeta\alpha$
3.  $\alpha^{\circ}\alpha^{\circ}\alpha\gamma\epsilon\alpha\iota\alpha\alpha\zeta\alpha^{\alpha}\alpha\gamma\alpha\ \text{C}^{\alpha}\alpha\pm\alpha\alpha\text{P}\alpha\upsilon\epsilon\text{U}\alpha\text{1}\text{4}\alpha\alpha$  - 1.  $\text{Dg}\ddot{\iota}$ .  
 $\text{Z}\alpha\alpha\zeta\alpha\alpha\epsilon\pm\epsilon\alpha\text{Rg}\ddot{\iota}$

**WÀIPÀ – 4 ÀAQĀtō**

1. C.  $\text{E}^{\circ}\epsilon\ \kappa\lambda\alpha\zeta\alpha\gamma\alpha\epsilon\ \xi\eta\epsilon\text{-}\alpha\text{j}$  -  $\text{JA.Dg}\ddot{\iota}.\ \text{P}\alpha^{\alpha}\alpha\alpha\text{R}$   
 D.  $\alpha\epsilon\alpha\text{U}\alpha\ \epsilon\alpha\iota\alpha\alpha^{\circ}\epsilon\zeta\epsilon\ \alpha\text{s}\alpha\alpha\epsilon\alpha\alpha$  - « $\alpha\text{s}\alpha$   
 2.  $\text{P}\alpha\lambda\alpha\beta\eta\alpha\ \alpha\alpha\alpha\upsilon\alpha\alpha\alpha\text{U}\ \text{P}\alpha\alpha\varphi\alpha\alpha\epsilon\alpha\text{lg}\ddot{\iota}$  -  $\text{n.f.}\ \alpha\alpha\alpha\alpha\alpha\alpha\alpha$   
 3.  $\text{P}\alpha\lambda\alpha\beta\eta\alpha\zeta\alpha^{\circ}\epsilon\ \text{U}\alpha\text{tP}\alpha\zeta\alpha\ \xi\text{1}\text{4}\alpha\text{P}\epsilon\alpha\iota\alpha\alpha\ \text{Ew}^{\circ}\alpha\text{,}\alpha\ \alpha\epsilon\text{1}\text{4}\alpha^{\alpha}\alpha\text{t}\alpha\text{U}\epsilon$   
 $\alpha\alpha\alpha\upsilon\alpha\alpha\alpha\text{U}\ \alpha\epsilon\alpha\ \alpha\ \alpha\zeta\alpha\alpha\upsilon\epsilon\text{U}\alpha\text{1}\text{4}\alpha\alpha\text{,}$   
 $\text{P}\alpha\lambda\alpha\beta\eta\alpha\ \alpha\text{s}\alpha\mu\epsilon\ \alpha\alpha\alpha\upsilon\alpha\alpha\alpha\text{U}\ \upsilon\alpha\alpha\upsilon\alpha\alpha\alpha\pm\alpha\text{U}\alpha\text{1}\text{4}\alpha\alpha$   
 $\text{P}\alpha\lambda\alpha\beta\eta\alpha\zeta\alpha^{\circ}\epsilon\ \text{U}\alpha\text{tP}\alpha\zeta\alpha\ \xi\text{1}\text{4}\alpha\text{P}\epsilon\text{U}\epsilon\ \pm\alpha\alpha\alpha\alpha\text{1}\text{z}\alpha$   
 $\upsilon\alpha\alpha\upsilon\alpha\alpha\alpha\alpha\alpha\alpha\text{U}\alpha\text{1}\text{4}\alpha\ \alpha\alpha\alpha\upsilon\alpha\alpha\alpha\text{U}\ \alpha\alpha\ \epsilon\text{U}\alpha\text{1}\text{4}\alpha\ \alpha\alpha\text{Q}\epsilon\varphi\alpha\text{U}\ \varphi\alpha\text{jZ}\alpha\alpha\iota\alpha\alpha$

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**$\varphi\alpha\alpha\chi\alpha^{\alpha}\alpha\alpha\ \text{Z}\alpha\upsilon\alpha\alpha\alpha\alpha\iota\alpha\delta\text{,}\alpha\ \text{C}\text{.}\text{C}\text{.}\text{J} - 2021-22\ \epsilon\epsilon\alpha\ \alpha^{\circ}\epsilon\alpha$**

**$\text{P}\alpha\lambda\alpha\beta\eta\alpha\ \alpha\text{s}\alpha\mu\alpha\ \varphi\alpha\alpha\alpha\alpha\text{P}\alpha\alpha\epsilon^{\alpha}\alpha\alpha$**

**$\alpha\alpha\alpha\delta^{\circ}\alpha\alpha\alpha\ \text{1j} - 1\ \text{J}\epsilon\ddot{\iota}.\text{E}\text{.}\text{!}.\ \varphi\alpha\alpha\alpha\alpha\text{P}\alpha\alpha\epsilon^{\alpha}\alpha\alpha$**

**WÀIPÀ -1.  $\text{P}\alpha\lambda\alpha\beta\eta\alpha\ \epsilon\alpha\eta\alpha\alpha\ \epsilon\alpha\alpha\text{r}\ \alpha\alpha\upsilon\alpha\epsilon\epsilon$**

- C)  $\alpha\alpha\iota\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\ \alpha\alpha\alpha\alpha\alpha\ \epsilon\alpha\alpha\text{r}$  -  $\text{P}\alpha\alpha\alpha\epsilon\alpha\varphi\alpha\alpha$   
 D)  $\text{P}\alpha\lambda\alpha\beta\eta\alpha\ \upsilon\alpha\alpha\alpha\alpha\alpha\alpha\ \alpha\alpha\varphi\alpha\alpha\alpha\alpha\alpha\upsilon\alpha\alpha$  -  $\eta\alpha$ .

$\text{Z}\alpha\alpha\zeta\alpha\alpha\epsilon\pm\epsilon\alpha\text{Rg}\alpha\ \text{P}\alpha\alpha\alpha\alpha\alpha\ \ast$

2.  $\alpha\alpha\text{U}\alpha^{\circ}\epsilon\lambda\alpha\ \gamma\alpha\text{t}\alpha$  -  $\alpha\alpha\iota\alpha\text{1}\text{U}\ \alpha\epsilon\alpha\text{P}\alpha\alpha\epsilon\alpha\alpha\pm\alpha$   
 $\text{C}\alpha\iota\alpha\alpha\alpha\alpha\text{U}\alpha\text{g}\ddot{\iota}$

3.  $\epsilon\alpha\lambda\alpha\beta\ \text{P}\alpha\lambda\alpha\beta\eta\alpha\ \alpha\text{U}\alpha\upsilon\alpha\alpha\text{U}$  -  $\text{P}\epsilon\ \alpha\alpha$ .  
 $\alpha\alpha\alpha\alpha\text{t}\text{U}$

**WÀIPÀ – 2.  $\text{Dz}\alpha\alpha\alpha\alpha\text{P}\alpha\upsilon\epsilon$**

- C.)  $\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\ \epsilon\alpha\upsilon\alpha\text{P}\alpha$  -  $\text{f.J}\ddot{\iota}$ .

$\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha$

- D) °Áç°ÁqÄÄ - PÉ.JA
- ªÄ,ÄÄAzsÄgÄ
2. qÁAŞgÄÄ ŞAzÄÄzÄÄ - zÉÄªÄ£ÄÆgÄÄ
- ªÄÄ°ÁzÉÄªÄ
3. mÉ°¥sÉÆÄ£i - K. J£i.
- ªÄÄÆwðgÄªi

**WÄIPÄ – 3 PÄÄIÄÄŞ**

1. C.) £ÁV - PÄÄªÉA¥ÄÄ \*  
 D) CªÄé - J¯i.  
 °Ä£ÄÄªÄÄAvÄAiÄÄä
2. vÄÄA©zÄ PÉÆqÄ - wæªÉÄtÄ
3. UÄÈ°Ä ²PÄët - °ÄqÉÄðPÄgi  
 ªÄÄAd¥Äà

**WÄIPÄ – 4 ÄAQÄtð**

1. C.) EAzÄæZÄ¥Ä - J,ï.«.  
 ¥ÄgÄªÉÄÄ±ÄégÄ ¨sÄIÖ \*  
 D.) AiÄÄÄzÄP - ,Ä«vÄ  
 £ÁUÄ¨sÄÆµÄt
2. ÄAŞ¼ÄPÉI ¹QìPÉÆAqÄ zÉªÄé -  
 ¥ÄÆtðZÄAzÄæ vÉÄd¹é
3. ªÄiÁ£Ä«ÄAiÄÄvÉ- MAzÄÄ Cª¹PÉ -  
 ŞgÄUÄÆgÄÄ gÄªÄÄZÄAzÄæ¥Äà

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**çéwÄAiÄÄ ZÄvÄÄªÄiÄð,Ä ©J – 2021-22 £ÉÄ,Ä°£Ä  
 PÄ£ÄßqÄ ¨sÄµÄ ¥ÄoÄäPÄæªÄÄ**

**PÄ¯Á 1j – 2 J£i.E.¡. ¥ÄoÄäPÄæªÄÄ**

**WÄIPÄ -1 eÁUÄwÄPÄgÄt**

3. C) PÀÌÖqÀzÀ PÉ®,ÀUÁgÀgÀÄ - JZì. J,ï.

2ªÀ¶ÀæPÁ±ï

D) PÄÄAmÉÆÄ©Éè - J PÉ gÁªÀiÁÄÄdÉï

2. ©qÀÄUÀqÉ - ZÄAzÀæPÄAvÀªÀqÀÄØ

3. ±ªÀgÀzÀ PÉÆAÉUÀ¼ÀèªÀ¼Àç JÉUÀ¼ÀÄ -

dAiÄÄAvÀ PÁ-ÄItÄ

**WÄIPÄ – 2 ,ÀªÀiÁd**

4. C. gÉÆnÖªÄvÄÄÛ PÉÆÄ« - ,ÄÄ gÄA JPÄÄÌAr

D. £Ä£Äß |æÄwÄAiÄÄ PÄÄPÄìgì - qÁ. ,À©ÄªÁ

¨sÄÆ«ÄUËqÄ

2. §aÑÄ,ÄÄ - zÄÄ. ,ÄgÄ,Äéw

3. £Á£ÄájUÄ®èzÄª¼ÄÄ - © « D£ÄAzÄªÄÄÆwð

**WÄIPÄ – 3 |æÄw**

3. C. ¨ÁgÉ, £Ä£Äß ±ÁgÀzÉ - PÉ J,ï £ÄgÄ¹AªÄ,Áé«Ä

D. |æÄw E®èzÄªÉÄÄÉ - f.J,ï. 2ªÀgÄÄzÀæ¶Äà

2. CªÀé - ¨É,ÀUÄgÄª¼Äª gÁªÄÄtÚ

3. |æÄwAiÄÄ ¶ÄÆtðvÉ - UËjÄ±À PÄAiÄÄItÄ

**WÄIPÄ – 4 ,ÄAQÄtð**

4. C. ©ü£Äß¨sÉÄzÄªªÀªÀiÁqÄ¨ÁârgÉÆ - CeÁÖvÄ

vÄvÄé¶ÄzÄPÁgÄ

D. ¶ÄgÄA¶ÄgÉ - qÁ. «dAiÄiÁzÄÉâ

2. ,ÄA§¼ÄPÉÌ¹QÌPÉÆAqÄ zÉªÀé - ¶ÄÆtðZÄAzÄæ

vÉÄd¹é

3. JzÉUÉ ©zÄÝ CPÄëgÄ PÄÈwAiÄÄ DÄiÄÄÝ¨sÄUÄUÄ¼ÄÄ -

zÉÄªÄ£ÄÆgÄÄªÄªªÁzÉÄªÄ

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**ϕέωÃΑiÄÄ ZÀvÄÄªÄiÁδ,À ©.PÁA**

**2021-22 £ÉÃ,Á°£À PÀ£ÀßqÀ "sÁµÁ  
¥ÀoÀâPÀæªÄÄ**

**ªÁtÂdâ 1j – 2 J£i.E.¡. ¥ÀoÀâPÀæªÄÄ  
WÀIPÀ -1,ËAzÀAiÄÄð**

- D)** PÀqÀ°UÉ PÀ½¹zÀ ϕÃ¥À - n. J®è¥Àà \*
- D) °À½¹AiÄÄ °ÀÆUÀ½UÉ - r.J,ï. PÀQð
2. £À£Àß vÉÆÃIUÁjPÉ - gÁPÀÄ
3. ËAzÀAiÄÄðªÀ ªÄvÄÄÛ ªÉÄÊ§tÚ -
- gªÄªÄªÄ£ÉÆÃ°ÀgÀ ¯ÉÆÃ»AiÄiÁ
- (C£ÄÄ: PÉ.«.  
ÄÄ§âtÚ)

**WÀIPÀ – 2 "sÀQÛ**

- C. "sÀQÛAiÉÄA§ ¥ÀÈyéAiÄÄ ªÉÄÃ¯É (ªÀZÀ£ÀUÀ¼ÄÄ) -  
§,ÄªÉÃ±ÀégÀ
- D. "sÉÆÃUÀ °ÀjzÄÄ °ÉÆÃUÀ° (PÉÊªÀ®ª ¥ÀzÀ) -  
ªÄÄÄ,à£À µÀqÀPÀëj
2. °ÀgÀPÉUÀ¼ÄÄ (¥Àæ§AzsÀ) - J.J£i.  
ªÄÄÆwðgªªi
3. "sÀQÛ °ÀÈzÀAiÄÄ – zÉÃªÀ ¢®AiÄÄ(aAvÀ£À) - ²æÃ  
¹zÉÝÃ±ÀégÀ, Áé«ÄUÀ¼ÄÄ

**WÀIPÀ – 3 zÉÃ¹AiÄÄvÉ**

1. C. UÁæªÄÄzÉÃªÀvÉ - qÁ.¹zÀÝ°AUÀAiÄÄª
- D. £É®ªÄÄÆ® - J,ï.f. ¹zÀÝgªªÄÄAiÄÄª
2. PÀxÉ PÉÃ¼ÄÄ UÄÄ§âPÀi ¢£Àß ªÀxÉAiÄÄ PÀxÉ PÉÃ¼ÄÄ  
- PÉ.J,ï. ¢,Ágĩ C°ÀªÄÄzi
3. "ÉÃ,ÁAiÄÄ, °À§âUÀ¼ÄÄ gÀAUÄÄ, "Á§AiÄÄª£À eÁvÉæ  
CAUÀzÀ£À ¥ÁvÀæ(ªÄÄuÉUÁgÀ – DvÄäPÀvÉ) -  
vÄÄA"Ár gªªÄÄAiÄÄª

**WÀIPÀ – 4,ÄAQÃtð**

5. C. ªÁtÂdâ ¥ÀvÀæUÀ¼ÄÄ
- D. ªÀgÀϕUÀ¼ÄÄ
2. ªAiÁgÀÄPÀmÉÖ ¢ªÀð°ÀuÉAiÄÄ°è eÁ»gÁvÄÄUÀ¼ÄÄ ¥ÁvÀæ
3. GzÀªªÄÄ ¯ÉÆÃPÀzÀ, ÁzsÀPÀgÀÄ (eÉ.Dgĩ.r "Á"Á, qÁ. ªÀVð,ï  
PÄÄjAiÄÄ£i,



JĚi.Dgĭ. ĚÁgÁAiÄÄt ªÄÄÆwð, KPÁÛ PÀŸÄÆgĭ, gĚĚÄPĭ 'AUĭ

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**ćéwÄAiÄÄ ZÄvÄÄªAiÁð, Ä ©.J'ĭ/©.ªÉÇÄPĭ**  
**2021-22 ĚÉÄ, ª°ĚÄ PÄĚÄßqÄ "sÁµÁ**  
**ŸÄoÄâPÄæªÄÄ**  
**«eÁÕĚÄ 1j -2 JĚi.E.ĭ. ŸÄoÄâPÄæªÄÄ**

**WÄIPÄ – 1 fÄªÄĚÄ PÄĚÉ**

- C. ,ÄAŞ¼ÄzÄ ,ÄAeÉ - PÉ.J,ĭ. ĚÄgÄ¹A°Ä,Áé«Ä
- D) CªÄé - ĭ. ®APÉÄ±Ä
- 2. zÉÄ«æzÁÝĚÉ ©qÄŸÄä - J.Dgĭ. ªÄÄtÄPÁAvĭ \*
- 3. ĚÁĚÄÄ ¢®ÄèªÉ JªÄgÉ,ĭÖ JvÄÛgÄç - ĚÉÄ«ÄZÄAzÄæ  
(ŞÄÄPÄÄ  
ŞzÄ°,ÄŞ°ÄÄzÄÄ)

**WÄIPÄ – 2 PÄĚÄ,ÄÄ**

- 5. C. wgÄÄPÄĚÉÆÄªÄðĚÄÆgÄªÄÄÄzÉ - ªÄÄÄĭàĚÄ
- µÄqÄPÄëj
- D. J®è °ÄÄqÄÄVAiÄÄgÄ PÄĚÄ,ÄÄ - ,Ä«vÁ
- ĚÁUÄ"sÄÆµÄuĭ
- 2. MAzÄÄ °ÄÄqÄÄUÄ¢UÉ ©zÄÝ PÄĚÄ,ÄÄ -
- ĚÉ,ÄUÄgÄªÄ½ĭ gÄªÄÄtÜ
- 3. PÄĚÄ,ÄÄ PÄtÄj PÄĚÄ,ÄÄUÄ¼Ä ±ÄQÛ - J ĭ eÉ CŞÄÝĭ
- PÄĚÄÄ

**WÄIPÄ – 3 ªÄÄ¼É**

- 1.C. vÉAPÄtUÄ½AiÄiÄI - ŸÄAeÉ
- ªÄÄAUÉÄ±ÄgÄAiÄÄ
- D. ªÄÄ¼É - f J,ĭ ²ªÄgÄÄzÄæŸÄä
- 2. ŞgÄ - AiÄÄÄ Dgĭ CĚÄAvÄªÄÄÆwð
- 3.Dçæ ªÄÄ¼ÉÄ° DzÄªÉßUÄAqÄ - ĚÉAŸÉ zÉÄªÄgÄeĭ

**WÄIPÄ – 4 ,ÄAQÄtð**

6. C. GϕÁWÁvÀ - C.gÁ. «ÄvÀæ \*  
 D. CgÀ½zÀ ᾿ÉÃ,ÀgiUÀ¼ÄÄ - ªÄÄtÄ ᾿sË«ÄPĩ

2. ªÄiÁ»w vÀAvÀæeÁÕËÀ ªÄÄvÀÄÛ PÀËÀßqÀ - n.f.  
 ²æÃϕÛ

3. PÀËÀßqÀ ªÄÄvÀÄÛ UÀtPÀAiÀÄAvÀæ \*

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ϕéwÃAiÄÄ ZÀvÀÄªÄiÁð,À ©¹J –

2021-22 ËÉÃ,À°ËÀ PÀËÀßqÀ ᾿sÁµÁ ϕÀoÀåPÀæªÄÄ

UÀtPÀ ¹j – 2 JËĩ.E.¡. ϕÀoÀåPÀæªÄÄ

WÀIPÀ -1 ªÄtÄdå

1. ªÄÄËÉ-ÄAzÀ ªÄÄËÉUÉ - PÉ.J,ĩ.  
 ËÀgÀ¹A°À,Áé«Ä

D) PÀiÖqÀzÀ PÉ®,ÀUÁgÀgÀÄ - JZĩ.J,ĩ.  
 ²ªÄϕÄæPÀ±ĩ

2. «Ä®Äè ªÄÄvÀÄÛ °ÀQì - ªÉËzÉÃ»

3. eÁUÀwÃPÀgÀt ªÄÄvÀÄÛ,ÀA,Àìøw - gÁeÉÄAzÀæ  
 eÉϕß

WÀIPÀ – 2 vÀAvÀæeÁÕËÀ

4. C. AiÄÄAvÀæ¶ð - PÄÄªÉAϕÄÄ \*  
 D. ϕPÄÄì - ϕÄæw᾿sÁ ËÄAzÀPÄÄªÄiÁgi

2. PÉÆÃPÉÆÃ PÉÆÃ-Á - D²µĩ ËÄAϕ, (PÀËÀßqÀPÉì  
 ËÄAiÄÄËÀ PÀ±Äåϕĩ)

3. vÀAvÀæeÁðËÀ ªÄÄvÀÄÛ PÀËÀßqÀ - PÉ.«.  
 ËÁgÁAiÄÄt

WÀIPÀ – 3 zÁAϕÄvÀå

1. C. ªÄÄËÀzÀËÉß - zÀ.gÁ. ᾿ÉÄAzÉæ  
 D. zÁAϕÄvÀå - ,À. GµÁ

2. VjeÁ PÀAqÀ 1ÉÉÀiÁ - §,ÀÀgÁd PÀnÖÃÀÄä \*  
 3. °ÉÆÈÀßÀÄäÈÀ Q«ÀiÁwUÉ MAzÀÄ ¥ÀæwQæAiÉÄ - qÁ.  
 «dAiÀiÁZÀÉâ

**WÀIPÀ – 4 ÀAQÃtø**

1. C. EAlgiÉÉmi eÉÃqÀ - PÉ.«. wgÀÄÀÄÉÄ±i  
 D. UÀtPÁ,ÄÄgÀ - qÁ. °ÉÉ.°ÉÉ.  
 PÉÆPÀiÈÀÀgÀ
2. rfi i ,Àαβ°ÉÄ±ÀzÀ°è
3. ¥ÁjˆsÁ¶PÀ ¥ÀzÀUÀ¼À §¼ÁPÉ - qÁ. AiÀÄÄ.©.  
 ¥ÀÀÈÈÀd

Cj«ÈÀ eÁ®vÁt °ÄÄvÀÄÛ ,ÁÀiÁfPÀ eÁÁvÁtUÀ¼À°è PÀÈÀßqÀzÀ  
 §¼ÁPÉ

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**çéwÄAiÄÄ ZÀvÄÄÀiÁð À ©.©.J  
 2021-22 ÈÉÄ ,Á°ÈÀ PÀÈÀßqÀ ˆsÁµÁ**

**¥ÀoÀåPÀæÀÄÄ**

**αÀð°ÀuÁ 1j – 2 JÈi.E.¡. ¥ÀoÀåPÀæÀÄÄ**

**WÀIPÀ -1 PÁAiÄÄPÀ**

1. °ÀZÀÈÀUÀ¼ÄÄ - C) DAiÄÄÝQì  
 °ÀiÁgÀAiÄÄå D) DAiÄÄÝQì ®PÀiÀÄÄä  
 D) ÈÀÈÀß dÈÀUÀ¼ÄÄ - 1zÀÝ°AUÀAiÄÄå  
 2. °ÉÆÈÄ - ˆsÁgÀwÄ¡æAiÄÄ  
 3. gÀAUÀzÀ °ÉÄÄÉ EgÀ° ÈÀÈÀß fÄÀ - ©. dAiÄÄ²æÄ

**WÀIPÀ – 2 ,ÁÀÄÄgÀ,Àå**

1. C. ÈÁÉ®ègÀÆ MAzÉÄ - JA. UÉÆÄ¥Á®PÀÈµÀÚ  
 CrUÀ  
 D. °ÄÄUÀÄ °ÄÄvÀÄÛ °ÀtÁÚUÀ¼ÄÄ - °ÉZi. J,ï.  
 2ªÀ¥ÀæPÀ±i
2. OzÁAiÄÄðzÀ ÈÉgÀ½ÈÀ°è - qÁ. PÀÈµÀÚªÄÄÆwð  
 °ÀÈÀÆgÀÄ

3. PÀËÀßqÀzÀ °ÀiË°é - UÉÆgÀÆgÀÄ gÁªÄÄ,Áé«Ä  
CAiÄÄåAUÁgĩ

**WÀIPÀ – 3 CAVÀBPÀgÀt**

- 4. C. ¢Ã »AUÀ ÉÉÆÃqÀªÁåqÀ ÉÀÉÀß -  
CA©PÁvÀÉÀAiÄÄ zÀvÀÛ
- 5. D. ¢ÄÖ¹jÉÀ° ÉÄÄAVzÀÉÄÄªÄÄÉÄzÀ CÉÄÄªsÁªªÄÉÄÄ -  
ÄÄdÉÁ
- 6. CªÀé - VÃvÁ ÉÁUÄªsÀÆµÀt
- 7.ªÉÆÃPÀè °ÄÄqÀÄPÀÄvÁÛ |æÃwAiÄÄ §AzsÀÉÄzÀ° - ¡.  
®APÉÃ±i

**WÀIPÀ – 4 ÄAQÄtð**

- 7. C. PÀ®Äè ÄPÀìgÉ PÉÆ½îgÉÆ -  
¥ÄÄgÄAzÄgÄzÁ,ÄgÄÄ  
D. °ÁUÁzÀgÉ ‘ªAiÁj©r’ - JA. Dgĩ. PÀªÄÄ®
- 2. ÁªAiÁÉÄªªÄÄÉÄÄµÄåÉÄÄ  
ªÉÄÄUÄ¼ÄzÀ°è «°Äj,Ä° - PÁª¥ÄÖËi UÉÆÃ|ÉÁxi
- 3.¥ÁjªsÁ¶PÀ ¥ÄzÀUÄ¼ÄÄ - ,ÁA§ªÄÄÆwð

\*\*\*\*\*

eÉJ,ïJ,ïªÄÄª«zÁå¡ÄoÀ  
eÉJ,ïJ,ï PÀª,ªÁtÄdªªÄÄvÄÄÛ «eÁÖÉÀ PÁªÉÄdÄ  
(ÄÉAiÄÄvÄÛ)  
Hn gÀ,ÉÛ ,ªÉÄË,ÄÆgÄÄ-25  
©.J LaÒPÀ PÀËÀßqÀ ¥ÄwæPÉ (rJ,ï¹)  
¥ÄæxÀªÄÄ zÀvÄÄªAiÁð,Ä  
¥ÄwæPÉ-1  
¥ÁæªÄÉÀ PÀËÀßqÀ,Á»vÄª zÄjvÉæªÄivÄÄÛ  
¥ÄoÄª

C. PÀÈÀßqÀ ,Á»vÀå ZÀjvÉæAiÄÄ ,ÀÆÜ®  
¥ÀjZÀAiÄÄ

D. ¥ÀÆªÀðzÀ °À¼ÀUÀÈÀßqÀ  
±Á,ÀÈÀ ,Á»vÀå ,PÀ«gÁdªÀiÁUÀð,  
ªÀqÁØgÁzsÀÈÉ

E. ¥ÀA¥À, ÈÁUÀªÀªÄð, gÀÈÀß, zÄÄUÀð¹A°À,  
ÈÁUÀZÀAzÀæ

αUÀçvÀ ¥ÀoÀå:

1. °À°är ±Á,ÀÈÀ
2. °ÀzÁ«Ä ±Á,ÀÈÀ
3. PÁªÀå ¥ÀæAiÉÆÄUÀ ¥ÀjtvÀ ªÄwUÀ¼Ä
4. «zÄÄåZÉÆÖÄgÀÈÉA§ j¹AiÄÄ PÀxÉ
5. °sÉÄç,ÀÉAzÉ zÀ ¯i ÈÄÄrzÀgÉÈÀßçgi

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©.J LaÒPÀ PÀÈÀßqÀ ¥ÀwæPÉ (rJ,ĩ¹)

¥ÀæxÀªÄ ZÀvÄªÀiÁð,À

¥ÀwæPÉ-2

ªÄzsÀªPÁ°ÄÈÀ PÀÈÀßqÀ ,Á»vÀå ZÀjvÉæ

CzsÁåAiÄÄ 1

C) ªÄzsÀªPÁ°ÄÈÀ PÀÈÀßqÀ ,Á»vÀå ZÀjvÉæAiÄÄ UÄt®PÄëtUÀ¼ÄÄ

D) ªÄzsÀªPÁ°ÄÈÀ PÀÈÀßqÀ ,Á»vÀåzÀ gÀÆ¥ÀUÀ¼ÄÄ

ªÄZÀÈÀ, gÀUÀ¼É, µÁlàç,QÄvÀðÈE, ,ÁUÀvÀå, ±ÀvÀPÀ,wæ¥Àç

E)  $\text{P}^{\text{A}}\text{A}\text{z}\text{s}\text{A}\text{P}^{\text{A}}\text{A}\text{E}\text{A}\text{P}\text{A}\text{E}\text{A}\text{B}\text{q}\text{A}\text{A}\text{A}\text{v}\text{A}\text{z}\text{A}\text{A}\text{A}\text{A}\text{A}\text{R}\text{P}\text{A}\text{U}\text{A}\text{A}\text{A}$   
eÉqAgA zA<sup>1a</sup>AAiAAa, <sup>a</sup>AiAzAgAZAÉAβAiAAa ,C®è<sup>a</sup>AA#Aæ"sAA,§,À<sup>a</sup>Atβ  
,CPÀ<sup>a</sup>AA°AzÉA« , °Àj°ÀgA,  
gAWA<sup>a</sup>APÀ ,PAA<sup>a</sup>AiAgA<sup>a</sup>A<sub>À</sub> , ®Qã±À , ÉAAdAAqAPÀ« , ÀAa°É/EEAβ<sup>a</sup>AA<sup>ä</sup>  
,<sup>a</sup>A<sup>ä</sup>öDÖ ,gAvÁBPÀgA<sup>a</sup>AtÁ<sup>ä</sup>.

CzsÁaAiAA 2

1. DAI<sup>a</sup>AY P<sup>a</sup>A<sup>a</sup>sAUUA<sup>1/4</sup>AA  
<sup>a</sup>AZAE<sup>a</sup> A»vA<sup>a</sup>

C) eÉqAgA zA<sup>1a</sup>AAiAAaÉA <sup>a</sup>AZAEUA<sup>1/4</sup>AA:

1. E<sup>1/4</sup>E <sup>a</sup>AA zAE<sup>a</sup> "E<sup>1/4</sup>E <sup>a</sup>AA zAE<sup>a</sup>
2. §gAA ±AoAAUAÉA "sAQÜ çI<sup>a</sup>EazAA ÉAA§®A "ÉqA

D) <sup>a</sup>AiAzAgAZAÉAβAiAAa ÉA <sup>a</sup>AZAEUA<sup>1/4</sup>AA:

1. ÉAqÉÉAr <sup>1</sup>zABAv<sup>a</sup>AzA<sup>o</sup>è PAA® °É/É<sup>-</sup> É<sup>-</sup> AEvAPÀ«®è
2. ±AAPÀè , ±É/ÉtAvA , <sup>a</sup>AAeÉO , <sup>a</sup>AiAA<sub>À</sub> , °A<sup>1a</sup>AA , vAÉμÉ , <sup>a</sup>A<sub>À</sub>ÉA

«μAAiAiAçUA<sup>1/4</sup>É/EAzÉ "sÉAzA

E) C®è<sup>a</sup>AA#Aæ"sAA A <sup>a</sup>AZAEUA<sup>1/4</sup>AA:

1. PÀ®è <sup>a</sup>AAÉÉAiAA <sup>a</sup>AiAr PÀ®èzÉ<sup>a</sup>AgA <sup>a</sup>AiAr
2. PÀEvAAiAAUAzA<sup>o</sup>è <sup>2</sup>æAUAAgAA <sup>2</sup>μAAAUÉ §rzAA §AçPAiAA PÀ<sup>o</sup>zAqÉ

F) §,À<sup>a</sup>AtUÉA <sup>a</sup>AZAEUA<sup>1/4</sup>AA:

1. zÉ<sup>a</sup>A<sup>-</sup>É/ÉPÀ <sup>a</sup>AvA<sup>ä</sup>ö<sup>-</sup>É/ÉPÀ<sup>a</sup>ÉA§AzAA "ÉAj®è PAtAgÉ/É
2. JÉAβ avAU °AwUiAA °AtAU ÉÉ/ÉqAAiAAa

G) CPÀ<sup>a</sup>AA°AzÉA« <sup>a</sup>AZAEUA<sup>1/4</sup>AA:

1. vÉgAtAAiAA °AA<sup>1/4</sup>AA vÉAβ ÉÉ<sup>o</sup>AçAzA <sup>a</sup>AAÉÉAiAA <sup>a</sup>AiAr
2. ZAAzÉA<sup>a</sup> PArzAA PÉ/ÉgÉzAA vÉAzÉ/ÉqÉ ÉÉ/ÉAzÉÉAzAA PAA#A

©nÖvÉÜ

CzsÁaAiAA 3

QAvAðÉA A»vA<sup>a</sup>:

C) #AAgAAzAgAzA<sub>À</sub>gA QAvAðÉÉ

1. GzAgA<sup>a</sup>ÉÉgAUAA«zAA

D) PÀÉAPAzA<sub>À</sub>gA QAvAðÉÉ

2. PAA® PAA®<sup>a</sup>ÉÉAβçgAA

CzsÁaAiAA 4

μA<sub>À</sub>ç A»vA<sup>a</sup>: 1. gAWA<sup>a</sup>APÀ- °Aj±ANAzAæ P<sup>a</sup>A<sup>a</sup>zA "sAUÀ- <sup>a</sup>AAAwUÉA  
AwUUEAiAAβvAAÜ<sub>À</sub>®AA

2 PAA<sup>a</sup>AiAgA<sup>a</sup>A<sub>À</sub>- PÀuÁðl'sAgAvA PAXA<sup>a</sup>AAAdj- μmÉ/EOAlzA<sup>o</sup>

°AAiAAÝÉAA ©IÖ

<sup>a</sup>AAaqÉAiAA<sup>o</sup>

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eÉJ<sub>ı</sub>J<sub>ı</sub> <sup>a</sup>AA<sup>o</sup>A«zA<sup>a</sup>!AoÀ

eÉJ<sub>ı</sub>J<sub>ı</sub> PÀ<sup>-</sup>A, <sup>a</sup>AtAd<sup>a</sup> <sup>a</sup>AAvAAÛ «eAÖÉA PÀ<sup>-</sup>EAdA

(<sub>À</sub>ÉAiAAvAÛ)

Hn g<sub>À</sub>ÉÜ , <sup>a</sup>ÉÄ<sub>À</sub>ÉgAA-25

©.J LaOPÀ PÀÉAβqA #AwæPÉ (rJ<sub>ı</sub>i')

ϕέwÃAiÄÄ ZÁvÄÄªAiÁð,À

¥ÄwæPÉ-3

DzsÄÄªPÀ ¥ÄÆªÀð PÀ£ÀßqÀ,Á»vÀå ZÀjvÉæ  
ªÄÄvÄÄÛ ¥ÄoÄå

¥ÄzÄå "sÁUÄ

- 1. ªAiÁw£Ä ªÃw w½AiÄÄ"ÉÃPÄÄ -  
PÀqÀPÉÆÄ¼Ä ªÄÄrª¼Ä¥Äà
- 2. ,ÆEiÄÄð °ÄÄnÖzÀ£ÄªÉ - dvÄÛ  
²ªÄ°AUÄªÉ
- 3. ,ÉÆÄgÄÄwªÄÄzÄÄ ªÄÄ£ÉAiÄÄ ªAi¼V - ,ÄAvÄ  
²±ÄÄ£¼Ä ±ÄjÃ¥sÄ
- 4. ,ÄvÄå¯ÉÆÄPÀçAç½zÀ PÉÆgÄ« - °É¼Äª£Ä  
PÀmÉÖ VjAiÄÄªÄä
- 5. PÀ£ÀßqÀ zÁ,ÄAiÄÄå - ,ÁPÀij  
"Á¼ÁZÁAiÄÄð(±ÁAvÄ PÄ«)

UÄzÄå "sÁUÄ

- 6. ZÁtPÄå ZÄAzÄæUÄÄ¥ÄÛgÄ PÄ¥ÄI PÄ®ª PÄxÀ£ÄªÄÄ  
- PÉA¥ÄÄ£ÁgÁAiÄÄt
- 7. ªªªQ zÄ±Äð£ÄÄ - ªÄÄzÄÝt
- 8. C©üeÁÖ£Ä"sÁgÄt ¥Äæ,ÄAUÄ - §,Äª¥Äà  
±Á¹Ûç

LaÒPÀ PÀ£ÀßqÀ ¥ÄwæPÉ -3

DzsÄÄªPÀ ¥ÄÆªÀð PÀ£ÀßqÀ,Á»vÀå ZÀjvÉæ

C) DzsÄÄªPÀ ¥ÄÆªÀð PÀ£ÀßqÀ,Á»vÀå ,ÀégÄÆ¥Ä,  
¥ÉæÃgÄuÉ, zsÉÆgÄuÉUÄ¼ÄÄ.

D) DzsÄÄªPÀ ¥ÄÆªÀð PÀ£ÀßqÀ,Á»vÄåzÄ gÄÆ¥ÄUÄ¼ÄÄ :  
vÄvÄÛ÷é¥ÄzÄUÄ¼ÄÄ ,UÄzÄå, £ÁIPÄ ,  
PÄªå ªÄÄvÄÄÛ C£ÄÄªzÄ,Á»vÄå.

E) DzsÄÄªPÀ ¥ÄÆªÀð PÀ£ÀßqÀ,Á»vÄåzÄ ¥ÄæªÄÄÄR  
"gÄªUÁgÄgÄÄ : 'AUÄgÁAiÄið ,  
°É¼Äª£ÄPÀmÉÖ VjAiÄÄªÄä ,PÉA¥ÄÄ £ÁgÁAiÄÄt,  
¥sÄrð£ÁAqí QmÉÖ¯i, JA.J¯i. ²æÃPÄAoÉÄUËqÄ, ªÄÄzÄÝt,

©.ªÉAPÀmÁZÁiÀið (zÉÃ¹ ¸Á»vÀå , ¸ÁA,ÀìøvÀ ¸Á»vÀå  
ªÄÄvÀÄÛ ¥Á±ÁÑvÀå ¸Á»vÀåzÀ ¥Àæ¨sÁªÀUÀ¼À  
»£Éβ¯ÉAiÄÄ°è.)

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eÉJ,ïJ,ïªÄÄ°Á«zÁå!ÃoÀ  
eÉJ,ïJ,ï PÀ¯Á,ªÁtÁdåªÄÄvÀÄÛ «eÁÕ£À PÁ¯ÉÃdÄ  
( ¸ÁéAiÄÄvÀÛ)

Hn gÀ,ÉÛ ,ªÉÄÊ,ÀÆgÀÄ-25

©.J LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ (rJ,ï¹)

çéwÃAiÄÄ ZÁvÀÄªAiÁð,À

¥ÀwæPÉ-4

DzsÄÄªPÀ PÀ£ÀßqÀ ¸Á»vÀå ZÀjvÉæ  
ªÄÄvÀÄÛ ¥ÀoÀå

¥ÀzÀå¨sÁUÀ

1. PÁtÂPÉ - ©.JA.ªæÃ
2. CªÁé - ¡.®APÉÃ±ï
3. ¸Á«gÁgÀÄ £ÀçUÀ¼ÀÄÄ - qÁ.  
¹zÀÝ°AUÀAiÄÄå
4. ²ªÀ£À«ÄÄ,ÄÄªÀ °ÁqÀÄ -ªÉÊzÉÃ»

UÀzÀå¨sÁUÀ

- 5.ªÉÆÃa -¨sÁgÀwÃ!æAiÄÄ
6. ZÉÆÃªÄÄ£À zÄÄr PÁzÀA§j-ÄAzÀ DAIÄÄÝ¨sÁUÀ -  
²ªÀgÁªÄÄ PÁgÀAvÀ
7. £ÀªÄÄª JªÉÄäUÉªAiÁvÀÄ w¹/²ªÄÄzÉ -  
UÉÆgÀÆgÀÄ gÁªÄÄ,Áé«Ä CAiÄÄåAUÁgï
8. «ZÁgÀ PÁæAwUÉ DªÁé£À - PÄªªÉA¥ÄÄ

LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ -4



**DzsÄÄαPÀ PÀξÀßqÀ „Á»vÀå ZÀjvÉæ ªÄÄvÄÄÜ  
¥ÀoÀå**

**DzsÄÄαPÀ PÀξÀßqÀ „Á»vÀå ZÀjvÉæ**

**C) DzsÄÄαPÀ PÀξÀßqÀ „Á»vÀå „ÀégÀÆ¥À, ¥ÉæÃgÀuÉ,  
zsÉÆgÀuÉUÀ¼ÄÄ.**

**D) DzsÄÄαPÀ PÀξÀßqÀ „Á»vÀå ¥ÀæªÄÄÄR WÀiÖUÀ¼ÄÄ  
£ÀªÉÇÃzÀAiÄÄ, ¥ÀæUÀw²Ã®, £ÀªÀå zÀ°vÀ - §AqÁAiÄÄ,  
ªÄÄ»¼Á „Á»vÀå (¥Àæ`sÁªÀ, ¥ÉæÃgÀuÉ, vÁwéPÀvÉUÀ¼Ä  
„ÀÆÜ® ¥ÀjZÀAiÄÄ)**

**E) DzsÄÄαPÀ PÀξÀßqÀ „Á»vÀå - ¥ÀæªÄÄÄR °gÀ°ÀUÁgÀgÄÄ  
°ÉÃAzÉæ, PÄªªÉA¥ÄÄ, C£ÀPÀÈ, UÉÆÃ¥Á®PÀÈµÀÚ CrUÀ,  
C£ÀAvÀªÄÄÆwð, zÉÃªÀ£ÀÆgÀªÄÄ°ÁzÉÃªÀ, «dAiÀiÁ zÀ°Éâ,  
„ÁgÁ C§Æ§PÀìgi.**

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**eÉJ„jJ„iªÄÄ°Á«zÁå|ÃoÀ**

**eÉJ„jJ„i PÀ¯Á, ªÁtÁdªªÄÄvÄÄÜ «eÁÕ£ÀPÀ¯ÉÃdÄ, ªÉÄÈ„ÀÆgÄÄ–  
25**

**PÀξÀßqÀ °sÁµÁ ¥Àæ±Éß¥ÀwæPÉAiÄÄªÀiÁzÀj**

**CªÀçü: 2.30 UÀAmÉUÀ¼ÄÄ  
CAPÀUÀ¼ÄÄ: 60**

**UÀjµÄÖ**

**1. MAzÄÄ ¥Àæ±ÉßUÉ GvÀÛj¹. 10  
CAPÀUÀ¼ÄÄ**

**(WÀIPÀ 1 jAzÀ JgÀqÄÄ ¥Àæ±ÉßUÀ¼ÄÄ£ÀÄß PÉÃ¼Ä°ÉÃPÄÄ)**

**2. MAzÄÄ ¥Àæ±ÉßUÉ GvÀÛj¹. 10  
CAPÀUÀ¼ÄÄ**

**(WÀIPÀ 1 jAzÀ JgÀqÄÄ ¥Àæ±ÉßUÀ¼ÄÄ£ÀÄß  
PÉÃ¼Ä°ÉÃPÄÄ**

3. MAzÄÄ ¥Àæ±ÉBUÉ GvÀÛj¹. 10

CAPÀUÀ¼ÄÄ

(WÀIPÀ 1 jAzÀ JgÀqÄÄ ¥Àæ±ÉBUÀ¼ÄÄÉÄÄß  
PÉÄ¼ÄÄ"ÉÄPÄÄ)

4. MAzÄÄ ¥Àæ±ÉBUÉ GvÀÛj¹. 10

CAPÀUÀ¼ÄÄ

(WÀIPÀ 1 jAzÀ JgÀqÄÄ ¥Àæ±ÉBUÀ¼ÄÄÉÄÄß  
PÉÄ¼ÄÄ"ÉÄPÄÄ)

5. JgÀqÄÄ ¥Àæ±ÉBUÀ½UÉ GvÀÛj¹ 2\*5= 10  
CAPÀUÀ¼ÄÄ

(WÀIPÀ 1,2,3,4 jAzÀ £Á®Äì ¥Àæ±ÉBUÀ¼ÄÄÉÄÄß  
PÉÄ¼ÄÄ"ÉÄPÄÄ)

6. MAzÄÄ «µÄAiÄÄªÄÉÄÄß PÄÄjvÄÄ ,ÀéAvÄ  
C©ü¥ÁæAiÄÄªÄÉÄÄß §gÉ¬Äj. 05 CAPÀUÀ¼ÄÄ

(¥ÀoÄåzÄ ¥ÀjPÀ®àÉÉAiÄÄÉÄÄß  
UÄªÄÄÉÄzÄ°èiÄÖPÉÆiAqÄÄ ¥Àæ±Éß PÉÄ¼ÄÄ"ÉÄPÄÄ)

7. MAzÄÄ ªÁPÄåzÄ°è GvÀÛj¹. 05

CAPÀUÀ¼ÄÄ

(LzÄÄ ¥Àæ±ÉBUÀ¼ÄÄÉÄÄß PÉÄ¼ÄÄ"ÉÄPÄÄ)

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eÉJ,ïJ,ï ªÄÄ°Á«zÁå|ÃoÄ

eÉJ,ïJ,ï PÄ¬Á, ªÁtÁdª ªÄÄvÄÄÛ «eÁÖ£ÄPÁ¬ÉÄdÄ, ªÉÄÊ,ÀÆgÄÄ-

PÄ£ÄßqÀLaÒPÀ (I-IV SEM) ªÄÄvÄÄÛ ªÄÄPÄÛ DAIÉÄiAiÄÄ

¥Àæ±Éß ¥ÀwæPÉAiÄÄ ,ÀégÄÆ¥Ä



**ΡΑΞΑΒαΑ "sÁμÁ ¥ÀwæPÉUÀ¼ÄÄ**  
**ªÄÄÆgÀÉÁiÄÄ ZÀvÄÄªÄiÄð,À**  
**(©.J./©PÁA/©.©.J./©.J'ì./©¹J/©.ªÉÇÄPì)**

ZÀvÄÄªÄiÄð	PÉÆÄ,ìò,ÄASÉª	PÉÆÄ,ìò PÉÆÄqì	¥ÀwæPÉUÀ¼ÄÄ ²Ä¶òPÉ	PÉÆÄ,ìòjÄw	PÉær mìUÀ¼ÄÄ «ÉÁª,À L:T:P	PÉær mìUÀ¼ÄÄ ÄASÉª	ªÆÄzsÁÉÄ UÀÄmÉUÀ¼ÄÄ /	ªÄiÈªªÄiÁ¥ÁÉÄ «ÉÁª,À			
								C1	C2	C3	MIÖ CAPÄ UÀ¼ÄÄ
III	C3 L 1-1	FHC010A QP 10301	©.J. ¥ÀwæPÉ-3 PÄÄ 1j-3	AECC	3:0:0	3	4	20	20	60	100
III	C3 L 1-3	FSC010A/ FPC010 SDC010 ANC010 QP 11301/	©.J'ì/©.ªÉÇÄ Pì ¥ÀwæPÉ- 3 «eÁÖÉÄ 1j-3	AECC	3:0:0	3	4	20	20	60	100
III	C3 L 1-3	FCC010A QP 12301	©. PÁA: ¥ÀwæPÉ-3 ªÄtÄðª 1j-3	AECC	3:0:0	3	4	20	20	60	100
III	C3 L 1-3	FBC010A QP 13301	©©J : ¥ÀwæPÉ-3 ªªÄðªUÄ 1j- 3	AECC	3:0:0	3	4	20	20	60	100
III	C3 L 1-3	FAC010A QP 14301	©¹J : ¥ÀwæPÉ-3 UÄtPÄ 1j -3	AECC	3:0:0	3	4	20	20	60	100

**COMBINATIONWISE COURSE CODE**

BA—EG- FHC01031,HP- FHC01032,KG- FHC01033,HE- FHC01034,  
 JP- FHC01035

BSc—PC- FSC01031,PM- FSC01032,PE- FSC01033,CsM- FSC01034,

ECs- FSC01035,BtZ- FSC01036,CBt- FSC01037,CZ- FSC01038,BZ- FSC01039

BtBC- FSC01040,MbBt- FSC01041,MBBC- FSC01042

B.VOC- FP- FPC010,SD- SDC010,ANI- ANC010

**αΑÄPÀÛ DAIÉÄ ÌPÀÈÀßqÀ ¥ÀwæPÉ**  
**αÄÄÆgÀÉÉAiÄÄ ZÀvÄÄαÀiÁð,À**  
**(©PÁA/©.©.J./©.J'ì./©'J)**

ZÀvÄÄαÀiÁ ð,	PÉÆÄ,ïð ,ÄSÉä	PÉÆÄ,ïð PÉÆÄqï	¥ÀwæP ÉUÀ¼Ä ²ÄïðPÉ	PÉÆÄ,ïðjÄw	PÉær miUÀ ¼Ä «ÉÄä, Ä L:T:P	PÉærmiUÀ¼Ä ÄSÉä	"ÉÆÄzsÄÉÄ UÀÄmÉUÀ¼ÄÄ / αÄÄPÉi	αÀiÈ®αÀiÁ¥ÄÈÄ «ÉÄä,À			
								C1	C2	C3	MIÖ CAPÀ UÀ¼Ä Ä
III	C3  OE-1	1.FHC880  2.FHC890	"sÁμÁÄ vÄgÄ  PÀÈÀß qÄ dÉÀ¥Äz Ä ,Ä»vÄä		3:0:0	3	4	20	20	60	100

**ΡΑΞΑΒqÀ "sÁμÁ ¥ÀwæPÉUÀ¼ÄÄ  
 £Á®ìÉÉAiÄ ZÀvÄÄªAiÁð,À**

(©.J./©.J¹i/©PÁA/©©J/©¹J/©.ªÉÇÃPi)

ZÀvÄÄªAiÁð,À	PÉÆÄ,ïò ,ÀASEá	PÉÆÄ,ïò PÉÆÄqj	¥ÀwæPÉU À¼Ä ²Ä¶ðPÉ	PÉÆÄ,ïòjÄw	PÉær mïUÀ ¼Ä «£Áá, À L:T:P	PÉærmiUÀ¼Ä,ÀASEá	"ÉÆÄzsÁ£Á UÀAmEII¼Ä,À	ªAiÈ®ªªAiÁ¥À£Á «£Áá,À			
								C1	C2	C3	MIÄ Ö CA PÀ UÀ ¼Ä Ä
IV C4 L 1-4	FHD010 QP 10401	©.J. ¥ÀwæPÉ-4 PÀ-Á ¹j-4	AECC	3:0:0	3	4	20	20	60	100	
IV C4 L 1-4	FSD010/ FPD010 SDD010 AND010 QP 11401/	©.J¹i/©.ªÉÇ ÃPi ¥ÀwæPÉ-4 «eÁÖ£Á ¹j- 4	AECC	3:0:0	3	4	20	20	60	100	
IV C4 L 1-4	FCD010 QP 12401	©.PÁA. ¥ÀwæPÉ-4 ªÁtÂðª ¹j-4	AECC	3:0:0	3	4	20	20	60	100	
IV C4 L 1-4	FBD010 QP 13401	©©J. ¥ÀwæPÉ-4 ªªÀðªÀuÁ ¹j--4	AECC	3:0:0	3	4	20	20	60	100	
IV C4 L 1-4	FAD010 QP 14401	©¹J ¥ÀwæPÉ-4 UÀtPÀ ¹j -4	AECC	3:0:0	3	4	20	20	60	100	

**COMBINATIONWISE COURSE CODE**

**BA—EG- FHD01031,HP- FHD01032,KG-FHD01033,HE- FHD01034,  
 JP-FHD01035**

**BSc—PC-FSD01031,PM-FSD01032,PE-FSD01033,CsM-FSD01034,  
 ECs-FSD01035,BtZ- FSD01036,CBt- FSD01037,CZ-FSD01038,BZ- FSD01039  
 BtBC-FSD01040,MbBt-FSD01041,MBBc-FSD01042  
 B.VOC- FP- FPD010,SD- SDD010,ANI- AND010.**

**ἄἌἌΡἈῦ ΔΑΙἘἰ ΠἈΞἈβqἈ ἴἈwæΠἘ  
 ξἈ©ἰξἘἘἰἈἌ ΖἈνἈἌἄἰἈἰᾶ  
 (©ΠἈἈ/©.©.J./©.J'ἰ./©'J)**

ΖἈνἈἌἄἰἈἰᾶ	ΠἘἘἌἰᾶ ἌἈΣἘἄ	ΠἘἘἌἰᾶ ΠἘἘἌqἰ	ἴἈwæ ΠἘῦἈ ¼Ἀ Ἄἰᾶἰᾶ Ἐ	ΠἘἘἌἰᾶ ἰᾶἰᾶ	ΠἘἄἰᾶ ἰᾶἰᾶ «ξἈἰᾶ L:T:P	ΠἘἄἰᾶἰᾶ ἌἈΣἘἄ	ἌἈἌἌἌἌἌ ἌἈἌἌἌἌἌἌ / ἌἈἌἌἌἌἌἌἌ	ἌἈἌἌἌἌἌἌἌἌ «ξἈἰᾶἌἌἌἌἌἌἌἌἌ			
								C1	C2	C3	ΜἰἈ ᾶ CἈ ΠἈ ῦἈ ¼Ἀ ἌἌ
IV	C4  OE-2	1.FHD880  2.FHD890		OE-2	3:0:0	3	4	20	20	60	100

**LaÑPÀ PÀÉÀßqÀ ¥ÀwæPÉUÀ¼À**  
**ªÀÄÆgÀÉÉiÀÄ ªÀÄvÀÄÛ ÉÁ®ìÉÉiÀÄ**  
**ZÀvÀÄªÀiÁö,À**

ZÀvÀÄªÀiÁ,À	PÉÆÄ j,ö ÀASÉ ª	PÉÆÄ,jö PÉÆÄqj	¥ÀwæPÉU À¼À ²Ä¶öPÉ	PÉÆÄ,jöjÁw	PÉær mïUÀ ¼À «ÉÁª, À L:T:P	PÉærmiUÀ¼À,ÀASÉª	ÆÆÄzsÀÉÁ UÀAmÉUÀ¼ÀÄ ªÁgÁPÉì	ªÀiË®ªÀiÁ¥ÀÉÁ «ÉÁª,À			
								C1	C2	C3	MIÄ Ö CA PÀ UÀ ¼À Ä
III	C5 OPT KAN	FHC490  QP 10314	¥ÀwæPÉ-5 ªÁgÁwÁAi ÄÄ ªÀÄvÀÄÛ ¥À±ÁÑvÀª PÁªÄª «ÄÄªÀiÁ,À É	DSC	3:0:0	3	3	20	20	60	100
III	C6  OPT KAN	FHC500  QP 10315	¥ÀwæPÉ-6 PÀÉÀßqÀ PÁªÄª «ÄÄªÀiÁ,À É DzsÀÄªPÀ gÀÆ¥ÀUÀ ¼ÀÄ	DSC	3:0:0	3	3	20	20	60	100



IV	C7  OPT KAN	FHD490  QP 10414	¶ÀwæPÉ-7 ÀA±ÉÆËz sÀÆÉ ªÄÄvÄÄÛ «ªÄÄ±Éð	DSC	3:0:0	3	3	20	20	60	100
IV	C8  OPT KAN	FHD500  QP 10415	¶ÀwæPÉ-8 eÁÆÀ¶ÄzÀ °ÁUÄÆ ªÄÄ»¼Ä Ä»vÄä	DSC	3:0:0	3	3	20	20	60	100

eÉJ, jJ, jªÄ°Á«zÁä!ÃoÀ

eÉJ, jJ, j PÀ-Á,ªÁtÄdªªÄÄvÄÄÛ «eÁÕÆÀ PÁ-ÉÄdÄ  
(,ÁéAiÄÄvÄÛ)

Hn gÀ,ÉÛ,ªÉÄË,ÀÆgÄÄ-25

ªÄÄÆgÀÆÉAiÄÄ ZÁvÄÄªÄiÄð,À ©.J.

**PÀ-Á<sup>1</sup>j-3**

(JÆi.E.!. ¶ÀoÀâPÀæªÄÄ-2021-22)

¶Äj«r

**WÀIPÀ-1 gÁ¶ÖçÃAiÄÄvÉ**

1. C) "sÁgÀwÃAiÄÄgÄÄ ÉÁªÄÄ

DÆÄAzÀPÀAzÀ

D) «±Äé"sÁgÀwUÉ PÀÆÀßqÀzÁgÀw

ZÉÆÀß«ÃgÀ PÀt«

2. DUÀ, jÖ PÁæAw

PÁ¶ÄÄ

3. FUÀ JAxÀ gÁ¶ÖçÃAiÄÄvÉ "ÉÄPÀÄ?

ªÄ,ÄAvi ±ÉnÖ

**WÀIPÀ-2 PÀÈ¶**

1. C) G¼ÄÄªÀ MPÀÌ®ÄªÄÄUÀ£À vÀ¶Äà -  
MPÀÌ°UÀªÄÄzÀÝtÚ  
£ÉÆÃqÀzÉ M¶ÄÄàUÉÆ¼ÄîAiÄÄå
- D) K¼ÄÄvÀ¯É JzÄÄÝ AiÄiÁgÁgÀ £É£ÉAiÄÄ° -  
UÀgÀwAiÄÄ°ÁqÄÄ (ÀAUÀæ°À)
2. CªÀgÀ ¶ÉÊQ £Á£ÀÆ M§â -  
CZÀðPÀ © gÀAUÀ,Áé«Ä
3. zsÀ£ÀéAvÀj aQvÉi -

PÄÄªÉA¶ÄÄ

### WÀIPÀ-3 QæÃqÉ

1. C) £ÉvÀÛªÄÄ£Ár ¨sÁ£ÄÄªÄÄw,ÉÆÃ¯ÉÆÛqÉ -  
- ¶ÄA¶Ä
- D) PÀ°è£ÁI - ¶ÄæeÁÕ  
ªÄÄwÛ°À½î
- 2.ªÉÄj PÉÆÃªÄî,ÀAvÀw,Á«gªªÁUÀ° -

VjeÁ ±Á¹Ûç

3. »lègiUÉ ¶ÁoÀ PÀ°¹zÀ PÀ¶ÄÄà,ÄÄzÀgÀ -  
- ¡.®APÉÃ±i

### WÀIPÀ-4 ÀAQÃtð

1. C) ¨ÉiÖzÀªÉÄÃ¯ÉÆAzÄªªÄÄ£ÉAiÄÄªÄiÁr -  
CPÀªÄÄ°ÁzÉÃ«
- D) vÀgªªÉ ©qÄÄ ¶ÀgÀ»A,É zÉÆÃµªªÄ -  
- PÀ£ÀPÀzÁ,ÀgÄÄ
2. PÀuÁÚZÉUÉ -

PÁ¼ÉÄUËqÀ £ÁUÀªÁgÀ

3. PÀAUÁ¯ÁV PÄÄ½vÄÄ - J.ï.

vÄÄPÁgÁA

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eÉJ,ïJ,ïªÄÄ°Á«zÁ!ÃoÀ  
eÉJ,ïJ,ï PÀ¯Á,ªÁtÂdªªÄÄvÄÄÛ «eÁÕ£À PÁ¯ÉÃdÄ  
(,ÁéAiÄÄvÄÛ)

Hn gÀ,ÉÛ,ªÉÄÊ,ÀÆgÄÄ-25

ªÄÄÆgÀ£ÉAiÄÄ ZÁvÄÄªÄiÁð,À ©.PÁA

# ªÁtÂdâ¹j- 3

(JËi.E.¡. ¥ÀoÀâPÀæªÀÄ-2021-22)

¥Áj«r

## WÀIPÀ-1 ªÄËÉÆÃgÀAd£Á ªÀiÁzsÀªÀÄ

1. C) PËgªÀ ªÉÆÉ PÉqÉzÀÄzÀÄ £ÀUÉAiÀÄ

PÀqÀ´ÉÆ¼ÀUÉ - PÄªÀiÁgÀªÀªÀ

D) PÀ£ÀßqÀA PÀvÀÄÛjAiÀÄ´ÉÛ

- ªÄÄzÀÝt

2. ¥ÉzÀÄÝAqÉ (d£À¥ÀzÀ PÀxÉ ) - (ªÀ)

qÁ.¡.PÉ. Dgĩ

3. fÃªÀPÉÃAçævÀ - qÁ.aPÉìgÉ

ªÀ±ÀAPÀgÀ

## WÀIPÀ-2 ªÀiÁgÀÄPÀmÉÖ

1. C) J´Àè ªÀiÁAiÀÄ - UÉÆ®èªÀ½î

ªÀ±ÀAPÀgĩ

D) PÉ®À«®èzÀªÀgÀ °ÁqÀÄ -

zÀ.gÁ.´ÉÃAzÉæ

2. Cw´sÉÆËUÀªÀzÀÄ gÉÆËUÀ,PÉÆ®èzÀÄ ´ÉËUÀ -

qÁ.£ÀgÀªÀ½î ´Á®ÀÄ§æªÀätå

3. ªÉÄÄzÀgÀªÀ½îAiÀÄ CªÀªÀ£À -

¥ÀÆtðZÀAzÀæ.vÉÄd¹é

## WÀIPÀ-3 °AUÀ ªÀiÁ£ÀvÉ

1.C) DAIÀÄÝªÀzÀ£ÀUÀ¼ÀÄ -

ªÀ±ÀAgÀtgÀÄ

D)PÄÄAwAiÀÄ ´É¼ÀUÀÄ -

«dAiÀiÁzÀ´Éâ \*

2. ´ÉAQªÀ¼ÀÉ -

´Á£ÀªÀªÀµÁÛPĩ

3. PªÀÄÄjzÀ PÀ£ÀªÀ (GªÀiÁ²æÃ DvÀäPÀxÉAiÀÄ

DAIÀÄÝ´sÁUÀ -ngÀÆ¥ÀPÀ :© UÀt¥Àw

## WÀIPÀ-4 ªÀAQÃtð

1. C) ªÀiÁçüAiÀÄ ªÀvÀé -

ªÀiÁ¹Û \*

- D) ©üÃªÀiÁ¯Á¶À -
  - f.J.ï.ªÀgÀÄzÀæ¶Àà -
  - 2 C¼ÀÄ -
  - ªÀÄ£ÀÄ§½UÁgï
  - 3. °ÉÊmÉPï gÀtªÉÊzÀå - £ÁUÉÃ±ï
- °ÉUÀqÉ

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eÉJ,ïJ,ïªÀÄªÁ«zÁ¡ÃoÀ  
 eÉJ,ïJ,ï PÀ¯Á,ªÁtÁdªªÀÄvÀÄÛ «eÁÕ£À PÁ¯ÉÃdÄ  
 (ÁéAiÀÄvÀÛ)  
 Hn gÀ,ÉÛ,ªÉÄÊ,ÀÆgÀÄ-25  
 ªÀÄÆgÀ£ÉAiÀÄ ZÁvÀÄªÀiÁð,À ©.J¹.ï./©.ªÉÇÃPï  
 «eÁÕ£À¹j-3  
 (J£ï.E.ï. ¶ÀoÀåPÀæªÀÄ-2021-22)  
 ¶Áj«r

**WÀIPÀ-1ªÀiÁ£À«ÃAiÀÄvÉ**

- 1. C) ZÀAzÀæªÁ,À£À ¶Àæ,ÀAUÀ (DAiÀÄÝ ¨sÁUÀ) -
  - ©QëöäÃ±À
  - D) £À£Àß £Á¬Ä - ¶ÀÄ .w. £À.
  - 2. vÁAiÀÄÛ£À - JZï.
- £ÁUÀªÉÃtÄ
- 3. ¶ÉæÃªÀÄ ©üPÀëÄ (DAiÀÄÝ ¨sÁUÀ) -
- ¶Àæ¨sÀÄ±ÀAPÀgÀ

**WÀIPÀ-2 ¶ÀæªÁ,À**

- 1. C) eÉÆÛUÀzÀÀ UÀÄAr -
- ªÀÄÆUÀÆgÀÄªÀÄ®è¶Àà -
- D)ªÉÄÊ,ÀÆjªAzÀªÀÄrPÉÃjUÉ -
- C§ÄÝ¯ï gÀ²Ãzi
- 2.ªÀÄªÁ£i UÉÆÃqÉ - ±ÀÆzÀæ
- ²æÃªªÁ,ï
- 3 C£À!ü®èªÀïªÀÄvÀÄÛ PÀzÀA§ -
- ©.f.J¯ï.Áé«Ä

### WÀIPÀ-3 «ZÁgÀ PÁæAw

- 1.C) ÉAd«ÄËï ªÉÆÃÁ¬Äï °ÁqÄÄ - qÁ.  
ZÉÈÀßtÚ ªÁ°ÃPÀgÀ  
D) zÉÆqÀØªÄÄ zÉÃªÄvÉUÉ PÀtÄÚ zsÄj¹zÀ°ÉÆvÄÄÛ  
- PÉ.¡. ªÄÈvÄÄåAdAiÄÄ  
2. ªÉÄÊªÉÄÄ¯É zÉÃªÄgÄÄ zÉªÄé §gÄÄªÄÄzÉ -  
qÁ. ¹.Dgï.ZÀAzÀæ±ÉÄRgï  
3. ªÄZÀÈÀPÁgÀgÀ «ZÁgÀPÁæAw -  
qÁ.f.J.ï.ªªÄgÄÄzÀæ¥Àà \*

### WÀIPÀ-4 ÀAQÄtð

1. C) ÈÀÈÀßfÓ -  
ÈÁUÀwªÄ½î gÄªÉÄÄ±ï  
D) UÀAqÁV °ÄÄIÖªÉÄQvÄÄÛ -  
²æÄzÉÄ« PÉgÉªÄÄÈÉ  
2. °ÄÈzÀAiÄÄ zÄÄ§ðªÄÁUÄÄwÛzÉAiÉÄÄ ?  
- qÁ.Dgï.PÉ. ÀgÉÆÄd  
3. PÄÄ¹AiÄÄÄwÛgÄÄªÄ À ÀA ÀìøwPÀ ÈÉ¯ÉUÀ¼ÄÄ  
- gÄAeÁËï zÀUÁð

\*\*\*\*\*

eÉJ.ïJ.ï ªÄÄªÄ«zÁå¡ÄoÀ  
eÉJ.ïJ.ï PÄ¯Á,ªÄtÄdª ªÄÄvÄÄÛ «eÁÖÈÀ PÄ¯ÉÄÄ  
( ÀéAiÄÄvÄÄÛ)  
Hn gÄÈÉÛ , ªÉÄÊ ÀÆgÄÄ-25  
ªÄÄÆgÄÈÈAiÄÄ ZÁvÄÄªÄiÁð À ©.¹.J.

### UÄtPÄ 1j-3

(JËï.E.¡. ¥ÄoÄåPÄæªÄÄ-2021-22)

¥Äj«r

### WÀIPÀ-1 zÉÊÈÀAçÈÀ ®AiÄÄ

1. C) dɛʌʔʌzʌ wæʔʌçUʌ¼ʌʌ

-

DeÁŌvÀ PÀ«

D) gÁªÀÄËï ᵘvÀÛ ᵘÀÄçÝ

- PÉ.J,ï.

ᵘÁgï CªÀäzi

2. vÀmÉŌAiÀÄ PÉÆÉÉ CUÀÄ¼ÀÄ

-

ᵘÀÄËÀAzÁ PÀqªÉÄ

3. CAzsÀ CËÀÄPÀgÀuÉAiÀÄ ©IÄŌ

-

ËÉÄ«ÄZÀAzÀæ

### WÀIPÀ-2 ᵘÈªÁzÀð

1. C) gÉÆnŌªÀÄvÀÄÛ PÉÆÄ«

- ᵘÀÄ.gÀA.

JPÀÄIAr \*

D) J®Ä©ËÀªÀAzÀgÀzÉÆ¼ÀUÉ

-

ªÀÄÆqÁßPÀÆqÀÄ æËÀß,Áé«Ä

2. PÁUÉ

- ¨É,ÀUÀgÀªÀ½î

gÁªÀÄtÚ

3 DzSÀÄᵘPÀ PÀËÀßqÀ PÁªÀª ᵘÈªÁzÀðvÉAiÀÄ ʔÀæeÉŌ

-Dgï.vÁjtÂ ±ÀÄ¨sÀzÁ¬Äᵘ

### WÀIPÀ-3 ᵘÁévÀAvÀæöª

1. C) ËÀ®ªÀvÉÚÄ¼ÀgÀ ᵘÁévÀAvÀæöª

- ¹zÀÝªAUÀAiÀÄª

2ªÀiÁrªÀÄrzªÀgÀÄ (PÁzÀAŞjAiÀÄ DAiÀÄÝ¨sÁUÀ) -

Ş,ÀªÀgÁd PÀnŌÄªÀÄᵘ

3. VjdªÀéËÀ gÉÆnŌ

- C.ËÀ. PÀÈ

### WÀIPÀ-4 ᵘÀAQÄtð

1. C) ᵘÁgÀyAiÀiÁUÀÄ ËÀqÉ

-

PÀÄªÀiÁgÀªÀª,À

D) ᵘÉÆÄªÉÄÄ±ÀégÀ

±ÀvÀPÀ

- ʔÀÄªUÉgÉ ᵘÉÆÄªÀÄËÁxÀ

2 ᵘ¶zÀß UÀrUÀ¼À zÁnzÀ qÁ. gÀÄPÁª¨Á¬Ä

- qÁ.

JZi.J,ï. CËÀÄʔÀªÀÄ

3. GqÀÄzÁgÀ

- qÁ. eÁf

zÉÄªÉÄAzÀæʔÀà

\*\*\*\*\*

eÉJ,ïJ,ïªÀÄªÀ«zÁª!ÄŌÀ

eÉJ,ĭJ,ĭ PÀ<sup>-</sup>Á,ªÁtÂdªªÄÄvÄÄÛ «eÁÕËÀ PÁ<sup>-</sup>ÉÄdÄ  
(,ÁéAiÄÄvÄÛ)  
Hn gÀ,ÉÛ ,ªÉÄË,ÀÆgÄÄ-25  
ªÄÄÆgÄËÉAiÄÄ ZÁvÄÄªÄiÁð,À ©.©.J.

ªªÄðªÄuÁ<sup>1j-3</sup>  
(JËi.E.ĭ. ¥ÀoÀªPÀæªÄÄ-2021-22)  
¥Äj«r

**WÀIPÀ-1 ,ÀªÄiÁd**

1. C)ªÄiÁzÁgÀ ZÉËÀßAiÄÄæËÀ gÀUÀ¼É  
- °ÄjªÄgÀ  
D) ¥ÄÄgÀAzÀgÀzÁ,ÀgÀ QÄvÀðÉÉUÀ¼ÄÄ  
- ¥ÄÄgÀAzÀgÀ zÁ,À  
2. zsÀtÂUÀ¼Ä "É<sup>1/2</sup>ĭ<sup>-</sup>ÉÆÄĭ - °ÉZi.  
ËÁUÀªÉÄtÂ  
3. OzÁAiÄÄðPÉi PÉÆÉÉAiÄÄÄAmÉ - vÄ.  
,Ä. ±ÁªÄÄgÁAiÄÄ

**WÀIPÀ-2ªÉËZÁjPÀvÉ**

1. C) "ÁâqÀ "ÁâqÀ¥Äà ËÀªÄÄVzÄÄ ,Äj<sup>-</sup>Ä®è -  
dËÀ¥ÄzÀªÄª°Á"sÁgÀvÀ  
D) Cw »vÀzÀªÄª«ªÄzÄÄ -  
PÀËÀPÀzÁ,ÀgÄÄ  
2. zÉÄªÄgÀ °Ét -  
PÄÄÄ.«ÄgÀ"sÄzÄæ¥Äà

3.ªÉËZÁjPÀ ¥ÄæeÉÕUÉ CqÉvÀqÉUÀ¼ÄÄ  
-JZi.ËÄgÀ¹AªÄAiÄÄª \*

**WÀIPÀ-3 fÄªÄËÀªÄÄvÄÄÛ PÀ<sup>-</sup>É**

1. C) ËÄÄr "ÉÄPÄÄªÄiËËÀªÄÇ "ÉÄPÄÄ -  
gÀvÁßPÀgÀªÄtÄð  
D) PÀ¼ÄªÄ¼ÄªÄªÄªÄV©qÄÄ - r.«.  
UÄÄAqÀ¥Äà  
2. ËÁIPÀgÀvÀß UÄÄ©â «ÄgÀtÚËÀªÄgÄÄ -  
C.ËÄ. PÀÈµÀÜgÁAiÄÄ

3. qÁ. gÁei PÄÄ<sup>a</sup>AiÁgi: ÉÁrÉÀ ÉÄÄr -  
zÉÆqÄØ<sup>o</sup>ÄÄ®ÆègÄ gÄÄPÉÆiÄf

### WÄIPÄ-4 ÄAQÄtð

1. C) ¥ÄgÄ»A ÉAiÄÄA <sup>a</sup>AiÄr <sup>a</sup>AiÁÉÄ<sup>a</sup>ÄA "Á¼ÄÝ¥ÄÉÉ -  
®QëöäÄ±Ä  
D) <sup>a</sup>ÄÄÉÄ<sup>a</sup>É¼Ä¹zÄ<sup>a</sup>ÉÇ®Ä ÉÄqÉAiÄÄçgÄÄ  
-ÉÄAdÄAqÄPÄ«
2. <sup>a</sup>ÄÈxÁ Ew<sup>o</sup>Ä<sup>a</sup>ÄÉÄÄ PÉtPÄçgÄÄ -

qÁ.gÁUË

(zÉÆgÉ zÄÄAiÉÆÄðzsÄÉÄ-

ÉÁIPÄzÄ DAIÄÄÝ "sÁUA)

3. "sÁµÁAvÄgÄ PÄ<sup>-</sup>É -  
gÄA.<sup>2</sup>æÄ.<sup>a</sup>ÄÄÄUÄ½

\*\*\*\*\*

eÉJ<sub>j</sub>iJ<sub>j</sub>i <sup>a</sup>ÄÄ<sup>o</sup>Ä«zÄá!ÄoÄ  
eÉJ<sub>j</sub>iJ<sub>j</sub>i PÄ<sup>-</sup>Á,<sup>a</sup>ÄtÄd<sup>a</sup> ÄÄvÄÄÜ «eÁÖÉÄ PÄ<sup>-</sup>ÉÄdÄ  
(ÄéAiÄÄvÄÜ)

Hn gÄ<sub>j</sub>ÉÜ , <sup>a</sup>ÉÄË<sub>j</sub>ÄÆgÄÄ-25

ÉÄ®ìÉÉAiÄÄ ZÄvÄÄ<sup>a</sup>AiÁð<sub>j</sub>Ä ©.J.

### PÄ<sup>-</sup>Á<sup>1j</sup> -4

(JÉi.E.¡. ¥ÄoÄäPÄæ<sup>a</sup>ÄÄ-2021-22)

¥Äj«r

### WÄIPÄ-1 PÄAiÄÄPÄ

1. C) PÄAiÄÄPÄPÉi ÄAŞAçü¹zÄ JgÄqÄÄ <sup>a</sup>ÄZÄÉÄUÄ¼ÄÄ -  
DAIÄÄÝQì ®PÄi<sup>a</sup>ÄÄä, ¥ÄÄtá¹ÜçÄPÄ¼Ä<sup>a</sup>ÉéAiÄÄ <sup>a</sup>ÄZÄÉÄUÄ¼ÄÄ  
D) <sup>a</sup>ÄiÁzÁgÄ ZÉÉÄBAiÄÄä - dÉÄ¥ÄzÄ ±ÄgÄt PÄ<sup>a</sup>Ää  
PÄÈw<sup>-</sup>ÄAzÄ

(ÄA: ¡.PÉ.gÁd±ÉÄRgi)

2. ÉÄÆgji gÄÆ¥Ä<sup>-</sup>Ä zÄÄrAiÉÆÄ ÇµÄÖgÄ<sup>o</sup>è ÄPï ÄPÁUÄÜzÉ -  
ægÄÆ¥ÄuÉ- n.PÉ. zÄAiÄiÁÉÄAzÄ

3. <sup>a</sup>ÄÄ»¼ÉAiÄÄÉÄÄ M¼ÄUÉÆ¼ÄzÉ - PÉ.¡.ÄÄgÉÄ±i

### WÄIPÄ-2 ŞqÄvÄÉÄ

1. C) dÉÄ¥ÄzÄ wæ¥ÄçUÄ¼ÄÄ -



D) PÄÄ<sup>a</sup>ÄiÁgÄ<sup>a</sup>Áå,À "sÁgÀvÀzÀ DAIÄÄÝ "sÁUÄ -  
PÄÄ<sup>a</sup>ÄiÁgÄ<sup>a</sup>Áå,À

2. zSÀ<sup>a</sup>ÄiÄÄgÄ,ÀvÀå£ÁgÁÄiÄÄt -  
PÉÆgÄqÄI<sup>ï</sup> ²æÃ<sup>a</sup>Ä,À gÁ<sup>a</sup>i

3. C£ÀßPÁIV gÁwæ-ÄrÃ PÁzÀzÄÄÝ -  
«dÄiÄÄPÄÄ<sup>a</sup>ÄiÁgÄ<sup>i</sup> ¹UÄgÄ£Ä°Ä½î

### WÄIPÄ-3 PÄ®

1.C) <sup>a</sup>ÄiÁ<sup>a</sup>,ÀgÉÄ<sup>a</sup>£ÄÆßgÄÄ <sup>a</sup>ÄµÄð<sup>a</sup>ÄÄA §¼ÄÝ¥ÄgÉÄ -  
¥ÄÄ¥Ä

D) zÄrUÄ<sup>a</sup>ÉtAUÄ¼Ä£É <sup>a</sup>ÉÄnÖ <sup>a</sup>ÉÄ®è£É £ÄqÉzÄA -  
gÄ£Äß

2. £Ä<sup>a</sup>ÄÄä,ÀA,Àìøw <sup>o</sup>É<sup>a</sup>ÉÄä,À®zÄÄ - <sup>2a</sup>ÄgÁ<sup>a</sup>ÄÄ  
PÁgÄAvÄ

3. °ÄUÄ®Ä EgÄ¼ÄÄUÄ¼Ä £ÄqÄÄ<sup>a</sup>É -  
PÁ.vÄ. aPÄìtÚ

### WÄIPÄ-4 ÄAQÄtð

C) <sup>a</sup>ÄÄÄ<sup>a</sup>ßÄgÄ<sup>i</sup> "É<sup>a</sup>ßÄgÉ£É "ÉgÄ,À®tÚ vÄtÄUÄgÉÆ¼Ä<sup>a</sup>É  
- £ÄUÄZÄAzÄæ

D) M®<sup>a</sup>ÄzÉÆqÉ gÄÆ!£Ä PÉÆÄI<sup>ï</sup>ÉÄiÉÄÄ<sup>a</sup>ÄzÉÆ -  
d£Äß

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eÉJ,ïJ,ï <sup>a</sup>ÄÄ°Á«zÁå|ÄoÄ  
eÉJ,ïJ,ï PÄ<sup>-</sup>Á,<sup>a</sup>ÄtÄdå <sup>a</sup>ÄÄvÄÄÜ «eÁÖ£Ä PÄ<sup>-</sup>ÉÄdÄ  
(,ÁéÄiÄÄvÄÜ)

Hn gÄ,ÉÛ, <sup>a</sup>ÉÄÊ,ÀÆgÄÄ-25

£Ä®ì£ÉÄiÄÄ ZÁvÄÄ<sup>a</sup>ÄiÁð,À ©.PÁA.

<sup>a</sup>ÄtÄdå<sup>1j</sup>-4

(J£i.E.¡. ¥ÄoÄåPÄæ<sup>a</sup>ÄÄ-2021-22)

¥Äj«r

### WÄIPÄ-1 PÄqÄ®Ä

1. C) ðÄ<sup>a</sup>Äðj-ÄAzÁzÄ<sup>a</sup>ÉÄ QjzÉAzÄÄ §UÉzÄ -  
¥ÄÄ¥Ä

- D) ḂUÀgÀzÀ±ÀðÈÀ -  
 gÀvÀßPÀgÀªÀtÀð  
 2. gÀªÀÄ PÀAqÀ PÀqÀ®Ä -qÀ. 2ªÀgÀªÀÄ  
 PÀgÀAvÀ  
 3. PÉAÏÄ PÀqÀ°ÈÀ gÀAVÈÀ ḂÉÆÏPÀ  
 - qÀ. ®vÀUÀÄwÛ

**WÀIPÀ-2 ḂÀ°ÀḂÁ¼Éé**

1. C) DAIÄÄÝ QÄvÀðÈÉUÀ¼ÄÄ -  
 PÀÈÀPÀzÀḂgÄÄ  
 D) ḂªÀðdÕÈÀªÀZÀÈÀUÀ¼ÄÄ  
 -ḂªÀðdÕ  
 2. ÈÄÄUÉÏÄ VqÀ -  
 ÈÄ.ªÉÆUÀḂÁḂÉ  
 3.ªÄÄÈÄÄµÀgÄÄḂÉÏPÀVzÁÝgÉ,ªÄÄqÄÄPÉÆÏt §αβ  
 - §gÀUÀÆgÄÄ gÀªÄÄZÄAzÀæÏÄà

**WÀIPÀ-3 ḂªÄÄ**

- 1.C)ªÄÄUÀÈÉ αÄαAvÀ½AiÉÄ ḂÉËÏªÉÈÉAvÉÆÄ -  
 µÀqÀPÀègÄzÉÄªÄ  
 D) αÈÀß PÀAzÀÈÉÆAzÄÄUÀæÏsÀtÄ wAzÄÄ  
 fÄªÄAUÀ¼ÉzÀÈÏ - gÀWÀªÄAPÀ  
 2. ḂªÄÄ (®vÀ ÏÄæ§AzsÀ) - «Ä.  
 1ÄvÀgÀªÄÄAiÄÄªÄ  
 3. ÈÄnAiÄiÁUÀ®ÄªÉÆgÀiÀªÄ¼ÄÄ zÄÄgÀAvÀ  
 ÈÄAiÄÄQAIÄiÁzÀ¼ÄÄ - qÀ. JA.DgÏ. gÄ«

**WÀIPÀ-4 ḂÄAQÄtð**

1. C) gÀAUÉÆÄªªÄÄvÄÄÛªÄÄUÀ - PÉ . JÏ.  
 αÄgÏ CªÄÄÄzi  
 D) PÄḂÉÑAqÄÄ - F±ÄégÄ  
 ḂÄtPÀ®è  
 2 §zÄÄPÄÄ ÈÄÈÀUÉÄÈÄÄ PÀª¹zÉ - JZi.  
 ÈÄgÀ¹AªÄAiÄÄªÄ.  
 3. §AqÉUÀ¼ÄªÉÄÄḂÉ aUÄÄgÉÆqÉAiÄÄḂÉÄQzÉ  
 - zÉÄªÄÈÄÆgÄÄªÄªªÄzÉÄªÄ

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eÉJ,ïJ,ï ºÄÄºÁ«zÁá!ÄoÀ  
eÉJ,ïJ,ï PÀ ¯Á, ºÁtÂdâ ºÄÄvÄÄÛ «eÁÕËÀ  
PÁ ¯ÉÄdÄ ( ¯ÁéAiÄÄvÄÛ)  
Hn gÀ,ÉÛ , ºÉÄË,ÀÆgÄÄ-25  
£Á®ì£ÉAiÄÄ ZÁvÄÄºAiÁð,À ©.J¹ì./©.ºÉÇÄPï  
«eÁÕËÀ 1j-4  
(J£i.E.!, ºÄoÄâPÄæºÄÄ-2021-22)

¥Äj«r

WÀIPÀ-1 zÄºÄÄxvÀ ¯ÉÆÄPÀ

1. C) ¥ÄÄIÖ ºÉÆmÉÖUÄ¼ÄÄ zsÄ£ÄâºAzÄºÄÄ -  
zÄÄ. ¯ÄgÄ,Àéw D) ºÄqÄç ºÁ,ÄÄºÄ CUA,ÀgÄ  
ºÄqÄÄ - «ÄgÄtÚ ºÄÄrºÄ¼ÄgÄ  
2. ZÉÆÄºÄÄ£Ä zÄÄr (DAiÄÄÝ ¯sÁUÄ) -  
ºÄÄgÄºÄÄ PÄgÄAvÄ  
3. vÄÈwÄAiÄÄ ºAV CPÄiAiÄii ¥ÄzÄä±Áº -  
§,ÄºÄgÄdÄ ºÉÄÄUÄ®PÉÄj

WÀIPÀ-2 ¯Ä»µÄÄÜvÉ

1. C) ©ü£Äß ¯sÉÄzÄºÄ ºAiÁqÄ ¯ÁârgÉÆÄ -  
CeÁÕvÄ vÄvÄé¥ÄzÄPÄgÄ  
D) ¹AºÄºÄ ¯ÉÆÄPÄ£Ä - JZi.J,ï.  
ºÄÄ¥ÄæPÄ±ï  
2. £ÄºÄÄä £ÉgÉAiÄÄºè çÄ¥ÄºÄ½ - ¥sÄQÄgi  
ºÄÄºÄºÄÄäzi PÄmÁär  
3. £ÄºÄÄä Hj£Ä gÄ¹PÄgÄÄ - UÉÆgÄÆgÄÄ  
gÄºÄÄ,Áé«Ä CAiÄÄâAUÁgi

WÀIPÀ-3 ²æÄ ¯ÁºAiÁ£Äð£Ä §zÄÄPÄÄ

- 1.C) ¯ÉgÄtÄ vÄiÄÖºÄ ºÄÄqÄÄV ºÄÄvÄÄÛ ZÄAzÄæºÄÄ  
zÉÄºÄgÄÄ - ºÉÄzÉÄ»  
D) §ºÄÄgÄÆ! - £ÄÄçººÉzÄÄÝUÄð  
2. ¯ÉIÖºÉÄUÉ - ºÄÄAdÄ PÉÆÄr

GUÄÄ£É

3. C"ÉÆâÃ° - CPÄëvÁ  
 PÄÈµÄÚªÄÄÆwð  
**WÀIPÀ-4 ÿÄAQÃtð**  
 1. C) °Á®Qì °ÁqÄÄ - gÉÃtÄPÁ  
     gÄªÄiÁÉÄAzÀ  
     D) ªÄÄª°Á ¥ÄjªªÁðt - gÄÆ¥Ä °ÁÄÉÄ  
 2 PÁ¥ÁqÄÄ ¥Äæ"ªÄÄªÉÃ -  
     CªÄÄgÉÃAzÀæ °ÉÆ®èA§½î  
 3. °ÉÆvÄÄÛ ªÄiÁgÄÄªªÄgÄÄ - J"i. 1.  
 ÿÄÄ«ÄvÁæ.

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eÉJÿjÿi ªÄÄª°Á«zÁå|ÃoÀ  
 eÉJÿjÿi PÄªÁ,ªÁtÄdª ªÄÄvÄÄÛ «eÁÕÉÄ PÄªÉÃdÄ  
 (ÿÁéAiÄÄvÄÛ)  
 Hn gÄªÉÛ , ªÉÄÊÿÆgÄÄ-25  
 £Á®ì£ÉAiÄÄ ZÁvÄÄªÄiÁðÿÀ ©.¹.J.

**UÄtPÄ 1j-4**

(J£i.E.¡. ¥ÄoÄªPÄæªÄÄ-2021-22)  
 ¥Äj«r

**WÀIPÀ-1 £ÁUÄjPÄvÉ**

1. C) EnÖUÉAiÄÄ ¥ÄÄiÖtÚ -  
     ZÄAzÀæ±ÉÄRgÄ PÄAªÁgÄ  
     D) MAzÄÄ ÿÄjÃ PÄrØUÁV - dAiÄÄAvÄ  
     PÄªÄitÄ  
 2. MAzÄÄ °ÄÄª°è£Ä PÄæAw -  
 ªÄÄÿÀ£ÉÆ§Ä ¥ÄÄPÄÄªÉÇPÄ  
 3. ©ÃÉPÄ®Äè ÿÄªÁj - PÄÄªÉA¥ÄÄ

**WÀIPÀ-2 C©üªÄÈçP**

1. C) ªÄÄÄªªªÉÊ eÁvÄPÄ - f.Jÿi.  
 ²ªÄgÄÄzÀæ¥Äà

D) °ÄÄqÄÄQzÄgÄÆ 1UÄ¯ÉÆ®èzÄÄ -

©.n.®°vÁÆÁAiÄÄPï

2 qÁAŞgÄÄ ŞAzÄÄzÄÄ -  
zÉÄªÀÆÄÆgÄÄªÄÄ°ÁzÉÄªÄ

3 ®ÆnAiÄÄ °ÉzÁÝjUÄ¼ÄÄ - £ÁUÉÄ±Ä  
°ÉUÄqÉ

### WÀIPÀ-3 PÄgÄÄuÉ

1.C) ZÄAzÄæªÄÄwAiÄÄ ¥Äæ¯Á¥Ä (°Äj±ÄÑAzÄæ  
PÁªÄª°sÁUÄ) - gÁWÄªÁAPÄ

D)PÄjªÄÄj £Á¬Ä - zÄ.gÁ.  
°ÉÄAzÉæ

2 PÉÆ£ÉAiÄÄ VgÁQ - µgÄAd£Ä

3. »A,ÉAiÄÄ ,ÀégÄÆ¥ÄUÄ¼ÄÄ §°-§°zÁ£Ä -  
ªÄÄgÄj §¯Áè¼Ä

### WÀIPÀ-4 ÄAQÄtð

1. C) vÄ¥Ä±ÄÑgÄt µ±ÄÑAiÄÄªÄÄ£Ä£ÁzÄÄ -  
¥ÄA¥Ä

D) JgÄqÄÄ V½UÄ¼Ä PÄxÉ(¥ÄAZÄvÄAvÄæ) -  
zÄÄUÄð¹A°Ä

2 ZÁ|èxi (DAiÄÄÝ °sÁUÄ) -  
PÄA.«ÄgÄ°sÄzÄæ¥Äà

3. aUÄÄgÉÆqÉAiÄÄwÛgÄÄªÄ VqÄzÄ vÄ£ÄªAiÄÄvÉ -  
QëÄgÄ,ÁUÄgÄ

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eÉJ,ïJ,ïªÄÄ°Á«zÁª|ÄoÄ  
eÉJ,ïJ,ï PÄ¯Á,ªÄtÄdªªÄÄvÄÄÛ «eÁÕ£Ä PÄ¯ÉÄdÄ  
(,ÁéAiÄÄvÄÛ)

Hn gÄ,ÉÛ ,ªÉÄË,ÀÆgÄÄ-25

£Ä®ì£ÉAiÄÄ ZÄvÄÄªÄiÁð,À ©.©.J.

ªªÄð°ÄuÁ 1j-4

(J£i.E.¡. ¥ÄoÄªPÄæªÄÄ-2021-22)

¥Aj«r

WÀIPÀ-1 AiÄÄzÀp

1. C) ¥ÉÆPÀìÈÀ©üªÄÄÄÄÄ «gÉÆÄçü¼ÄÄÄgÁ²AiÄÄÄ - ¥ÄÄ¥Ä

D) "Éè£ĩ»ÄªÄi PÀzÀÈÀ (ªÄÄÆ®-DAUÀèPÀ« ,ÄZÉ - (CÈÄÄ) ©.JA.²æÄ

2. AiÄÄÄzÀpªÄiÁÈÀªÄÉÆÄPÀzÀªÄiÁAiÄÄzÀ UÁAiÄÄ - Q.gÄÄ. £ÁUÀgÁd

3. CtÄ ZÀ½UÁ® CqÀUÀ®Ä ,Ü¼ÄªÉ°è ? - £ÁUÉÄ±i°ÉUÀqÉ

WÀIPÀ-2 gÁ¶ÖçÄAiÄÄvÉ

1. C) ZÉªBUÀ «ÄgÀªÄªÄzÉÄªÄ¥ÄªªÉÄÊªÁgÀ - gÁtÄªÉÄÆßgÄÄ ,ÄªÄÄzi ,ÁªÉÄ§

D) dAiÄÄªsÁgÀvÀªÄAzÉÄ - ZÉÈÄß «ÄgÀ PÀt«

2. gÀPÀÛ zsÀéd - §,ÄªÁgÁd PÀnÖÄªÄÄª

3. FUÀ JAxÁ gÁ¶ÖçÄAiÄÄvÉªÉÄPÄÄ ? -ªÄ,ÄAvÀ±ÉnÖ

WÀIPÀ-3 ±ÁAw

1. C) ¥ÉvÀÛ ¥ÄjÄµªªª dAiÄÄªªÉÄ vÀ¥ÄÄ - d£Äß

D)ªÄÄgÄÄUÀçgÄÄªÄÄUÀ¼ÄÄªÄÄnÖzÀ¼ÉAzÄÄ - ®vÁ gÁd±ÉÄRgĩ

2. D®zÀªÄÄgÀ - ¥ÄzÄª®vÁªÉÆÄªªÉÄ

3. ±ÉéÄvÀªsÄªÄÈÄzÀªÄÄÄzÉÄ -

£ÉÄ«ÄZÄAzÄæ

WÀIPÀ-4 ,ÄAQÄtö

1. C) ¥ÄÄgÁvÀÈÀ PÀªÄiÁðAiÄÄvÀÛªÄÄªÉÜ zÉÄ»UÀ¼É,ÁPÄÄ - £ÁUÀZÄAzÄæ

D)ªÉ¼ÉAiÄÄÄvÀÛªÉÄEgÄÄªÀ KPÀ®ªÄª PÉ. UÉÆÄ«AzÀgÁdÄ -

2.ªÄÄÈÄzÀ¼ÄÄ®£ÉAvÄÄ vÀqÉªÉÄªÄÄUÀ¼É (ªÄÄÆ®: PÁ½zÄ,Ä) - (CÈÄÄ) §,ÄªÄ¥Äªª±Á¹Ûç

3. ,ÄªÁAiÄÄ vÀ,ÉäöÊ £ÄªÄÄB - C.gÁ.

«ÄvÄæ

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eÉJ<sub>3</sub>iJ<sub>3</sub>i<sup>a</sup>Ä°Á«zÁ!ÄoÀ  
eÉJ<sub>3</sub>iJ<sub>3</sub>i PÀ<sup>-</sup>Á,<sup>a</sup>ÁtÄdâ<sup>a</sup>ÄvÄÄÛ «eÁÕξÀ PÁ<sup>-</sup>ÉÄdÄ  
(<sub>3</sub>ÁéAiÄÄvÄÛ)

Hn gÀ<sub>3</sub>ÉÛ ,<sup>a</sup>ÉÄË<sub>3</sub>ÀÆgÄÄ-25

LaÒPÀ PÀξÀßqÀ ¥ÄwæPÉ

(rJ<sub>3</sub>i<sup>1</sup>)

<sup>a</sup>ÄÄÆgÀξÉAiÄÄ ZÁvÄÄ<sup>a</sup>ÄiÁð<sub>3</sub>À

¥ÄwæPÉ-5

“sÁgÄwÄAiÄÄ<sup>a</sup>ÄvÄÄÛ ¥Á±ÁÑvÄå PÁ<sup>a</sup>Äå  
«ÄÄ<sup>a</sup>ÄiÁÄ<sub>3</sub>É

(PÉæmiUÄ¼ÄÄ-3; C<sup>a</sup>Äçü-<sup>a</sup>ÁgÀPÉÌ 3 UÄAmÉUÄ¼ÄÄ; °TvÄ ¥ÄjÄPÉëUÉ 60  
CAPÄUÄ¼ÄÄ; DAvÄjPÀ UÄuÄÄ±ÄUÄ¼ÄÄ - 40; MIÄÖ CAPÄUÄ¼ÄÄ-100.)

1. “sÁgÄwÄAiÄÄ PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÄiÁÄ<sub>3</sub>É: “sÁgÄwÄAiÄÄ PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÄiÁÄ<sub>3</sub>ÉAiÄÄ GUÄ<sup>a</sup>ÄÄ<sup>a</sup>ÄvÄÄÛ «PÁ<sub>3</sub>À, PÁ<sup>a</sup>Äå<sub>3</sub>ÀégÀÆ¥Ä, ¥Äæw“sÉ<sup>a</sup>ÄvÄÄÛ<sup>a</sup>ÄÄvÄÄwÛ, <sub>3</sub>°ÄÈzÄAiÄÄ, PÁ<sup>a</sup>Äå ¥ÄæAiÉÆÄdξÄUÄ¼ÄÄ.
2. ¥Äæ<sup>a</sup>ÄÄÄR ¥Äæ<sub>3</sub>ÄÜξÄUÄ¼ÄÄ: C®APÁgÀ (G¥Ä<sup>a</sup>ÄÄ, gÀÆ¥ÄPÀ, çÄ¥ÄPÀ, AiÄÄ<sup>a</sup>ÄÄPÀ), zsÄéæ, gÀ<sub>3</sub>À, OavÄå
3. ¥Á±ÁÑvÄå «ÄÄ<sup>a</sup>ÄiÁÄ<sub>3</sub>ÉUÄ¼ÄÄ: ¥ÉèÄmÉÆÄ (CξÄÄPÀgÀt<sup>a</sup>ÄzÀ), Cj<sub>3</sub>ÁÖI<sup>-</sup>i (PÉxÁ<sup>1</sup>ð<sub>3</sub>i), n J<sub>3</sub>i J°AiÄÄmi (<sup>a</sup>ÄåQÛvÄé ægÀ<sub>3</sub>ÀξÄ<sup>1</sup>zÁPvÄ)

¥ÄgÁ<sup>a</sup>ÄÄ±ÄðξÄ UÄæAxÄUÄ¼ÄÄ:

1. “sÁgÄwÄAiÄÄ PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÄiÁÄ<sub>3</sub>É- wÄ.ξÄÄ.<sup>2</sup>æÄ
2. vË®æPÀ PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÄiÁÄ<sub>3</sub>É- JZi w¥ÉàÄgÄÄzÄæ<sub>3</sub>Áé«Ä
3. ¥Á±ÁÑvÄå «ÄÄ<sup>a</sup>ÄiÁÄ<sub>3</sub>É- ¥ÉÆæ. JA EξÄAzÄgï

4. „Á»vÀå ¥ÀæªÉÃ±À- 1.¡.PÉ
5. „Á»vÀå «ªÀÄ±ÉðAiÀÄªÀÄÆ®vÀvÀéUÀ¼ÄÄ- JZi  
w¥ÉàÃgÀÄzÀæ,Áé«Ä
6. PÁªÁåxÀð aAvÀ£À - f.J.ï. 2ªÀgÀÄzÀæ¥Àà

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eÉJ,ïJ,ïªÀÄªÁ«zÁå!ÃoÀ  
 eÉJ,ïJ,ï PÀªÁ,ªÁtÁdªªÀÄvÀÄÛ «eÁÕ£À PÁªÉÃdÄ  
 (ªÁéAiÀÄvÀÛ)  
 Hn gÀ,ÉÛ ,ªÉÄÊ,ÀÆgÀÄ-25  
**LaÒPÀ PÀ£ÀßqÀ ¥ÀwæPÉ (rJ,ï¹)**  
 ªÀÄÆgÀ£ÉAiÀÄ ZÁvÀÄªÀiÁð,À  
**¥ÀwæPÉ-6**  
 PÀ£ÀßqÀ PÁªÀå «ÄÃªÀiÁÄ,É DzsÀÄªPÀ  
 gÀÆ¥ÀUÀ¼ÄÄ

(PÉæmiUÀ¼ÄÄ-3; CªÀçü-ªÁgÀPÉì 3 UÀAmÉUÀ¼ÄÄ; °TvÀ ¥ÀjÄPÉëUÉ 60  
 CAPÀUÀ¼ÄÄ; DAvÀjPÀ UÀuÁA±ÀUÀ¼ÄÄ - 40; MIÄÖ CAPÀUÀ¼ÄÄ-100.)

1. PÀ£ÀßqÀ PÁªÀå «ÄÃªÀiÁÄ,É: PÁªÀå  
 „ÁégÀÆ¥ÀªÀ£ÀÄß PÄÄjvÀÄ PÀ£ÀßqÀ ¯ÁPÀëtÂPÀgÀ  
 aAvÀ£ÉUÀ¼ÄÄ, PÀ«gÁdªÀiÁUÀð,  
 PÁªÀåªÀÉÆÄPÀ£À, PÀ£ÀßqÀ PÄªÀªÀiÀiÁ£ÀAzÀ  
 (eÁAiÀÄUÉÆAqÀ) , d£À¥ÀzÀ PÁªÀå «ÄÃªÀiÁÄ,É  
 (d£À¥ÀzÀ PÁªÀåzÀ PÄÄjvÀÄ GªÉèÃRUÀ¼ÄÄ).
2. DzsÀÄªPÀ PÁªÀå «ÄÃªÀiÁÄ,É: PÄªªÉA¥ÀÄ,  
 ¥ÀÄ.w.£À, CrUÀ, zÀªvÀ-§AqÁAiÀÄ PÁªÀå  
 «ÄÃªÀiÁÄ,É



3. <sup>a</sup>ÄÄ»¼Á PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÀiÁÄ,É: ¹ÛçÄ, ÄA<sup>a</sup>ÉÄzÀÉÉAiÄÄ  
»ÉÉß<sup>-</sup>ÉAiÄÄ<sup>o</sup>è gÄÆ<sup>!</sup>vÄUÉÆAqÄ PÁ<sup>a</sup>Äå  
vÄvÄéUÄ¼ÄÄ

¥ÄgÁ<sup>a</sup>ÄÄ±ÄðÉÄ UÄæAxÄUÄ¼ÄÄ:

1. <sup>ˆ</sup>sÁgÄwÄAiÄÄ PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÀiÁÄ,É- wÄ.ÉÄÄ.<sup>2</sup>æÄ
2. vË®PÄ PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÀiÁÄ,É- JZi w¥ÉàÄgÄÄzÄæ,Áé«Ä
3. ¥Á±ÁÑvÄå «ÄÄ<sup>a</sup>ÀiÁÄ,É- ¥ÉÆæ. «. EÉÁAzÁgï
4. Ä»vÄå ¥Äæ<sup>a</sup>ÉÄ±Ä- ¹.!.PÉ
5. PÄÉÄßqÄ PÁ<sup>a</sup>Äå «ÄÄ<sup>a</sup>ÀiÁÄ,É- ÉÄlgÁd \$ÆzÁ¼ÄÄ
6. PÄÉÄßqÄ Ä»vÄå «ÄÄ<sup>a</sup>ÀiÁÄ,É- gÄ<sup>o</sup>Ä<sup>a</sup>Ävï vÄjÄPÉgÉ
7. dÉÄ¥ÄzÄ Ä»vÄå «ÄÄ<sup>a</sup>ÀiÁÄ,É- «ÄgÄtÜ zÄAqÉ
8. PÁ<sup>a</sup>ÄåxÄð aAvÄÉÄ - f.J.ï. <sup>2a</sup>ÄgÄÄzÄæ¥Ää

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eÉJ,ïJ,ï <sup>a</sup>ÄÄ<sup>o</sup>Ä«zÄå!ÄoÄ  
eÉJ,ïJ,ï PÄ<sup>-</sup>Ä, <sup>a</sup>ÄtÄdå <sup>a</sup>ÄÄvÄÄÜ «eÄÖÉÄ PÄ<sup>-</sup>ÉÄdÄ  
(ÄéAiÄÄvÄÜ)  
Hn gÄ,ÉÜ, <sup>a</sup>ÉÄÊ,ÄÆgÄÄ-25  
LaÖPÄ PÄÉÄßqÄ ¥ÄwæPÉ (rJ,ï¹)  
ÉÄ®ìÉÉAiÄÄ zÄvÄÄ<sup>a</sup>ÀiÄð,Ä  
¥ÄwæPÉ-7

ÄÄ±ÉÆÄzsÄÉÉ <sup>a</sup>ÄÄvÄÄÜ «<sup>a</sup>ÄÄ±Éð

(PÉærmïUÄ¼ÄÄ-3; C<sup>a</sup>Äçü-<sup>a</sup>ÄgÄPÉì 3 UÄAmÉUÄ¼ÄÄ; °TvÄ ¥ÄjÄPÉèUÉ 60  
CAPÄUÄ¼ÄÄ; DAvÄjPÄ UÄuÄÄ±ÄUÄ¼ÄÄ - 40; MIÄÖ CAPÄUÄ¼ÄÄ-100.)

1. ÄÄ±ÉÆÄzsÄÉÉ: ¥ÄjPÄ®àÉÉ, CxÄð,ÄégÄÆ¥Ä, DPÄgÄ  
Ä<sup>a</sup>ÀiVæUÄ¼ÄÄ, ÄÄ±ÉÆÄzsÄÉÉAiÄÄ «zsÁÉÄUÄ¼ÄÄ,  
PÉèÄvÄæPÄAiÄÄð, ¥Äæ±Áß<sup>a</sup>Ä½UÄ¼ÄÄ,  
ÄÄ±ÉÆÄzsÄÉÉ <sup>a</sup>ÄÄvÄÄÜ «<sup>a</sup>ÄÄ±ÉðAiÄÄ CAvÄ,ÄA\$AzsÄ
2. Ä»vÄå «<sup>a</sup>ÄÄ±Éð: ÄégÄÆ¥Ä <sup>a</sup>ÄÄvÄÄÜ ®PÄëtUÄ¼ÄÄ,  
Ä»vÄå «<sup>a</sup>ÄÄ±Éð <sup>ˆ</sup>É¼ÉzÄÄ \$AzÄ zÄj: ¥ÉèÄmÉÆÄ,  
Cj,ÁÖI<sup>-</sup>ï, °ÉÆgÉÄ,ï, <sup>-</sup>ÁAeÉÉÉÄ,ï, PÉÆÄ<sup>o</sup>æqiÓ, L J  
jzÄqið E<sup>a</sup>ÄgÄ ¹zÄPÄvÄUÄ¼ÄÄ ÄÆÜ® ¥ÄjzÄAiÄÄ

3. DzsÄÄµPÀ «<sup>a</sup>Ä±Äð ¥Äæ, ÄÜÉÀUÄ¼Ä, ÄÆÜ®  
 ¥ÄjZÄAiÄÄ: PÄvÄÈðµÄx «<sup>a</sup>Ä±Éð, <sup>a</sup>ÄÆÉÆÄ«eÄÖÉÄ  
 «<sup>a</sup>Ä±Éð, ZÁjwæPÀ «<sup>a</sup>Ä±Éð («¥ÉÆÄ°mï mÉÄÏi),  
<sup>a</sup>ÄiÁPïð<sup>a</sup>Äç «<sup>a</sup>Ä±Éð (LrAiÄiÄ®f, ÄÄ, ÄìøwPÀ  
 AiÄÄd<sup>a</sup>ÄiÁÉÄå, ÇÉÁxÄ ¥ÄæeÉÖ, ÄÄ, Äìøw GzÄå<sup>a</sup>ÄÄ)  
 ¹ÜçÄµÄx «<sup>a</sup>Ä±Éð.

¥ÄgÄ<sup>a</sup>ÄÄ±ÄðÉÄ UÄæAxÄUÄ¼ÄÄ:

1. ÄÄ±ÉÆÄzsÄÉÉ- JA azÁÉÄAzÄÄ <sup>a</sup>ÄÆwð
2. PÄÉÄßqÄ, ÄÄ±ÉÆÄzsÄÉÄ ±Ä, ÄÜç- qÄ JA JA PÄ®§ÄVð
3. ÄÄ±ÉÆÄzsÄÉÄ «zsÄÉÄ- | « PÄÄ®PÄtÄð, °ÄjPÄÈµÄÜ °sÄgÄtå, f, ÄzÄ²ÄÄ
4. PÄÉÄßqÄ, ÄÄ±ÉÆÄzsÄÉÄ <sup>a</sup>ÄiÄUÄð <sup>a</sup>ÄÄvÄÄÜ Ew°Ä, Ä- qÄ  
 ÄAUÄ<sup>a</sup>ÉÄÄ±Ä, Ä<sup>a</sup>ÄzÄwÜ<sup>a</sup>ÄÄoÄ
5. ÄÄ±ÉÆÄzsÄÉÄ gÄAUÄ- vÄ¼ÄÜeÉ <sup>a</sup>Ä, ÄAvÄPÄÄ<sup>a</sup>ÄiÄgÄ
6. ÄÄ±ÉÆÄzsÄÉÄ, ÄégÄÆ¥Ä- qÄ ©.« <sup>2</sup>gÄÆgÄ
7. <sup>a</sup>ÄiÁÉÄ«PÄ, ÄÄ±ÉÆÄzsÄÉÉ- qÄ ZÄAzÄæ ¥ÄÆeÄj
9. Ä»vÄå «<sup>a</sup>Ä±ÉðAiÄÄ <sup>a</sup>ÄÄÆ®vÄvÄéUÄ¼ÄÄ- JZi w¥ÉàÄgÄÄzÄæ, Äé«Ä
- 10 «<sup>a</sup>Ä±ÉðAiÄÄ ¥Äj°sÄµÉ- N J°i ÉÄUÄ°sÄÆµÄt, Äé«Ä
- 11 ¥ÄæAiÉÆÄVPÄ «<sup>a</sup>Ä±Éð- qÄ f.J°i <sup>2a</sup>ÄgÄÄzÄæ¥Äà
- 12 PÄÉÄßqÄ, ÄÄ»vÄå «Ä<sup>a</sup>ÄiÄÄ, É- gÄ°Ä<sup>a</sup>ÄÄvi vÄjÄPÉgÉ
- 13 ¥Ä±ÄÑvÄå, ÄÄ»vÄå <sup>a</sup>ÄzÄUÄ¼ÄÄ- ¹ Dgï AiÄÄgÄ«ÉÄvÉÄ°É<sup>a</sup>ÄÄoÄ
- 14 PÄÉÄßqÄ ±Ä, ÄÜç ¥Äj°sÄµÉ- <sup>a</sup>ÄÄ°ÉèÄ¥ÄÄgÄÄ f <sup>a</sup>ÉAPÄmÉÄ±Ä

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eÉJ, j, j, j <sup>a</sup>ÄÄ°Ä«zÄå|ÄoÄ  
 eÉJ, j, j, j PÄ°Ä, <sup>a</sup>ÄtÄdå <sup>a</sup>ÄÄvÄÄÜ «eÄÖÉÄ PÄ°ÉÄdÄ  
 (ÄéAiÄÄvÄÜ)  
 Hn gÄ, ÉÜ, <sup>a</sup>ÉÄÊ, ÄÆgÄÄ-25  
 LaÖPÄ PÄÉÄßqÄ ¥ÄwæPÉ (rJ, j°i)

ÉÄ®ìÉÉAiÄÄ ZÄvÄÄ<sup>a</sup>ÄiÄð, Ä  
 ¥ÄwæPÉ-8  
 eÄÉÄ¥ÄzÄ °ÄUÄÆ <sup>a</sup>ÄÄ»¼ÄÄ, ÄÄ»vÄå

(PÉærmïUÄ¼ÄÄ-3; C<sup>a</sup>Äçü-<sup>a</sup>ÄgÄPÉì 3 UÄAmÉUÄ¼ÄÄ; °TvÄ ¥ÄjÄPÉëUÉ 60  
 CAPÄUÄ¼ÄÄ; DAvÄjPÄ UÄuÄÄ±ÄUÄ¼ÄÄ - 40; MIÄÖ CAPÄUÄ¼ÄÄ-100.)

1. eÁŁÀŷÀzÀ: "sËwPÀ eÁŁÀŷÀzÀ, °ÀiËTPÀ eÁŁÀŷÀzÀ, dŁÀŷÀzÀ °ÀÄ°ÁPÁ°ÀåUÀ¼ÄÄ, ŷÀæzÀ±ÀðŁÀ PÀÉUÀ¼ÄÄ, ŁÁIPÀUÀ¼ÄÄ, Lw°ÀåUÀ¼ÄÄ
2. eÁŁÀŷÀzÀ PÉëÑvÀæ PÁAiÄÄð: eÁŁÀŷÀzÀ „Á»vÀå „ÀUÀæ°À, °ÀVÑðPÀgÀt, «±ÉèÑµÀuÉ
3. °ÀÄ»¼Á „Á»vÀå: PÀŁÀßqÀ „Á»vÀåzÀ°è °ÀÄ»¼É/ dŁÀŷÀzÀ gÀAUÀ"sÀÆ«Ä, PÀŁÀßqÀ ÉĀRQAIÄÄgÀÄ, ŁÀAdŁÀUÀÆqÄÄ wgÄÄ°ÀÄ-ÁÁ, PÉÆqÀvŁÀ UËgÀ°Ää, CŁÄÄŷÀ°ÀiÁ µgÀAdŁÀ, °ÉËzÉĀ», „ÁgÁ CŞÆŞPÀigī, UÄÄ-Á© mÁQÑ,ī MAzÄÄ «±ÉèÑµÀuÉ

ŷÀgÁ°ÄÄ±ÀðŁÀ UÀæAxÀUÀ¼ÄÄ:

1. eÁŁÀŷÀzÀ PÁ°ÀåUÀ¼ÄÄ- Dgī « J,ī „ÄÄAzÀgÀA. °ÉĒ „ÆgÄÄ ««
2. eÁŁÀŷÀzÀ 1zÁPvÀUÀ¼ÄÄ- «ĀgÀtÚ zÀAqÉ
3. eÁŁÀŷÀzÀ vÀvÀéUÀ¼ÄÄ °ÄÄvÄÄŪ 1zÁPvÀUÀ¼ÄÄ- CAŞ½PÉ »jAiÄÄtÚ
4. eÁŁÀŷÀzÀ „Á»vÀå- VgÀrØ UÉÆĀ«AzÀgÁd
5. 1ŪçĀ°ÁzÀ çPÀÆiA- DgZÁī EAçgÁ
6. 1ŪçĀ °ÁzÀ- © JĒī „ÄÄ«ÄvÁæ"Á-Ä
7. °ÄÄ»¼Á „Á»vÀå „Ä«ÄĀPÉë –DgÁåAŞ ŷÀmÁÖ©ü
8. DzsÄÄµPÀ °ÄÄ»¼Á „Á»vÀå- GµÁ JA
9. °ÄÄ»¼Á „Á»vÀå ZÀjvÉæ - °ÉZī.J,ī. ²æĀ°ÄÄw

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(LzÄÄ °ÄÄvÄÄŪ DgÀŁÉÉAiÄÄ  
ZÀvÄÄ°ÀiÁð „ÀUÀ¼ÄÄ) BA (DSE) KEG  
LzÀŁÉÉAiÄÄ ZÀvÄÄ°ÀiÁð „À

5	1	„Á»vÀá «ªÄÄ±Éð ¥ÀÆgÀPÀ ¥ÀoÀá ¥ÀoÀá ¥ÀÆgÀPÀ ZÀÌÄªÀnPE	<b>ELE250</b>	03 02 01 <b>5:1:0</b>	06	48 32 32 <b>80+32=112</b>	0 3	40 30 - <b>70</b>	<b>30</b> ( <sup>1</sup> -1-15 ªÄÄvÄÄÛ <sup>1</sup> -2-15)	100
<b>r J, i E – 5.2 LzÀÆÉAiÄÄ ZÀvÄÄªÄiÁð, Ä</b>										
5	2	«±ÉÄµÀ PÀ« PÁªÄá CzsÄáAiÄÄ£Ä °ÉÆ, ÄUÀ£ÄBqÄ ¥ÀÆgÀPÀ ¥ÀoÀá ¥ÀoÀázsÁjvÄ ZÀÌÄªÀnPEUÄ¼ÄÄ	<b>ELE252</b>	03 02 01 <b>5:1:0</b>	06	48 32 32 <b>80+32=112</b>	03	40 30 - <b>70</b>	<b>30</b> ( <sup>1</sup> -1-15 ªÄÄvÄÄÛ <sup>1</sup> -2-15)	100
<b>r J, i E – 5.3 LzÀÆÉAiÄÄ ZÀvÄÄªÄiÁð, Ä</b>										
5	3	PÀ£ÄBqÄ £ÁIPÀ „Á»vÀá ¥ÀÆgÀPÀ ¥ÀoÀá ¥ÀoÀázsÁjvÄ ZÀÌÄªÀnPEUÄ¼ÄÄ	<b>ELE254</b>	03 02 01 <b>5:1:0</b>	06	48 32 32 <b>80+32=112</b>	03	40 30 - <b>70</b>	<b>30</b> ( <sup>1</sup> -1-15 ªÄÄvÄÄÛ <sup>1</sup> -2-15)	100
<b>r J, i E – 5.4 LzÀÆÉAiÄÄ ZÀvÄÄªÄiÁð, Ä</b>										
5	4	ªÄÄ¼Ä „Á»vÀá CzsÄáAiÄÄ£Ä ¥ÀÆgÀPÀ ¥ÀoÀá ¥ÀoÀázsÁjvÄ ZÀÌÄªÀnPEUÄ¼ÄÄ	<b>ELE256</b>	03 02 01 <b>5:1:0</b>	06	48 32 32 <b>80+32=112</b>	03	40 30 - <b>70</b>	<b>30</b> ( <sup>1</sup> -1-15 ªÄÄvÄÄÛ <sup>1</sup> -2-15)	100
<b>r J, i E – 5.5 LzÀÆÉAiÄÄ ZÀvÄÄªÄiÁð, Ä</b>										
5	5	PÀ£ÄBqÄ d£Ä¥ÄZÄ „Á»vÀá CzsÄáAiÄÄ£Ä ¥ÀÆgÀPÀ ¥ÀoÀá ¥ÀoÀázsÁjvÄ ZÀÌÄªÀnPEUÄ¼ÄÄ	<b>ELE258</b>	03 02 01 <b>5:1:0</b>	06	48 32 32 <b>80+32=112</b>	03	40 30 - <b>70</b>	<b>30</b> ( <sup>1</sup> -1-15 ªÄÄvÄÄÛ <sup>1</sup> -2-15)	100

**DgÀÆÉAiÄÄ ZÀvÄÄªÄiÁð, Ä**

**r J, i E – 6.1 DgÀÆÉAiÄÄ ZÀvÄÄªÄiÁð, Ä**

6	1	°À¼ÉUÀ£ÀBqÀ ªÀÀPÀgÀtªÀÄvÀÄÛ ¥ÀæAiÉÆÄUÀ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀå ¥ÀÆgÀPÀ ZÀlÄªÀnPEÉ	ELF250	03 02 01 5:1:0	06	48 32 32 80+32=1 12	03	40 30 - 70	30 (¹-1-15 ªÀÄvÀÄÛ ¹-2-15)	100
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**r J, i E – 6.2 DgÀ£ÉAiÄÄ ZÀvÄÄªÀiÄö, Ä**

6	2	«±ÉÃµÀ PÀ» PÀªÀå CzsÀåAiÄÄ£À (°À¼ÀUÀ£ÀBqÀ) ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀåzsÁjvÀ ZÀlÄªÀnPEUÀ¼ÄÄ	ELF252	03 02 01 5:1:0	06	48 32 32 80+32=1 12	03	40 30 - 70	30 (¹-1-15 ªÀÄvÀÄÛ ¹-2-15)	100
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**r J, i E – 6.3 DgÀ£ÉAiÄÄ ZÀvÄÄªÀiÄö, Ä**

6	3	PÀ£ÀBqÀ, Á»vÀå ªÀÄvÀÄÛ ¹ªÀiÁ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀåzsÁjvÀ ZÀlÄªÀnPEUÀ¼ÄÄ	ELF254	03 02 01 5:1:0	06	48 32 32 80+32=1 12	03	40 30 - 70	30 (¹-1-15 ªÀÄvÀÄÛ ¹-2-15)	100
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**r J, i E – 6.4 DgÀ£ÉAiÄÄ ZÀvÄÄªÀiÄö, Ä**

6	4	¥ÀæPÀgÀ PEÁAçævÀ CzsÀåAiÄÄ£À ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀåzsÁjvÀ ZÀlÄªÀnPEUÀ¼ÄÄ	ELF256	03 02 01 5:1:0	06	48 32 32 80+32=1 12	03	40 30 - 70	30 (¹-1-15 ªÀÄvÀÄÛ ¹-2-15)	100
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**r J, i E – 6.5 DgÀ£ÉAiÄÄ ZÀvÄÄªÀiÄö, Ä**

6	5	PÀ£ÀBqÀ, Á»vÀå ªÀÄvÀÄÛ, ÄªÀÄÆ°À ªÀiÁzsÀªÀÄÄ ¥ÀÆgÀPÀ ¥ÀoÀå ¥ÀoÀåzsÁjvÀ ZÀlÄªÀnPEUÀ¼ÄÄ	ELF258	03 02 01 5:1:0	06	48 32 32 80+32=1 12	03	40 30 - 70	30 (¹-1-15 ªÀÄvÀÄÛ ¹-2-15)	100
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**“sÁμÉ PÀ£ÀβqÀ**

¹©¹J, ĩ ¥ÀzÀPwAiÀÄ ¥ÀoÀå«£Áå, À  
 2019-20jAzÀ DgÀA“sÀÁUÀÄ“À ±ÉÊPÀëtÂPÀ “ÀμÀðPÉÌ ¹©¹J, ĩ ¥ÀzÀPwAiÀÄ  
 ¥ÀoÀPÀæ“ÀÄ “ÀÄvÀÄÛ ¥ÀjÁPÁë AiÉÆÄd£É  
**“ÀÄÄPÀÛ LaÒPÀ ¥ÀwæPÉ**  
 eÉ.E - Generic Elective(GE) HEG

É « Ä, À Ö gĩ	¥Àwæ PÉ	PÉÆÄ, ĩ ø PÉÆÄqĩ	¥À wæ PÉ ²ÄŒ ðPÉ	PÉær mĩ «£Áå , À LTP			MIÄÖ PÉærmĩ	“ÉÆÄzs À£Á UÀAmÉ UÀ¼Ä , ÀASÉå (É«Ä, À ÖgĩUE)	¥ÀjÁPÁ ë C“Äçü (UÀAm ÉUÀ¼Ä Ä)	CAPAUÄ ¼ÄÄ	DAvÁjPÁ “ÀiÉ@“ÀiÁ¥À£À CAPAUÄ¼ÄÄ	MIÄÖ CAPÀ UÀ¼ÄÄ
<b>LzAA£ÉAiÄÄ ZAvÄÄ“AiÄð, À PÀ£ÀβqÀ , Á»vÀå ¥ÀjZÀAiÄÄ</b>												
5	1	<b>ELE259</b>	<b>WÀIPÀ 1 :</b> ¥ÁæaÁ£À PÀ£ÀβqÀ , Á»vÀå ¥ÀjZÀAiÄÄ	01	02	16	02	20	15	15 (¹ -1 – 10 “ÀÄvÀÄÛ ¹ - 2- 10)	<b>50</b>	
			<b>WÀIPÀ 2 :</b> DzsÀÄæPÀ PÀ£ÀβqÀ , Á»vÀå ¥ÀjZÀAiÄÄ	01		16						35
<b>DgÀ£ÉAiÄÄ ZAvÄÄ“AiÄð, À PÀ£ÀβqÀ PÀ°PÉ – UÀ¼PÉ</b>												
6	1		<b>WÀIPÀ</b> <b>1 :</b> PÀ£Àβq À , Á»vÀå PÀ°PÉ <b>WÀIPÀ</b>	01	02	16	02	20	15	(¹ -1 – 10 “ÀÄvÀÄÛ ¹ - 2 -10)	<b>50</b>	
			01	16		35						

			2 :	2:0						
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			À½PÉ							

**LzÀÈÉAiÀÄ ZÀvÀÄªÀiÁð,À**  
**(DAiÉÄÌªÀiÁzÀj²,ÄÄÛ r.J,ï.E CzsÀªÀiÀÄÄÈÀ)**  
**LaÒPÀ PÀÈÀßqÀ**  
**r.J,ï.E - ¥ÀwæPÉ -5.1(DSE)**  
**Course code : ELE25023 ELE25026**

**„Á»vÀª «ªÀÄ±ÉðªÀÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀª**

**WÀIPÀ 1**

- C) „Á»vÀª «ªÀÄ±ÉðAiÀÄ, ÀégÀÆ¥ÀªÀÄvÀÄÛ ®PÀètUÀ¼ÀÄ
- D) „Á»vÀª «ªÀÄ±Éð ·É¼ÉzÀÄ §AzÀ zÁj, ¥ÉèÄmÉÆÄ, Cj,ÁÖl ï, °ÉÆgÉ,ï,  
 - ÁAeÉÈÈÀ,ï, PÉÆÄ®jei,  
 L.J. jZÀqñð, n. J,ï. EªAiÀÄmi EªÀgÀ ¥ÀæªÀÄÄR ½zÁPvÀUÀ¼ÀÈÀÄß  
 ¥ÀjZÀ-Ä,ÄªªÀÄzÀÄ.

**WÀIPÀ 2 – DzsÀÄæPÀ «ªÀÄ±Áð ¥Àæ,ÁÜÈÀUÀ¼À, ÀÆÜ® ¥ÀjZÀAiÀÄ**

PÀvÀÈðæµÀ× «ªÀÄ±Éð, PÀÈwæµÀ×,ªÀÄÈÉÆÄªÉÈeÁÕæPÀ, ZÁjwæPÀ,  
 ªÀiÁPñðªÁçªÀÄvÀÄÛ ¹ÛçÄæµÀ× «ªÀÄ±Éð

**WÀIPÀ : 3**

**PÀÈÀßqÀ „Á»vÀª «ªÀÄ±Éð**

- C) ÈÀÈÇÄzÀAiÀÄ «ªÀÄ±Éð, ÀégÀÆ¥À, ®PÀèt, æªÀÄÄUÀ¼ÀÄ - ¥ÀæªÀÄÄR  
 «ªÀÄ±ÀðPÀgÀÈÀÄß CÈÄÄ®Qè¹
- D) ÈÀªÀª «ªÀÄ±Éð - ¥ÀæªÀªªÀ, ¥ÉæÄgÀuÉ, zÀÈ¶ÖPÉÆÄÈÀ ¥ÀæªÀÄÄR  
 «ªÀÄ±ÀðPÀgÀÈÀÄß CÈÄÄ®Qè¹
- E) zÀªÀ, §AqÁAiÀÄ «ªÀÄ±Éð - ÈÉzÁPwPÀ æªÀÄÄUÀ¼ÀÄ ¥ÀæªÀÄÄR  
 «ªÀÄ±ÀðPÀgÀÈÀÄß CÈÄÄ®Qè¹
- F) ¹ÛçÄªÁç «ªÀÄ±Éð - ¥ÀæªÀªªÀ, ¥ÉæÄgÀuÉ, DªÀAiÀÄUÀ¼ÀÄ ¥ÀæªÀÄÄR  
 «ªÀÄ±ÀðPÀgÀÈÀÄß CÈÄÄ®Qè¹

G) „ÁÀ,ÀÌøwPÀ «<sup>a</sup>ÀÄ±Éð ©üfÀß fÉ-ÉUÀ¼ÄÄ ¥Àæ<sup>a</sup>ÄÄÄR  
«<sup>a</sup>ÀÄ±ÀðPÀgÀfÀÄß CfÀÄ®Që¹

**WÀIPÀ : 4**

**¥ÀÆgÀPÀ ¥ÀoÀå : «<sup>a</sup>ÀÄ±Áð „ÀAUÁw**

**C) «<sup>a</sup>Ài±Áð <sup>a</sup>ÀiÁzÀj CzÀåAiÀÄfÀ**

1. „ÀgÉÆÄ<sup>a</sup>ÀgÀzÀ 1jUÀfÀßrAiÀÄ°è – PÀÄ<sup>a</sup>ÉA¥ÀÄ
2. ¥ÀæÉÖ <sup>a</sup>ÀÄvÀÄÛ ¥Àj,ÀgÀ MAzÀÄ n¥ÀàtÀ – AiÀÄÄ.Dgi. CfÀAvÀ<sup>a</sup>ÄÄÆwð
3. „Á»vÁå©ü<sup>a</sup>ÀQÛAiÀÄ°è „Á<sup>a</sup>ÀiÁfÀå <sup>a</sup>ÀÄfÀÄµÀå - ¹zÀÝ°AUÀAiÀÄå
4. PÀfÀßqÀ „Á»vÁå MAzÀÄ ¹Ûç¥ÀgÀzÀÈ¶Ö : ©.Jfï. „Ä«ÄvÁæ·Á-Ä

**WÀIPÀ : 5**

**D) «<sup>a</sup>ÀÄ±ÉðAiÀÄ C<sup>·</sup>sÁå,ÀPÁÏV DAIÀÄÝ ¥ÀoÀå °sÁUÀUÀ¼ÄÄ**

**1. ¥ÀzÀå<sup>·</sup>sÁUÀUÀ¼ÄÄ**

UÉÆ§âgÀ : PÀÄ<sup>a</sup>ÉA¥ÀÄ  
C<sup>a</sup>Àé : †. ®APÉÄ±ï  
<sup>a</sup>ÀiÁA,ÀzÀAUÀrAiÀÄ fÀ«®Ä : Jfï.PÉ. °ÀfÀÄ<sup>a</sup>ÄÄAvÀAiÀÄå  
zÉÄ«<sup>a</sup>ÀÄ°ÁvÉä : ®°vÀ ¹zÀÝ§,À<sup>a</sup>ÀiÀÄå

**2.PÀvÉUÀ¼ÄÄ**

„ÉgÉ : AiÀÄ±À<sup>a</sup>AvÀ avÁÛ®  
zÉÄ<sup>a</sup>ÀgÀ zÁj : <sup>a</sup>ÉÆUÀ¼Ä UÀuÉÄ±À

**WÀIPÀ – 6 <sup>a</sup>ÀÄvÀÄÛ WÀIPÀ 7 : ¥ÀoÁåzÀÁjvÀ ZÀiÄ<sup>a</sup>ÀnPEUÀ¼ÄÄ**

**(iÄåmÉÆÄjAiÀÄ-ï)**

- «<sup>a</sup>ÀÄ±ÉðAiÀÄ fÉ-ÉUÀ¼ÄfÀÄß UÀ<sup>a</sup>ÄÄç,ÀÄ<sup>a</sup>ÀÄzÀÄ <sup>a</sup>ÀÄvÀÄÛ  
¥ÀæAiÉÆÄVPÀ «<sup>a</sup>ÀÄ±Éð <sup>a</sup>ÀiÁqÀÄ<sup>a</sup>ÀzÀÄ
- ¥ÀÆgÀPÀ «<sup>a</sup>ÀÄ±ÉðAiÀÄ -ÉÄRfÀUÀ¼Ä „ÀAUÀæ°À
- «<sup>a</sup>ÀÄ±ÀðPÀgÀfÀÄß „ÀAzÀð,ÀÄ<sup>a</sup>ÀÄzÀÄ, „ÀA<sup>a</sup>ÁzÀ fÀqÉ,ÀÄ<sup>a</sup>ÀÄzÀÄ
- «zÀåyðUÀ¼ÄÄ „ÀévÀB «<sup>a</sup>ÀÄ±Éð §gÉAiÀÄÄ<sup>a</sup>AvÉ ¥ÉÆæÄvÁi»,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- PÀfÀßqÀzÀ ¥Àæ<sup>a</sup>ÄÄÄR «<sup>a</sup>ÀÄ±ÀðPÀgÀfÀÄß, ¥Á±ÁÑvÀå «<sup>a</sup>ÀÄ±ÀðPÀgÀfÀÄß  
UÀÄgÀÄw,ÀÄ<sup>a</sup>ÀÄzÀÄ <sup>a</sup>ÀÄvÀÄÛ «<sup>a</sup>ÀgÀUÀ¼ÄfÀÄß „ÀAUÀæ»,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- «zÀåyðUÀ¼ÄzÀÄ «<sup>a</sup>ÀÄ±Éð PÀÄjvÀÄ ¥Àæ§AzÀUÀ¼ÄfÀÄß  
¹zÀP¥Är,ÀÄ<sup>a</sup>ÀÄzÀÄ CzÀfÀÄß <sup>a</sup>ÀÄAr,À®Ä GvÉÛÄf,ÀÄ<sup>a</sup>ÀÄzÀÄ.



**ƳÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ**

1. vĒ®PÀ PÁªÀª«ÄªªÀiÁA,É : JZi. wƳÉàÃgÀÄzÀæ,Áé«Ä
2. ƳÁ±ÁÑvÀª PÁªÀª«ÄªªÀiÁA,É : E£ÁAzÁgĩ. «,JA
3. «ªÀÄ±ÉðAiÀÄ ƳÀj'sÁµÉ : N.J.ĩ. £ÁUÀ'sÀÆµÀt,Áé«Ä
4. |æŋƳÀ- ĩi DƳsĩ °lgÀj Qæn'dA : L. J. jZÀqĩð
5. ç ƳsÀAPÀèfi DƳsĩ Qæn'dA : n. J.ĩ. E°AiÀÄmĩ
6. Cj,ÁÖl®£À PÁªÀª«ÄªªÀiÁA,É : Jfi. °Á®,ÄÄ§æ°Àätå
7. ƳÁ±ÁÑvÀª «ªÀÄ±ÉðAiÀÄ ƳÀQè£ÉÆÄI : ,ÁA. f.  
±ÀAPÀgÀAiÀÄª
8. ,ÁA,ÀiøwPÀ CzSÀªAiÀÄ£À : gÀªªÀÄvi vÀjPÉgÉ
9. ,Á»vÀª «ªÀÄ±Éð : °Jfi. gÁªªÄZÀAzÀæfi
10. ªZÀ£À «£Áª,À : VgÀrØ UÉÆÄ«AzÀgÁei

**LzÀ£ÉAiÀÄ ZÀvÀÄªªÀiÁð,À**

**LaÒPÀ PÀ£ÀBqÀ**

**r.J.ĩ.E - ƳÀwæPÉ -5.2(DSE)**

**Course code : ELE25223 ELE25226**

**«±ÉÄµÀ PÀ« PÁªÀª CzSÀªAiÀÄ£À ªÄvÀÄÛ ƳÀÆgÀPÀ ƳÀoÀª**

**«±ÉÄµÀ PÀ« : PÀªªÉAƳÄÄ**

**WÀIPÀ 1 : PÀ«PÁªÀª »£ÉB-É : ,ÀÆÛ® ƳÀjZÀAiÀÄ**

- C) PÁ®, ,ÀAzÀ'sÀðªªvÀÄÛ ƳÉæÃgÀuÉ Ƴæ'sÁªUÀ¼ÀÄ
- D) PÀ«AiÀÄ fªªÀ£ÀªªvÀÄÛ ,Á»vÀªPÀ ,ZsÀ£ÉUÀ¼ÀÄ
- E) ,Á»vÀª gÀZÀ£ÉAiÀÄ ,ÁégÀÆƳªªvÀÄÛ ®PÀètUÀ¼ÀÄ
- F) ,ªªPÁªÀ£À ,àAzÀ£ÀªªvÀÄÛ ZÁjwæPÀªªªvÀé

**WÀIPÀ 2 – ƳÀzÀª £ÁIPÀ (DAiÀÄÝ °sÁUÀUÀ¼ÀÄ)**

- C) ƳÀæÁƳæ'sÀÄvÀé vÀvÀé : CvÀÛ- Á zÉÈvÀª  
,À'sÉAiÉÆÄ¼i (ªªªPÁªª)
- D) °ÛÃ ,ªªÉÄzÀ£É : £ÁV (PÀxÀ£À PÀªÀ£À)
- E) fªªÀƳÀj,ÀgÀzÀ ƳÀæÉÖ : °sªªVªvÉUÀ¼ÀÄ
- F) ,ªªÇÃðzÀAiÀÄ : d®UÁgÀ (£ÁIPÀ)

**WÀIPÀ : 3 – UÀzÀª PÀxÀ£À (DAiÀÄÝ °sÁUÀUÀ¼ÀÄ)**

- C)  $v\frac{1}{4}\dot{\Lambda} - \acute{E}\acute{E}\acute{A}\acute{P}\acute{A}z\dot{\Lambda} \text{ } \text{£}\acute{A}i\acute{\Lambda}\acute{A}\acute{P}\acute{A}v\acute{\Lambda}\acute{e} : \acute{a}\acute{\Lambda}\acute{\Lambda} - \acute{E}U\frac{1}{4}\dot{\Lambda}^{\circ}e$   
 $\acute{a}\acute{\Lambda}\acute{z}\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{\Lambda}\acute{U}\frac{1}{4}\acute{\Lambda}\acute{\Lambda}$  (PÁZÀA§j)
- D)  $C\text{£}\acute{\Lambda}\acute{B}z\acute{A}v\acute{\Lambda}\text{£}\acute{\Lambda} \text{ } \text{,}\acute{\Lambda}\acute{a}\acute{\Lambda}\acute{\Lambda},\acute{E}\acute{a} : z\text{£}\acute{\Lambda}\acute{e}A v\acute{\Lambda}j aQv\acute{E}i$  (PÀxÉ)
- E)  $\acute{a}\acute{E}\acute{E}z\acute{A}jP\acute{A}v\acute{E} : \langle z\acute{A}g\acute{\Lambda}P\acute{A}\acute{e}AwU\acute{E} D^{\circ}\acute{A}\acute{e}\text{£}\acute{\Lambda} (aAv\acute{\Lambda}\text{£}\acute{E})$
- F)  $\text{£}\acute{A}q\acute{\Lambda}\acute{\Lambda} \text{£}\acute{\Lambda}\acute{A}r \langle z\acute{A}g\acute{\Lambda} : \text{¨}\acute{A}j,\acute{\Lambda}\acute{\Lambda} P\acute{\Lambda}\text{£}\acute{\Lambda}\acute{B}q\acute{\Lambda} rAr\acute{a}\acute{\Lambda}\acute{\Lambda} (-\acute{E}\acute{A}R\text{£}\acute{\Lambda})$

**WÀIPÀ : 4**

**¥ÀÆgÀPÀ ¥ÀoÀå : PÀÄ<sup>a</sup>ÉA¥ÀÄ ,Á»vÀå ,ÀAUÁw**

**DvÀäPÀxÀ£ÁvÀäPÀ §gÀ<sup>o</sup>ÀUÀ¼ÄÄ: <sup>a</sup>ÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ**

**¨sÁUÀUÀ¼ÄÄ)**

- C.  $Ct\acute{U}\text{£}\acute{\Lambda} \text{£}\acute{E}\text{£}\acute{\Lambda}\text{¥}\acute{\Lambda}\acute{\Lambda} : P\acute{E}. |. \text{¥}\acute{\Lambda}\acute{E}t\acute{\delta}z\acute{\Lambda}Az\acute{\Lambda}\acute{e} v\acute{E}\acute{\Lambda}d\acute{e}$
- D.  $\acute{a}\acute{\Lambda}\acute{U}\frac{1}{4}\dot{\Lambda}\dot{\Lambda} P\acute{A}Aq\acute{\Lambda} P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} : v\acute{A}jt\acute{A}$   
 $az\acute{\Lambda}\text{£}\acute{\Lambda}Az\acute{\Lambda}$
- E.  $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda}U\acute{E} \text{¥}\acute{\Lambda}\acute{I}\acute{O} P\acute{\Lambda}\text{£}\acute{\Lambda}Br : P\acute{E}. \langle. \text{,}\acute{\Lambda}\acute{\Lambda}\text{£}\acute{\Lambda}t\acute{U}$
- F.  $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} C^a\acute{g}\acute{\Lambda} P\acute{E}\acute{E}\text{£}\acute{E}Ai\acute{\Lambda}\acute{\Lambda} \text{ } \text{¢}\text{£}\acute{\Lambda}U\frac{1}{4}\dot{\Lambda}\dot{\Lambda} : z\acute{E}\acute{\Lambda}dU\acute{E}$

**WÀIPÀ : 5**

**,Á»vÀå C<sup>a</sup>À-ÉÆĀPÀ£À §gÀ<sup>o</sup>ÀUÀ¼ÄÄ : <sup>a</sup>ÀiÁzÀj CzsÀåAiÀÄ£À (DAiÀÄÝ**

**¨sÁUÀUÀ¼ÄÄ)**

- C)  $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} P\acute{A}\acute{E}w \text{¥}\acute{\Lambda}\acute{e}\acute{E}\acute{\Lambda}\pm\acute{\Lambda} : \text{,}\acute{\Lambda}\acute{A}d\text{£}\acute{\Lambda}$
- D)  $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} P\acute{A}\acute{a}\acute{\Lambda}\langle\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{I}\acute{A}\text{,}\acute{E} : f. J,\acute{i}. \text{ } ^2\acute{a}\acute{g}\acute{\Lambda}\acute{z}\acute{\Lambda}\acute{e}\text{¥}\acute{\Lambda}\acute{\Lambda}$
- E)  $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} \text{£}\acute{A}IP\acute{A}U\frac{1}{4}\dot{\Lambda}\dot{\Lambda} : \text{£}\acute{\Lambda}g\acute{\Lambda}^{\circ}\acute{\Lambda}\frac{1}{2}\text{¨}\acute{A}\text{®}\text{,}\acute{\Lambda}\acute{\Lambda}\text{£}\acute{\Lambda}^{\circ}\acute{\Lambda}\acute{a}t\acute{a}$
- F)  $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} P\acute{A}z\acute{\Lambda}Az\acute{\Lambda}jU\frac{1}{4}\dot{\Lambda}\dot{\Lambda} : \text{©.J}\acute{£}\acute{i}. \text{ } \text{,}\acute{\Lambda}\acute{\Lambda}\langle\acute{A}v\acute{A}\acute{e}\text{¨}\acute{A}\text{¨}\acute{A}$

**WÀIPÀ – 6 <sup>a</sup>ÀÄvÀÄŪ WÀIPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀIÄ<sup>a</sup>ÀnPEUÀ¼ÄÄ**

**(IÄåmÉÆĀjAiÀÄ-ı)**

- $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} C^a\acute{A}jU\acute{E} \text{,}\acute{\Lambda}A\text{£}A\text{¢}\acute{u}^1z\acute{\Lambda} \text{ } \text{ } \acute{a}\acute{I}\acute{A}\text{»}wU\frac{1}{4}\dot{\Lambda}\dot{\Lambda}\text{£}\acute{\Lambda}\acute{\Lambda}\acute{B} \text{,}\acute{\Lambda}AU\acute{\Lambda}\acute{e}\text{»}\text{,}\acute{\Lambda}\text{®}\acute{\Lambda} \text{,}\acute{\Lambda}\acute{E}a \text{,}\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{\Lambda}z\acute{\Lambda}\acute{\Lambda}.$
- $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} C^a\acute{g}\acute{\Lambda} P\acute{A}\acute{E}wU\frac{1}{4}\dot{\Lambda}\dot{\Lambda}\text{£}\acute{\Lambda}\acute{\Lambda}\acute{B} \text{,}\acute{\Lambda}AU\acute{\Lambda}\acute{e}\text{»}\text{,}\acute{\Lambda}\text{®}\acute{\Lambda} \text{,}\acute{\Lambda}\acute{E}a \text{,}\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{\Lambda}z\acute{\Lambda}\acute{\Lambda}.$
- $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} C^a\acute{g}\acute{\Lambda} \text{¨}s\acute{A}\mu\acute{\Lambda}tU\frac{1}{4}\dot{\Lambda}\dot{\Lambda} DrAi\acute{E}\acute{E}\acute{A}U\frac{1}{4}\dot{\Lambda}\dot{\Lambda}\text{£}\acute{\Lambda}\acute{\Lambda}\acute{B} P\acute{E}\acute{\Lambda}\frac{1}{2}\text{,}\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{\Lambda}z\acute{\Lambda}\acute{\Lambda}$
- $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} C^a\acute{A}jU\acute{E} \text{,}\acute{\Lambda}A\text{£}A\text{¢}\acute{u}^1z\acute{\Lambda} \langle rAi\acute{E}\acute{E}\acute{A}U\frac{1}{4}\dot{\Lambda}\dot{\Lambda}\text{£}\acute{\Lambda}\acute{\Lambda}\acute{B} \text{¥}\acute{\Lambda}\acute{e}z\acute{\Lambda}^2\acute{\delta},\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{\Lambda}z\acute{\Lambda}\acute{\Lambda}.$
- $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} V\acute{A}v\acute{E}U\frac{1}{2}U\acute{E} g\acute{A}U\text{,}\acute{\Lambda}AAi\acute{E}\acute{E}\acute{A}d\text{£}\acute{E} \text{ } \text{ } \acute{a}\acute{I}\acute{A}r^1 \text{ } \text{ } \acute{a}\acute{r} \text{,}\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{\Lambda}z\acute{\Lambda}\acute{\Lambda}.$
- $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} \text{£}\acute{A}IP\acute{A}U\frac{1}{4}\dot{\Lambda}\dot{\Lambda}\text{£}\acute{\Lambda}\acute{\Lambda}\acute{B} C\acute{u}\text{£}\acute{\Lambda}\text{¨}\acute{A}\text{,}\acute{\Lambda}\text{®}\acute{\Lambda} \text{¥}\acute{E}\acute{e}\acute{\Lambda}g\acute{E}\acute{\Lambda}\text{,}\acute{\Lambda}\acute{\Lambda}\acute{a}\acute{\Lambda}z\acute{\Lambda}\acute{\Lambda}.$
- $P\acute{A}\acute{A}\acute{E}A\text{¥}\acute{\Lambda}\acute{\Lambda} C^a\acute{g}\acute{\Lambda} \text{ } \text{ } \acute{a}\acute{\Lambda}\acute{I}\acute{E}\acute{O}jU\acute{E} \text{¥}\acute{\Lambda}\acute{e}\acute{A} \text{,}\acute{\Lambda} P\acute{A}\acute{E}U\acute{E}\acute{E}\frac{1}{4}\dot{\Lambda}\dot{\Lambda}\acute{r}\acute{a}\acute{\Lambda}z\acute{\Lambda}\acute{\Lambda}$





- £ÁIPÀzÀ Cü£ÀAiÀÄ ¥ÀÆªÀðPÀ NzÀÄ (,ÁªÄÄÆ»PÀªÁV Cü£Àß ¥ÁvÀæUÀ¼À£ÀÄß ¯ªÀð»,ÄÄ«PÉ).
- £ÁIPÀzÀ ¥ÀjPÀgÀ ¹zÀp¥Àr,ÄªªÀÄzÀÄ (´É¼ÀPÀÄ, gÀAUÀ«£Áª,À EvÁªç)
- £ÁIPÀ gÀAUÀ¥ÀæzÀ±Àð£À
- QgÀÄ£ÁIPÀ gÀZÀ£ÉUÉ GvÉÛÄd£À
- KPÀ¥ÁvÁæCü£ÀAiÀÄPÉÌ ¥ÉÆæÃvÁiªÀ

**¥ÀgÁªÄ±Àð£À UÀæAxÀUÀ¼ÀÄ**

1. £Álª±Á,ÀÛç : ¨sÀgÀvÀ
2. zÀ±ÀgÀÆ¥ÀPÀ : zsÀ£ÀAdAiÀÄ
3. Cü£ÀAiÀÄ zÀ¥Àðt : £ÀAçPÉÄ±ÀégÀ
4. ¨sÁgÀwÃAiÀÄ PÁªÀª «ÄªªÀiÁA,É : wÃ.£ÀA.  
²æÃPÀAoÀAiÀÄª
5. Cj,ÁÖΓ i£À PÁªÀªª«ÄªªÀiÁA,É : J£i, ÄÄªæªÀätª
6. jPÀÛ gÀAUÀ¨sÀÆ«Ä : §mÉÆÄð iÖ ¨ÉæPiÖ
7. £À£ÉAiÀÄ ¥ÁoÀUÀ¼ÀÄ : ¥Àæ,À£Àß
8. PÀ£ÀßqÀ gÀAUÀ¨sÀÆ«Ä : ªÄgÀÄ¼ÀÄ  
¹zÀp¥Àà.PÉ
9. gÀAUÀ¥ÀæAiÉÆÄUÀ : PÉ.«.CPÀégÀ
10. VæÃPi gÀAUÀ¨sÀÆ«ÄªªvÀÄÛ £ÁIPÀUÀ¼ÀÄ : J i. J, i.  
±ÉÄµÀVjgÁª
11. ²PÀëtªÀªè £ÁIPÀªªvÀÄÛ PÀ-É : qÁ. J£i. JA. VjeÁ¥Àw

**LzÀ£ÉAiÀÄ ZÀvÀÄªÀiÁð,À**

**LaÒPÀ PÀ£ÀßqÀ**

**r.J, i. E - ¥ÀwæPÉ -5.4(DSE)**

**Course code : ELE25623/ELE25626**

**ªÄªª¼ÀÁ,ÁªªvÀªzÀ CzsÀªAiÀÄ£ÀªªvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀª**

**WÀIPÀ 1 : C)ªÄªª¼ÀÁ,ÁªªvÀª :**

CUÀvÀävÉ ÀégÀÆÿÀ. GUÀ<sup>a</sup>ÄÄ, «PÁ,À <sup>a</sup>ÄvÄÄÛ CzsÀâAiÄÄ£ÀzÀ

**WÀIPÀ 2 – <sup>a</sup>ÄÄ»¼Á, Á»vÀâ CzsÀâAiÄÄ£À ««zsÀ °ÀAvÀUÀ¼ÄÄ**

- C) d£ÀÿÀzÀ
- D) <sup>a</sup>ÄZÀ£À <sup>a</sup>ÄvÄÄÛ zÁ,À,Á»vÀâ
- E) MqÉAiÄÄgÀ PÁ@zÀ,Á»vÀâ

**WÀIPÀ : 3 – EÿÀävÀÛ£ÉAiÄÄ ±ÀvÀ<sup>a</sup>ÄiÄ£ÀzÀ <sup>a</sup>ÄÄ»¼Á, Á»vÀâ**

- C) ,ÁévÀAvÀæöâ ÿÀÆ<sup>a</sup>Äð,Á»vÀâ
- D) d£À;æAiÄÄ <sup>a</sup>ÄÄ»¼Á,Á»vÀâ
- E) ,ÁévÀAvÉÆæöâÛvÀÛgÀ <sup>a</sup>ÄÄ»¼Á,Á»vÀâ
- F) <sup>1</sup>ÛçÃ<sup>a</sup>ÁzÀ - ÿÀæ<sup>·</sup>s<sup>a</sup>À, ÿÉæÃgÀuÉUÀ¼ÄÄ
- G) §AqÁAiÄÄ, zÀ<sup>°</sup>vÀ, <sup>a</sup>ÄÄÄ<sup>1</sup>èA ,ÀA<sup>a</sup>ÉÄzÀ£ÉUÀ¼ÄÄ
- H) EwÛÄa£À ÿÀæ<sup>a</sup>ÀÈwÛUÀ¼ÄÄ
- IÄ) <sup>1</sup>ÛçÃ C£À£ÀävÉAiÄÄ °ÄÄqÀÄPÁl

**WÀIPÀ : 4**

**ÿÀÆgÀPÀ ÿÀoÀâ : <sup>a</sup>ÄÄ»¼Á, Á»vÀâ ,ÀAUÁw**  
**<sup>a</sup>ÄiÄzÀj CzsÀâAiÄÄ£À (DAiÄÄÝ <sup>·</sup>sÁUÀUÀ¼ÄÄ)**  
**DAiÄÄÝ PÀ«vÉUÀ¼ÄÄ**

- 1. <sup>·</sup>É¼ÉUÉgÉ eÁ£ÀPÀ<sup>a</sup>ÄÄä2. ,À. GμÁ 3. J,i. <sup>a</sup>ÄiÄ@w
- 4. JA.Dgĩ. PÀ<sup>a</sup>ÄÄ® 5. ,À©Ã<sup>°</sup>Á <sup>·</sup>sÀÆ«ÄUËqÀ 6. PÀ«vÁ gÉÊ

**WÀIPÀ : 5**

**<sup>a</sup>ÄiÄzÀj CzsÀâAiÄÄ£À (DAiÄÄÝ <sup>·</sup>sÁUÀUÀ¼ÄÄ)**  
**DAiÄÄÝ PÀvÉUÀ¼ÄÄ:**

- 1. . «ÃuÁ ±ÁAvÉÄ±ÀégÀ 2. <sup>·</sup>Á£ÀÄ<sup>a</sup>ÄÄÄμÁÛPĩ

**DAiÄÄÝ UÀzÀâ<sup>·</sup>sÁUÀUÀ¼ÄÄ**

1. .<sup>a</sup>ÉÊzÉÄ»
2. ..<sup>s</sup>ÄÄ<sup>a</sup>À£ÉÄ±Àéj °ÉUÀqÉ

**DvÄäPÀxÀ£À DAIÄÄÝ ..<sup>s</sup>ÁUÀUÄ¼ÄÄ**

1. E¼Ä«dAiÄÄ
2. dAiÄÄ<sup>2</sup>æÄ

**WÀIPÀ – 6<sup>a</sup>ÄÄvÄÄÛ WÀIPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀIÄ<sup>a</sup>ÀnPEÜÄ¼ÄÄ**

**(IÄämÉÆÄjAiÄÄ<sup>-i</sup>)**

- <sup>a</sup>ÄÄ»¼Ä C©ü<sup>a</sup>ÀåQÛAiÄÄ «±ÉÄóµÀ UÄÄtUÄ¼Ä£ÄÄß (..<sup>s</sup>ÁµÉ, £ÄÄrUÀlÄÖ, ±ÉÊ° EvÄåç) UÄÄgÄÄgw, Ä®Ä , ÄÆa, ÄÄ<sup>a</sup>ÄÄzÄÄ.
- ,ÄzsÀQAIÄÄgÄ<sup>a</sup>ÄÄvÄÄÛ -ÉÄRQAIÄÄgÄ \$zÄÄPÄÄ, ,ÄzsÀ£É PÄÄjvÄÄ «ZÄgÄ UÉÆÄ¶xUÄ¼Ä£ÄÄß £ÄqÉ, ÄÄ<sup>a</sup>ÄÄzÄÄ.
- <sup>a</sup>ÄÄ»¼Ä PÉÄAçævÄ «µÄAiÄÄUÄ¼Ä \$UEÍ PÄ«vÉ, PÄvÉ \$gÉAIÄÄ®Ä GvÉÛÄf, ÄÄ<sup>a</sup>ÄÄzÄÄ
- <sup>a</sup>ÄÄ»¼Ä ,Ä»vÄå<sup>a</sup>ÄÄvÄÄÛ<sup>a</sup>ÄÄÄRå ,Ä»vÄå<sup>a</sup>ÄÄ£ÄÄß vÉ®PÄ<sup>a</sup>ÄV CzsÀåAiÄÄ£Ä<sup>a</sup>ÄiÄqÄ®Ä GvÉÛÄf, ÄÄ<sup>a</sup>ÄÄzÄÄ.
- «zÄåyðUÄ½UÉ C<sup>a</sup>ÄgÄ ¥Äj, ÄgÄzÄ°è «±ÉÄµÄ<sup>a</sup>ÄV UÄÄgÄÄw¹PEÆArgÄÄ<sup>a</sup>Ä<sup>a</sup>ÄÄ»¼ÄÉAIÄÄgÄ/ <sup>a</sup>ÄÄ»¼Ä ,ÄzsÀQAIÄÄgÄ \$UEÍ ¥Äæ\$AzsÄ \$gÉAIÄÄ®Ä ,ÄÆa, ÄÄ<sup>a</sup>ÄÄzÄÄ.

**¥ÄgÄ<sup>a</sup>ÄÄ±Äð£Ä UÄæAxÄUÄ¼ÄÄ**

1. PÄ£ÄßqÄ<sup>a</sup>ÄÄ»¼Ä ,Ä»vÄå ZÄjvÉæ : JZi. J, i. 2æÄ<sup>a</sup>ÄÄw
2. DzsÄÄPÄ<sup>a</sup>ÄÄ»¼Ä ,Ä»vÄå ZÄjvÉæ : ,ÄA. JA. GµÄ
3. PÄ£ÄßqÄ ,Ä»vÄå<sup>a</sup>ÄÄvÄÄÛ<sup>1</sup>ÛçÄ<sup>a</sup>Äç aAvÄ£É : ««zsÄ -ÉÄRQAIÄÄgÄÄ
4. ZÄ°ÄgÉ : JZi. J, i. 2æÄ<sup>a</sup>ÄÄw
5. PÄ£ÄßqÄ ,Ä»vÄå<sup>a</sup>ÄÄvÄÄÛ<sup>a</sup>ÄÄ»¼ÄÉ : ,Ä°Á ..<sup>s</sup>ÄÆ«ÄUËqÄ
6. <sup>1</sup>ÛçÄ<sup>a</sup>ÄzÄ : ©.Jfi. ,ÄÄ«ÄvÄæ<sup>-</sup>ÄÄ

**LaÖPÀ PÀ£ÀßqÀ**  
**r.J.i.E - ¥ÀwæPÉ -5.5(DSE)**  
**Course code : ELE25823/ELE25826**  
**PÀ£ÀßqÀ d£À¥ÀzÀ ‚Á»vÀå CzsÀåAiÀÄ£À**

**WÀIPÀ 1 :**

- C) PÀ£ÀßqÀ d£À¥ÀzÀ ‚Á»vÀå CzsÀåAiÀÄ£À ‚ÀégÀÆ¥À
- D) PÀ£ÀßqÀ ‚Á»vÀå ªÄvÀÄÛ d£À¥ÀzÀzÀ CAvÀgi ‚À§AzsÀUÀ¼ÄÄ

**WÀIPÀ 2 –**

- C) d£À¥ÀzÀ PÁªÀ : VÃvÉUÀ¼ÄÄ, PÀxÀ£ÀPªÀÀ£À, - ÁªÀtÁ, ªÄªPªªÀ – EªÀUÀ¼Ä ‚ÀégÀÆ¥À, ®PÀët (ªAiÁzÀj ¥ÀjZÀAiÀÄzÉÆAçUÉ)

**WÀIPÀ : 3**

- C) d£À¥ÀzÀ UÀzÀª : UÁzÉ, MUÀiÄ, LwªÀ, £ÄÄrUÀiÄÖ – EªÀUÀ¼Ä ‚ÀégÀÆ¥À, ®PÀët (ªAiÁzÀj ¥ÀjZÀAiÀÄzÉÆAçUÉ)
- D) d£À¥ÀzÀ PÀxÉ: ‚ÀégÀÆ¥À, ®PÀëtUÀ¼ÄÄ, ªVÃðPªgÀt, d£À¥ÀzÀ PÀxÉUÀ¼Ä «zsÀUÀ¼ÄÄ – gªªÀ PÀxÉUÀ¼ÄÄ, «£ÉÆÄzÀ PÀxÉUÀ¼ÄÄ, ¢Ãw PÀvÉUÀ¼ÄÄ

**WÀIPÀ : 4**

**¥ÀÆgÀPÀ ¥ÀoÀª : d£À¥ÀzÀ ‚Á»vÀå ‚ÀAUÁw**  
**ªAiÁzÀj CzsÀåAiÀÄ£À DAIÀÄÝ ªsÀUÀ¼ÄÄ**

- C) d£À¥ÀzÀ PÁªÀ – DAIÀÄÝ d£À¥ÀzÀ VÃvÉ, - ÁªÀtÁ, PÀxÀ£À PªªÀUÀ¼Ä CzsÀåAiÀÄ£À
- D) d£À¥ÀzÀ UÀzÀª – UÁzÉ, MUÀiÄ, LwªÀ, £ÄÄrUÀiÄÖUÀ¼Ä CzsÀåAiÀÄ£À
- E) d£À¥ÀzÀ ªÄªPªªÀ – DAIÀÄÝ ªÄªPªªÀUÀ¼Ä CzsÀåAiÀÄ£À

**WÀIPÀ : 5**

**¥ÀÆgÀPÀ - ÉÄR£ÀUÀ¼ÄÄ**

- C) d£ÀªÁtÁ ªÄgÄÄ PªªÀªÁtÁ ªÆªª – ©.JA.ªª
- D) d£À¥ÀzÀ ‚Á»vÀå CzÀgÀ ‚ÀégÀÆ¥À – ªªªiÁ £ÁAiÀÄPÀ
- E) eÁ£À¥ÀzÀ ªÄvÀÄÛ DzsÀÄPª ‚Á»vÀå – Q.gÀA. £ÁUÀgÁd
- F) PÉªªª Hgª ªÉ, ÀgÀÄUÀ¼ÄÄ ªÄvÀÄÛ CªªUÀ¼Ä »£Éß-É – ª.PÀ. gÁeÉÄUËqÀ



## WÀIPÀ – 6<sup>a</sup>ÀÄvÀÄÛ WÀIPÀ 7

### ÏÀoÁâzÁjvÀ ZÀiÄ<sup>a</sup>ÀnPEUÀ¼ÄÄ (iÄâmÉÆjAiÄÄ<sup>-i</sup>)

- PÀ£ÀßqÀzÀ<sup>è</sup> ÏÀæPÀIUÉÆArgÀÄ<sup>a</sup>À d£ÀÏÀzÀ ,Á»vÀâPÉi ,ÀA§Açü<sup>1</sup>zÀ ÏÀÄ,ÀÛPÀUÀ¼Ä£ÀÄß ,ÀAUÀæ»,À®Ä ,ÀÆa,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- d£ÀÏÀzÀ VÄvéUÀ¼Ä£ÀÄß C<sup>a</sup>ÀÄUÀ¼Ä<sup>a</sup>ÄÆ®<sup>a</sup>ÄÄiÄÖUÀ¼Ä<sup>è</sup> °ÁqÀ®Ä GvÉÛÄf,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- MUÀiÄUÀ¼Ä£ÀÄß °ÉÄ½ C<sup>a</sup>ÀÄUÀ¼ÄÉÆ¼ÄV£À ðUÀÆqsÀ CxÀð<sup>a</sup>À£ÀÄß UÀæ»<sup>1</sup> w½,ÀÄ<sup>a</sup>À ZÀiÄ<sup>a</sup>ÀnPEAiÄÄ£ÀÄß £ÀqÉ,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- d£ÀÏÀzÀ UÁzÉUÀ¼Ä CxÀð<sup>a</sup>À£ÀÄß «,ÀÛj,À®Ä ,ÀÆa,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- vÀ<sup>a</sup>ÄÄ ÏÀj,ÀgÀzÀ PÀ<sup>-</sup> Á«zÀgÀ£ÀÄß ,ÀAzÀ²ð<sup>1</sup> ,ÀA§Açü<sup>1</sup>zÀ<sup>a</sup>iÄ»wUÀ¼Ä£ÀÄß zÁR°,À®Ä w½,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- d£ÀÏÀzÀ PÀgÀPÀÄ±À® PÀ<sup>-</sup> ÁPÀÈwUÀ¼Ä£ÀÄß ,ÀAUÀæ»,À®Ä ,ÀÆa,ÀÄ<sup>a</sup>ÀÄzÀÄ.
- MAzÀÄ ðçðµÀÖ «µÀAiÄi<sup>a</sup>À£ÀÄß ,ÀÆa<sup>1</sup> CzÀ£ÀÄß PÀÄjvÀÄ UÁæ«ÄÄt<sup>1</sup> sÁµÉAiÄÄ<sup>è</sup> ÄiÄvÀ£ÁqÀ®Ä w½,ÀÄ<sup>a</sup>ÀÄzÀÄ.

### ÏÀgÁ<sup>a</sup>ÄÄ±Àð£À UÀæAxÀUÀ¼ÄÄ

1. eÁ£ÀÏÀzÀ CzsÀâAiÄÄ£À : zÉÄ.d.UË
2. eÁ£ÀÏÀzÀ ,ÀégÀÆÏÀ : °Á.<sup>a</sup>iÄ. £ÁAiÄÄPÀ
3. eÁ£ÀÏÀzÀ ÏÀÄgÁtUÀ¼ÄÄ : gÁUË
4. d£ÀÏÀzÀ ÏÀæ<sup>a</sup>ÉÄ²PÉ : 1,1.PÉ
5. Dç<sup>a</sup>Ä d£ÀÏÀzÀ : <sup>a</sup>ÉÆUÀ¼Äi UÀuÉÄ±À
6. UÁæ<sup>a</sup>ÄzÉÄ<sup>a</sup>vÉUÀ¼ÄÄ : 1zÀÝ°AUÀAiÄÄâ
7. eÁ£ÀÏÀzÀ CzsÀâAiÄÄ£À ,ÀAQèÏÀÛ Ew°Á,À : £ÀA.  
vÀÏÀ<sup>1</sup>éÄPÀÄ<sup>a</sup>iÄgï
8. zÀQèt PÀ£ÁðIPÀzÀ d£ÀÏÀzÀ PÁ<sup>a</sup>Ä ÏÀæPÁgÀUÀ¼ÄÄ :  
fÄ.±ÀA.ÏÀgÀ<sup>a</sup>ÄÄ<sup>2a</sup>ÄAiÄÄ

DgÀ£ÉAiÄ ZÀvÄÄªÀiÁð,À  
LaÒPÀ PÀ£ÀßqÀ  
r.J.ï.E - ¥ÀwæPÉ -6.1(DSE)  
Course code : ELF25026 ELF25023

¥ÀoÀå (C) °À¼ÀUÀ£ÀßqÀ ªÀPÀgÀt - ¥ÀoÀå ªÀvÀÄÛ ¥ÀæAiÉÆÛUÀ  
WÀIPÀ 1 :

C) PÉÃ²gÁd£À PÁ®, zÉÃ±À, ªÀQÛvÀé, PÀÈw ¥ÀjZÀAiÄÄ, ªÀPÀgÀt  
CzsÀªAiÄÄ£ÀzÀ CªÀ±ÀPÀvÉ

D) ªÀtðªÀiÁ-É : CPÀìgÀ, ªÀtð, ±ÀæªÀt, ZÁPÀèÄµÀ, ,ÀégÀUÀ¼ÄÄ,  
ªÀAd£ÀUÀ¼ÄÄ, ªÀVÃðAiÄ ªÀAd£ÀUÀ¼ÄÄ,  
AiÉÆÛUÀªÀUÀ¼ÄÄ, zÉÃ²ªAiÄÄ CPÀègÀUÀ¼ÄÄ,  
ªÀ°Á¥ÀætUÀ¼ÄÄ, ¾¼¼À, PÀÄ¼¼À, PÀè¼¼À «ZÁgÀ, ¥ÀAZÀ«zsÀ  
±ÀÄzÀPUEUÀ¼ÄÄ, ªÀtðªÀiÁ-ÉAiÄ ªÀtðUÀ¼À ,ÀASÁæðAiÄÄ  
,ÀÆvÀæUÀ¼ÄÄ: 1, 2, 3, 6, 7, 8, 10, 12, 14, 18, 22, 23, 24, 25, 26, 27, 41,  
42, 43,- 20 ,ÀÆvÀæUÀ¼ÄÄ

WÀIPÀ 2

C) ,ÀAçüUÀ¼ÄÄ : ,ÀAçü«ZÁgÀ, -ÉÆÃ¥À, DUªÀÄÄ, DzÉÃ±À, çévÀé  
,ÀAçüUÀ¼ÄÄ, ¥ÀæPÀÈw ¨sÁªÀ, ±ÀÄæwPÀµÀÖ,  
±ÀÄæw ,ÀªÀ, ,ÀAçü«PÀ®à  
,ÀÆvÀæUÀ¼ÄÄ: 53, 55, 56, 57, 58, 59, 60, 62, 63, 65, 66, 73 – 13  
,ÀÆvÀæUÀ¼ÄÄ

E) £ÁªÀÄ¥ÀæPÀgÀt : £ÁªÀÄ¥ÀzÀ – gÀÆqsÀ, C£ÀéxÀð, CAQvÀ,  
,Àªð£ÁªÀ ¨sÉzÀUÀ¼ÄÄ, ,ÀªÀ,ÀA,ÀìøvÀ  
°AUªÀÉÆA§vÀÄÛ vÉ¾A, ªÀZÀ£ÀUÀ¼À «ZÁgÀ, ªÀZÀ£À ¥À®èl,  
«¨sÀQÛ, - ,À¥ÀÛ«zsÀ «¨sÀQÛUÀ¼ÄÄ ªÀvÀÄÛ CªÀUÀ¼À §¼ÀPÉ,  
«¨sÀQÛ ¥À®èl, ¥ÀPÁgÀPÉì °ÀPÁgÀ

ÄÆvÄæU¼ÄÄ: 75, 76, 77, 81, 85, 86, 87, 88, 89, 100, 103, 106 – 18

ÄÆvÄæU¼ÄÄ

**WÀIPÀ : 3**

C) ÄªÄiÁÄ: ÄªÄiÁÄªÄÄvÄÄÛ CzÀgÀ ¨sÉÄzÀU¼ÄÄ: vÄvÄÄàgÄÄµÄ, çéUÄÄ, PÄªÄÄðzsÁgÁAiÄÄ, §°ÄÄ«æÄ», zÀéAzÀé, CªÄªÄÄÄªÄªÄªÄ (CA²Ä) QæAiÄiÁ, UÄªÄÄPÄªÄªÄvÄÄÛ Cj,ÄªÄiÁÄ

ÄÆvÄæU¼ÄÄ: 107, 109, 110, 111, 112, 114 – 06 ÄÆvÄæU¼ÄÄ

F) CSÁävÄ – zsÁvÄÄ, CSÁävÄ ¥ÄævÄªÄiÄÄU¼ÄÄ, zÄ – zÄ¥Ä –ªÄ JA§ PÄ®ÄÆZÀPÄ ¥ÄævÄªÄiÄÄU¼ÄÄ, ¥ÄæwµÉÄzsÄ, ¥ÄgÄÄµÄvÄæAiÄÄU¼ÄÄè QæAiÄiÁ¥ÄzÄzÄ gÄZÀféÉ, ¥ÄævÄªÄiÄÄU¼ÄÄ, PÄ®vÄæAiÄÄU¼ÄÄè QæAiÄiÁ¥ÄzÄU¼ÄÄ gÄZÀféÉ, ÄwÄ¥ÄÛ«Ä

ÄÆvÄæU¼ÄÄ: 115, 116, 127, - 04 ÄÆvÄæU¼ÄÄ

G) zsÁvÄÄ : vÄçÝvÁAvÄ ®PÄëtU¼ÄÄ, C¥ÄªÄªÄæA±Ä, CªÄªÄiÄÄU¼ÄÄ ÄªÄiÁÄféÄªÄ «ZÁgÄ, PÄÉÄßqÄzÄ C,ÄzsÁgÄt ®PÄëtU¼ÄÄ «ªÉÄZÀféÉ

**WÀIPÀ : 4**

¥ÄÆgÀPÄ ¥ÄoÄª :ªÄªPÄgÄt ÄAUÁw

ªÄiÁzÄj CzSÄªÄiÄÄféÄ

n.«.ªÉAPÄmÁZÀ® ±Á¹ÛçAiÄÄªÄgÄÄ ÄA¥Äç¹gÄªªÄ ±Ä§ÝªÄÄtÄzÄ¥ÄðtA PÄÈwAiÄÄèféÄ DÄiÄÄÝ 16 ®PÄëöª ¥ÄzÄªU¼ÄÄ

**WÀIPÀ : 5**

ªÄiÁzÄj CzSÄªÄiÄÄféÄ

ªÄªPÄgÄt ÄAUÄwU¼ÄÄféÄÄß PÄÄjvÄ DÄiÄÄÝ 4 ¨sÁUÄU¼ÄÄ

**WÀIPÀ – 6ªÄªvÄÄÛ WÀIPÀ 7 : ¥ÄoÄªzsÁjvÄ ZÄIÄªÄnPEÜU¼ÄÄ**

(IÄmÉÆÄjAiÄÄ~i)

- ÄÆvÄæU¼ÄÄféÄÄß PÄæªÄÄ§zÄPªÄv Nç,ÄªªÄªÄzÄÄ.
- ÄÆvÄæzÄ «ZÁgÄU¼UÉ ¥ÄæAiÉÆÄU¼ÄÄféÄÄß CféÄé-Ä,Ä®Ä ÄÆe,ÄªªÄªÄzÄÄ.

- PÁ<sup>a</sup>À<sup>å</sup>UÀ¼À ¨sÁUÀUÀ¼À£ÀÄß ðÃr C<sup>°</sup>ègÀÄ<sup>a</sup>À<sup>a</sup>ÁpÀgÀuÁA±ÀUÀ¼À£ÀÄß UÀÄgÀÄw,À®Ä w½,ÄÄ<sup>a</sup>ÀÄzÀÄ.
- ,ÀAçü<sup>a</sup>ÄÄvÀÄÛ ,À<sup>a</sup>ÀiÁ,À ¥ÀzÀUÀ¼À £ÀqÀÄ<sup>a</sup>Àt<sup>a</sup>ÀävÁå,ÀUÀ¼À£ÀÄß ¥ÀnÖ<sup>a</sup>ÀiÁr,ÄÄ<sup>a</sup>ÀÄzÀÄ.
- PÀ£ÀßqÀ<sup>a</sup>ÁpÀgÀtPÀgÀgÀ §zÀÄPÀÄ - §gÀ<sup>°</sup>À PÀÄjvÀ «ZÁgÀ UÉÆÄ¶» K¥Àðr,ÄÄ<sup>a</sup>ÀÄzÀÄ.
- ¥ÀzÀ§AzsÀUÀ¼À£ÀÄß gÀa,À®Ä<sup>a</sup>ÄÄvÀÄÛ ©r,À®Ä ,ÀÆa,ÄÄ<sup>a</sup>ÀÄzÀÄ.

**¥ÀgÀ<sup>a</sup>ÄÄ±Àð£À UÀæAxÀUÀ¼ÀÄÄ**

1. PÉÄ<sup>2</sup>ÄgÀd£À ±À§Ý<sup>a</sup>ÀÄtÀ zÀ¥Àðt : r.J<sup>-</sup>ï £ÀgÀ<sup>1</sup>A<sup>°</sup>ÁZÁgï
2. PÉÄ<sup>2</sup>gÀd£À ±À§Ý<sup>a</sup>ÀÄtÀzÀ¥Àðt : n.«. <sup>a</sup>ÉAPÀmÁZÀ® ±Á<sup>1</sup>Ûç
3. ±À§Ý<sup>a</sup>ÀÄtÀzÀ¥Àðt : J<sup>-</sup>ï. §,À<sup>a</sup>ÀgÀdÄ
4. ±À§Ý<sup>a</sup>ÀÄtÀzÀ¥Àðt : eÉ. J,ï. PÀÄ½î
5. C<sup>-</sup>ÉÆÄPÀ : JZi. J,ï. ©½Vj
6. ±À§Ý<sup>a</sup>ÀÄtÀ zÀ¥ÀðtzÀ 101 ,ÀÆvÀæUÀ¼ÀÄÄ : J.J,ï. dAiÀÄgÀA<sup>a</sup>ÄÄvÀÄÛ PÉ<sup>a</sup>ÄÄ<sup>°</sup>ÀzÉÄ<sup>a</sup>À¥Àà
7. zÀ¥Àðt çÄPÉ : C§ÄÝ<sup>-</sup>ï §¶Ägï
8. <sup>°</sup>¼ÀUÀ¼À£ÀßqÀ vÈ®ðPÀ CzsÀåAiÀÄ£À : PÉ. PÀÄ±Á®¥Àà UÈqÀ

**DgÀ£ÉAiÀÄ ZÀvÀÄ<sup>a</sup>ÀiÁð,À  
LaÒPÀ PÀ£ÀßqÀ  
r.J,ï.E - ¥ÀwæPÉ -6.2(DSE)  
Course code :ELF25226 ELF25223**

**«±ÉÄµÀ PÀ« PÁ<sup>a</sup>Àå CzsÀåAiÀÄ£À<sup>a</sup>ÄÄvÀÄÛ ¥ÀÆgÀPÀ ¥ÀoÀå  
«±ÉÄµÀ PÀ« : ¥ÀA¥À**

**WÀIPÀ 1 : ¥ÀA¥À£À PÁ®, zÉÄ±À, ZÁjwæPÀvÉ<sup>a</sup>ÄÄvÀÄÛ AiÀÄÄUÀzsÀ<sup>a</sup>ÄÄð**

**WÀIPÀ 2 – ¥ÀA¥À£À PÁ<sup>a</sup>ÀåUÀ¼ÀÄÄ**

C) Dç ¥ÄÄgÁt – DPÀgÀ, ªÄ,ÄÄÛ, ,ÀégÀÆ¥À, ¥ÁvÀæ avÀæt, ,ÀœßªÉÃ±À ,ÀÈ¶Ö

D) «PÀæªAiÁdÄð£À «dAiÄÄ - DPÀgÀ, ªÄ,ÄÄÛ, ,ÀégÀÆ¥À, ¥ÁvÀæ avÀæt, ,ÀœßªÉÃ±À ,ÀÈ¶Ö

**WÀIPÀ : 3 –**

C. Dç ¥ÄÄgÁt – DAiÄÄÝ ¨sÁUÀUÀ¼Ä CzsÀåAiÄÄ£À

CzsÀåAiÄÄ£À

D) «PÀæªAiÁdÄð£À «dAiÄÄ - DAiÄÄÝ ¨sÁUÀUÀ¼Ä

**WÀIPÀ : 4**

**¥ÀÆgÀPÀ ¥ÀoÀå : ¥ÀA¥À ,Á»vÀå ,ÀAUÁw**

**ªAiÁzÀj CzsÀåAiÄÄ£À (DAiÄÄÝ ¨sÁUÀUÀ¼ÄÄ)**

C. £ÁqÉÆÄd ¥ÀA¥À : ªÄÄ½AiÄÄ

wªÄä¥ÀàAiÄÄå

D. ¥ÀA¥À : wÃ.£ÀA.²æÃ

E. ¥ÀA¥À PÉ®ªÀª ªÄÄRUÀ¼ÄÄ : !.PÉ

F. ªÄvÉÛª ªÄvÉÛ ¥ÀA¥À : f. JZi. £ÁAiÄÄPÀ

**WÀIPÀ : 5**

**ªAiÁzÀj CzsÀåAiÄÄ£À (DAiÄÄÝ ¨sÁUÀUÀ¼ÄÄ)**

**¥ÀA¥À£À PÁªå PÄÄjvÀ «ªÄ±Áð - ÉÄR£ÀUÀ¼ÄÄ**

C) ¥ÀA¥À£À JgÀqÀÄ ¥ÀzÀåUÀ¼ÄÄ : n. J.ï. ªÉAPÀtÚAiÄÄå

D) ¥ÀA¥À£Àª ¨sªªåvÉ : PÄªªÉ¥ÀÄ

E) ¥ÀA¥À ¨sÁgÀvÀzÀª ªÄ,ÄÄÛ «£Áª,À : ,ÄÄd£Á

F) ¥ÀA¥À MAzÀªª ªÄiÈ®ª «ªÉZÀ£É : PÉ. !. ¥ÀÆtðZÀAzÀæ vÉÄd¹é

**WÀIPÀ – 6ªÄvÀÄÛ WÀIPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀLªªÀnPEUÀ¼ÄÄ**

**(LÄåmÉÆÄjAiÄÄ-ï)**

➤ ¥ÀA¥ÀœUÉ ,ÀAŞAçü¹zÀ ±Á,À£ÀzÀª ªAiÁ»wUÀ¼Ä£ÀÄß ,ÀAUÀæ»,À®Ä ,ÀÆa,ÀªªÄzÀÄ.

➤ ¥ÀA¥À£À PÄÈwUÀ½UÉ ,ÀAŞAçü¹zÀ «ªÄ±ÉðUÀ¼Ä£ÀÄß ,ÀAUÀæ»,À®Ä ,ÀÆa,ÀªªÄzÀÄ.

- $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
- $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
- $\forall x \exists y \exists z (\exists w (P(w) \wedge U(w,x) \wedge U(w,y) \wedge \neg U(w,z)))$
- $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
- $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$

**$\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$**

1.  $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : r.J i. Jf i.
2.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : J i. §,  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
3.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : J i. §,  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
4.  $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : J i. §,  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
5.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : J i. §,  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
6.  $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : «.1<sup>Ä</sup>
7.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : vÄ, ÄÄ.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
8.  $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : f. J, i. <sup>2a</sup>  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
9.  $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  :  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
10.  $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : PÉ. <sup>a</sup>EÊ.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
11.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : dAiÄÄ $\forall x \exists y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  ±i ±ÉnÖ. JZi.
12.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : <sup>1z</sup>ÄP°AUÄAiÄÄ
13.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : f. § $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$
14.  $\exists x \forall y \exists z (P(x) \wedge U(x,y) \wedge U(x,z) \wedge \neg P(z) \wedge \neg \exists w (U(x,w) \wedge P(w)))$  : J i. UÄÄAq

PÀ£ÀβqÀ ,Á»vÀâ ªÀÄvÀÄÛ PÀ£ÀβqÀ ¹ªÀiÁ

WÀIPÀ 1 : ¹ªÀiÁ ¥ÀjPÀ®à£É ªÀÄvÀÄÛ Ew°Á,À

C. ¹ªÀiÁzÀ ,ÀégÀÆ¥À, ®PÀèt

D. PÀ£ÀβqÀ ¹ªÀiÁ ¨É¼ÉzÀÄ §AzÀ §UÉ

WÀIPÀ 2 – ,Á»vÀâ ªÀÄvÀÄÛ ¹ªÀiÁ CAvÀgĭ ,ÀA\$AzsÀ

C. d£À¥ÀzÀ ,Á»vÀâ ªÀÄvÀÄÛ ¹ªÀiÁ

D. ¥ÈgÁtÁPÀ – ZÁjwæPÀ ,Á»vÀâ ªÀÄvÀÄÛ ¹ªÀiÁ

WÀIPÀ : 3 – ¹ªÀiÁ ªÀiÁzsÀªÀÄzÀ ªÀÄÛUÀ¼ÁV ,Á»vÀâ ¥ÀæPÁgÀUÀ¼ÄÄ

C) PÀxÉ PÁzÀA§j DzsÁjvÀ ¹ªÀiÁUÀ¼ÄÄ : ¨sÀÆvÀAiÀÄâ£À ªÀÄUÀ CAiÀÄÄâ, £ÁUÀgÀ°ÁÄÄ,

QgÀUÀÆj£À UÀAiÀiÁ½UÀ¼ÄÄ

D) £ÁIPÀ, PÀ«vÉ, ¹ªÀiÁUÀ¼ÄÄ - £ÁUÀªÀÄAqÀ®, GzÀãÀ, ,ÀAUÁªÁ¼Äâ, ªÉÄÊ,ÀÆgÀª ªÀÄ°èUÉ, PÉgÉUÉ °ÁgÀ

E) fÃÀ£À ZÁjvÉæ DzsÁjvÀ ¹ªÀiÁUÀ¼ÄÄ : ²±ÄÄ£Á¼À µÀjÃ¥sÀ, dUÀeÉÆãw §,ÀªÉ±ÀégÀ, ¨sÀPÀÛ PÀ£ÀPÀzÁ,À

WÀIPÀ : 4

¥ÀÆgÁPÀ ¥ÀoÀâ : ¹ªÀiÁ ,ÀAUÁw

ªÀiÁzÀj CzsÀªÀiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÄÄ)

C) ,ÀA¨sÁµÀuÉ gÀZÀ£É

D) avÀæPÀxÉ gÀZÀ£É

E) VÃvÀ gÀZÀ£É

WÀIPÀ : 5

PÀ£ÀβqÀzÀ ¹ªÀiÁUÀ¼ÄÄ : ªÀiÁzÀj CzsÀªÀiÀÄ£À (DAiÀÄÝ ¨sÁUÀUÀ¼ÄÄ)

C. ¨sÁµÉ : d£À¥ÀzÀ, ¥ÈgÁtÁPÀ - ¨Á®£ÁUÀªÀÄä §§Äæª°À£À

D. ªÀÄÛ : ,ÁªÀiÁfPÀ, PÀ- ÁvÀäPÀ - ¥sÀtÀAiÀÄªÀÄä, vÀ§gÀ£À PÀxÉ

E. ±ÉÊ° : £ÉÃgÀ ¢gÀÆ¥ÀuÉ, »£ÉÆßÃl vÀAvÀæ, (DAiÄÄÝ ¹¸ªÀiÁ ¸sÁUÀU¼À ¹ªÀiÁzÀj CzsÀªÀiÀÄ£À)

**WÀIPÀ – 6ªÀÄvÀÄÛ WÀIPÀ 7 : ¥ÀoÁåzsÁjvÀ ZÀlÄªÀnPEUÀ¼ÄÄ (lÄãmÉÆÄjAiÄÄ-ï)**

- ¥ÀoÁåPEÌ ¥ÀÆgAPÀªÀzÀ ¹¸ªÀiÁ ¥ÀæzÀ±Àð£ÀªÀ£ÀÄß K¥Àðr, ÄªÀªÀzÀÄ,
- ¹¸ªÀiÁ gÀ,ÀUÀæ°Àt ²©gÀUÀ¼Ä£ÀÄß K¥Àðr, ÄªÀªÀzÀÄ.
- ¹¸ªÀiÁzsÀªÀ,ÄÄÛ, D±ÀAiÄÄ, ¥ÁvÀæ avÀætUÀ¼Ä£ÀÄß PÄÄjvÀ UÄÄA¥ÄÄ ZÀZÉðUÀ¼Ä£ÀÄß K¥Àðr, ÄªÀªÀzÀÄ.
- DAiÄÄÝ PÀxÉUÀ¼Ä£ÀÄß, ÀÆa¹ CªÀÁUÀ½UÀ avÀæPÀxÉªÀÄvÀÄÛ, ÀªÀsÁµÀuÉUÀ¼Ä£ÀÄß §gÉ, ÄªÀªÀzÀÄ.
- ¹¸ªÀiÁ ¥ÄÄgªÀÀtÀUÀ¼Ä°è §gÀÄªÀ ZÀ®£À avÀæ «ªÀÄ±ÉðUÀ¼Ä£ÀÄß, ÀAUÀæ», ÄªÀªÀzÀÄ.
- VÄvÀ gÀZÀ£ÉªÀiÁqÀÄªÀAvÉ ¥ÉæÃgÉÄ, ÄªÀªÀzÀÄ.

**¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÄÄ**

1. PÀ£ÀßqÀ ¹¸ªÀiÁ : UÀAUÁzsÀgìªÉÆzÀªÀiÀiÁgì
2. CªÉÄjPª CªÉÄjPª avÀæPÀxÉ : £ÁUÀwªÀ½ZÀAzÀæ±ÉÄRgì
3. PÀxÉ, avÀæPÀxÉ, ÀªÀsÁµÀuÉ : eÉÆÄV
4. ¹¸ªÀiÁ, ÀAPÀxÀ£À : Dgì. ¹. UÉÆÄªÀzÀgÁdÄ,
5. ¹¸ªÀiÁAiÀiÁ£À : ¥ÀÄlÖ, ÁéªÀ.PÉ
6. ¥ÀÄlÖtÚ PÀtUÁ-ï: ¹¸ªÀiÁUÀ¼ÄÄ : J,ï. ¥Àæ, Ázi, ÁéªÀ
7. ÀªÀ»vÀªÀªÀvÀÄÛ ZÀ®£ÀavÀæ : PÉ. «. ÀªÀ§âtÚ
8. ÀªÀiÄÄªÀªÀªÀÄÄ£Àß £ÉÆÄqÀ-ÉÄ-ÉÄPÁzÀ 101 PÀ£ÀßqÀ ¹¸ªÀiÁUÀ¼ÄÄ : gÀªÀzÀæ
9. PÀ£ÀßqÀ avÀægÀAUÀ MAzÀÄª «ªÉZÀ£É : J,ï. ²æÄzsÀgÀªÀÄÆwð
10. qÁ. gÁdPÄªªÀiÁgì, ÀªÀÄUÀæ ZÀjvÉæ : zÉÆqÀØªÀ®ÆègÀÄ gÀÄPÉÆlÄf



DgÀ£ÉAiÄ ZÀvÄÄªAiÁð,À

LaÒPÀ PÀ£ÀβqÀ

r.J.ï.E - ¥ÀwæPÉ -6.4(DSE)

Course code : ELF25623/ELF25626

¥ÀæPÁgÀ PÉÃAçævÀ CzsÀªAiÄÄ£À : PÀ£ÀβqÀ ,Á»vÀª ¥ÀæPÁgÀ - ,ÀtÚ PÀxÉ

WÀIPÀ 1 : PÀxÉAiÄÄ ,ÀégÀÆ¥À.ªÄÄvÄÄÛ ®PÀët

C. ,ÀtÚPÀxÉ ¨É¼ÉzÄÄ §AzÀ zÁj

1. ,ÀA,ÀÌøvÀ PÀxÉUÀ¼ÄÄ »£Éβ-É

2. ¥Á±ÁÑvÀª ¥Àæ¨sÁª ¥ÉæÃgÀuÉ

3. d£À¥ÀzÀ ¥ÀgÀÄ¥ÀgÉ

WÀIPÀ 2 – PÀ£ÀβqÀ ,ÀtÚPÀxÉ ,Á»vÀª ¥ÀæPÁgÀzÀ ¥ÀjZÀAiÄÄ

C) °À¼ÄUÀ£ÀβqÀ, £ÀqÀÄÄUÀ£ÀβqÀ PÀvÉUÀ¼ÄÄ :ªqÁØgÁzsÀ£É,

zsÀªAiÁðªÄÈvÀ, ¥ÀAZÀvÀAvÀæ, gÁdgÀvÀβA PÀxÉ

D) ,ÁªAiÁfPÀ PÀxÉUÀ¼ÄÄ : £À£Àβ aPÀÌvÁ-Ä, zsÀªAiÄÄgÀ ,AvÀª£ÁgÁAiÄÄt

WÀIPÀ : 3 – PÀ£ÀβqÀ ,ÀtÚ PÀvÉUÀ¼ÄÄ ¨É¼ªªÀtÁUÉAiÄÄ Ewª,À

C) ¥ÀAeÉªªÄAUÉª±gÁAiÄÄjAzÀ EAç£ÀªgÉUÀÆ DAiÄÄÝ PÀvÉUÁgÀgÀ ¥ÀjZÀAiÄÄ

D) PÀ£ÀβqÀ ,ÀtÚ PÀvÉUÀ¼ÄÄ¨sÁµÉ, «£Áª,À, vÀAvÀæUÀ¼ÄÄ CzsÀªAiÄÄ£À (ªAiÁzÀj PÀxÉUÀ¼ÄÄÉÆAçUÉ)

WÀIPÀ : 4

¥ÀÆgÀPÀ ¥ÀoÀª : PÀxÁ ,Á»vÀª ,ÀAUÁw

PÀ£ÀβqÀ ,ÀtÚ PÀvÉUÀ¼ÄÄ :ªAiÁzÀj CzsÀªAiÄÄ£À DAiÄÄÝ¨sÁUÀUÀ¼ÄÄ

C. ,ÉÃrAiÄiÁ¥ÄÄ PÀÈµÀÚ¨sÀiÖ : ZÉ£ÉβªÄÄuÉ

D. D£ÀAzÀ : £Á PÉÆAzÀ °ÄÄqÄÄV

E. ±ÁAw£ÁxÀ zÉÃ,Á-Ä : Qëwd

F. £ÉÃ«ÄZÀAzÀæ B DAiÉÄÌ £ÀªÄÄª PÉÊªzÉ

G. CªÄÄgÉÃ±i £ÄÄUÀqÉÆÄtÄ : ,ªªj

H. gÁWªªÉÄAzÀæ ¥ÀnÃ® : zÉÃ,ÀUÀw

**WÀIPÀ : 5**

**<sup>a</sup>ÀiÁzÀj CzsÀâAiÀÄÆÀ (DAiÀÄÝ ``sÁUÀUÀ¼ÄÄ)**

**EwÛÄaÆÀ ¥Àæ<sup>a</sup>ÀÈwÛUÀ¼Ä CzsÀâAiÀÄÆÀ**

C. MAzÀÄ ¥ÄÄlzÀ PÀxÉ

D. «Äœ PÀxÉ

E. °Äœ PÀxÉ

F. <sup>a</sup>Amüÿi <sup>a</sup>ÄvÀÄÛ ¥sÉÄ, i§ÄPï PÀxÉUÀ¼ÄÄ

**WÀIPÀ – 6 <sup>a</sup>ÄvÀÄÛ WÀIPÀ 7 : ¥ÀoÁâzsÁjvÀ ZÀlÄ<sup>a</sup>AnPÉUÀ¼ÄÄ**

**(lÄâmÉÆÄjAiÀÄ<sup>-</sup>i)**

- PÀxÉUÀ¼ÄÆÀÄB Nç, ÄÄ<sup>a</sup>ÀzÀÄ.
- PÀxÉUÀ¼ÄÆÀÄB gÄa, ÄÄ<sup>a</sup>ÀAvÉ ¥ÉæÄgÉÄ, <sup>1a</sup>ÄÄzÀÄ.
- vÄ<sup>a</sup>ÄÄ ¥Äj, ÄgÀzÀ PÀvÉUÁgÄgÉÆAçUÉ, ÄA<sup>a</sup>ÁzÀ <sup>a</sup>ÄvÀÄÛ  
ÄAzÀ±ÄðÆÀUÀ¼ÄÆÀÄB K¥Äðr, ÄÄ<sup>a</sup>ÀzÀÄ.
- PÀxÉUÀ¼Ä°ègÄÄ<sup>a</sup> aAvÀÆÁvÀÄPÀ CA±ÀUÀ¼ÄÆÀÄB ZÀað, ÄÄ<sup>a</sup>ÀzÀÄ.
- Ä»vÄâ œAiÀÄvÀPÁ°PÀUÀ¼Ä°è ¥ÄæPÁ<sup>a</sup>ÁUÄÄ<sup>a</sup> EwÛÄaÆÀ PÀxÉUÀ¼Ä  
<sup>a</sup>ÀiÁzÀjUÀ¼ÄÆÀÄB ÄAUÄæ», ÄÄ<sup>a</sup>ÀzÀÄ.
- PÀxÁgÀZÀÆÀ PÄ<sup>a</sup>ÄÄlUÀ¼ÄÆÀÄB K¥Äðr, ÄÄ<sup>a</sup>ÀzÀÄ.
- ÄtÚPÀvÉUÀ¼ÄÆÀÄBzsÀjzÀ <sup>1a</sup>ÄiÁUÀ¼Ä ¥ÄæzÀ±ÄðÆÀÄÆÀÄB  
K¥Äðr, ÄÄ<sup>a</sup>ÀzÀÄ.

**¥ÄgÄ<sup>a</sup>ÄÄ±ÄðÆÀ UÄæAxÀUÀ¼ÄÄ**

1. ±ÄvÄ<sup>a</sup>ÀiÁÆÀzÀ ÄtÚPÀvÉUÀ¼ÄÄ : PÀÆÁðIPÀ Ä»vÄâ CPÁqÉ«Ä
2. °ÉÆ, ÄUÄÆÀßqÀzÀ CgÄÄuÉÆÄzÀAiÀÄ : <sup>2</sup>æÄœ<sup>a</sup>Ä, Ä°Á<sup>a</sup>ÆÀÆgÀ
3. °ÉÆ, ÄUÄÆÀßqÀ Ä»vÄâ ZÄjvÉæ : Jï, J, i. ±ÉÄµÀVjgÄ<sup>a</sup>i
4. AiÀÄÄUÄzsÀ<sup>a</sup>Äð<sup>a</sup>ÄvÀÄÛ PÀÆÀßqÀ Ä»vÄâ : QÄwðÆÁxÀ  
PÄÄvÀÄðPÉÆÄn
5. PÀxÀÆÀ Ä»vÄâ : f, J, i. C<sup>a</sup>ÄÄÆgÀ
6. PÀÆÀØqÀzÀ ÄtÚPÀvÉUÀ¼ÄÄ : f, JZi, ÄÁAiÀÄPÀ
7. fÄ<sup>a</sup>ÆÀ |æÄw : ÄA. PÁ¼ÉÄUËqÀ ÄÁUÄ<sup>a</sup>ÁgÀ
8. ÄévÀAvÉÆæÄvÀÛgÀ PÁ@zÀ PÀÆÀßqÀ Ä»vÄâ : GzÀAiÀÄ``sÁÆÄÄ  
PÄ<sup>-</sup>Ä, ÄAWÀ
9. PÀÆÀßqÀ PÀxÀÆÀ Ä»vÄâzÀ°è ÄA, ÄlØwPÀ ÄAWÄµÄð : Jfi. PÉ. PÉÆÄzÀAqÀ  
gÄ<sup>a</sup>ÄÄ
10. <sup>a</sup>ÀiÁ<sup>1</sup>ÛAiÀÄgÀ PÀxÉUÀ¼ÄÄ : J.JÆÄ. <sup>a</sup>ÄÄÆwðgÄ<sup>a</sup>i

**¥ÀoÁâzsÁjvÀ ZÀlÄ<sup>a</sup>ÀnPE, ¥ÀjÄPÉë<sup>a</sup>ÀÄvÄÄÛ<sup>a</sup>ÀiË®<sup>a</sup>ÀiÁ¥À£À ¥ÀæQæAiÉÄ**  
 PÀ<sup>-</sup>Á, <sup>a</sup>ÁtÁdâ<sup>a</sup>ÀÄvÄÄÛ «eÁÕ£À PÁAiÀÄUÀ½UÉ C£ÀéAiÀÄ<sup>a</sup>ÁUÀÄ<sup>a</sup>ÀAvÉ DAIÉÄÌ  
 DzsÁjvÀ UÄÄuÁAPÀ ¥ÀzÀPw (¹©¹J, ÿ) PÀ£ÀBqÀ<sup>a</sup>·sÁµÉ<sup>a</sup>ÀÄvÄÄÛ LaÒPÀ  
 ¥ÀwæPÉUÀ¼À ¥ÀoÀâPÀæ<sup>a</sup>ÀÄPÉÌ, ÀA§Açü¹zÀAvÉ PÀ£ÀBqÀ «<sup>a</sup>·sÁUÀzÀ  
<sup>a</sup>ÀÄÄRâ, ÀÜgÀÄ<sup>a</sup>ÀÄvÄÄÛ CzsÁâ¥ÀPÀjUÉ, ÀÆZÀ£ÉUÀ¼ÄÄ.

- ¥ÀoÁâzsÁjvÀ ZÀlÄ<sup>a</sup>ÀnPEUÀ¼À£ÄÄß PÀqÁØAiÀÄ<sup>a</sup>ÁV £ÀqÉ, ÄÄ<sup>a</sup>ÀÄzÄÄ
- ¥ÀoÁâzsÁjvÀ ZÀlÄ<sup>a</sup>ÀnPEUÀ¼À zÁR<sup>-</sup>ÉUÀ¼À£ÄÄß CzsÁâ¥ÀPÀgÄÄ  
 «zÁâÿðUÀ½AzÀ, ÀAUÀæ»¹, ÀAgÀQë, ÄÄ<sup>a</sup>ÀÄzÄÄ.
- ¥ÀoÁâzsÁjvÀ ZÀlÄ<sup>a</sup>ÀnPEUÀ¼À<sup>è</sup> «<sup>a</sup>·sÁUÀ<sup>a</sup>», ÄÄ<sup>a</sup>À «zÁâÿð «<sup>a</sup>ÀgÀUÀ¼À£ÄÄß  
 (ZÀlÄ<sup>a</sup>ÀnPEUÀ¼À, ÀégÀÆ¥À, «zÁâÿð<sup>è</sup>É, ÀgÄÄ, vÀgÀUÀw, ç£ÁAPÀ) n¥ÀàtÄ  
 ¥ÄÄ, ÀÛPÀzÀ<sup>è</sup> zÁR<sup>è</sup>, ÄÄ<sup>a</sup>ÀÄzÄÄ.
- ¥ÀoÁâzsÁjvÀ ZÀlÄ<sup>a</sup>ÀnPEUÀ½UÉ, À<sup>o</sup>ÁAiÀÄPÀ<sup>a</sup>ÁUÀÄ<sup>a</sup>ÀAvÉ «<sup>a</sup>·sÁUÀzÀ  
 UÀæAxÁ®AiÀÄ<sup>a</sup>À£ÄÄß gÀÆ, PÉÆ¼ÄÿÉÄPÄÄ
- ¹-1 : 15 CAPÀUÀ¼ÄÄ ZÀvÄÄ<sup>a</sup>ÀiÁð, À (É«Ä, ÀÖgï) DgÀA<sup>a</sup>·sÀ<sup>a</sup>ÁzÀ 8<sup>a</sup>ÁgÀUÀ¼ÄÄ  
 M¼ÀUÉ ¥Àæw WÀIPÀzÀ®Æè ±ÉÄ. 50gÀµÀÄÖ ¥ÀoÀâ<sup>a</sup>·ÉÆÄzsÀ£É  
<sup>a</sup>ÀiÁrgÀ<sup>a</sup>ÉÄPÄÄ. «<sup>a</sup>·ÉÆÄçü¹gÀÄ<sup>a</sup>À ¥ÀoÀâ «µÀAiÀÄUÀ¼À<sup>a</sup>ÉÄÄ<sup>-</sup>É ¹-1<sup>a</sup>ÀiË®<sup>a</sup>  
<sup>a</sup>ÀiÁ¥À£À ¥ÀæQæAiÉÄAiÀÄ£ÄÄß PÁAiÀÄð CxÀ<sup>a</sup>Á «ZÁgÀ  
<sup>a</sup>ÀÄAqÀ£É<sup>a</sup>ÀÄÆ®PÀ £ÀqÉ, ÄÄ<sup>a</sup>ÀÄzÄÄ.
- ¹-2 : CAPÀUÀ¼ÄÄ, ZÀvÄÄ<sup>a</sup>ÀiÁð, À (É«Ä, ÀÖgï) DgÀA<sup>a</sup>·sÀ<sup>a</sup>ÁzÀ 15<sup>a</sup>ÁgÀUÀ¼ÄÄ  
 M¼ÀUÉ ¥Àæw WÀIPÀzÀ®Æè ±ÉÄ. 100gÀµÀÄÖ ¥ÀoÀâ<sup>a</sup>·ÉÆÄzsÀ£É  
<sup>a</sup>ÀiÁrgÀ<sup>a</sup>ÉÄPÄÄ. «<sup>a</sup>·ÉÆÄçü¹gÀÄ<sup>a</sup>À ¥ÀoÀâ«µÀAiÀÄUÀ¼À<sup>a</sup>ÉÄÄ<sup>-</sup>É ¹-2<sup>a</sup>ÀiË®<sup>a</sup>  
<sup>a</sup>ÀiÁ¥À£À ¥ÀæQæAiÉÄAiÀÄ£ÄÄß QgÀÄ ¥ÀjÄPÉë<sup>a</sup>ÀÄÆ®PÀ  
 £ÀqÉ, ÄÄ<sup>a</sup>ÀÄzÄÄ.
- «±Àé«zÁâ®AiÀÄzÀ PÁiÀÄ<sup>a</sup>ÀÄUÀ¼À£ÀéAiÀÄ ¹-1<sup>a</sup>ÀÄvÄÄÛ ¹-2<sup>a</sup>ÀiË®<sup>a</sup>  
<sup>a</sup>ÀiÁ¥À£À ¥ÀæQæAiÉÄAiÀÄ zÁR<sup>-</sup>ÉUÀ¼À£ÄÄß, ÀAgÀQë¹qÀÄ<sup>a</sup>ÀÄzÄÄ.

- 1-3 : 70 CAPÀUÀ¼ÄÄ ªÄÄRâ ¥ÄjÄPÉë: ªÄÄÆgÄÄ UÀAmÉUÀ¼Ä CªÄçü: ¥ÄjÄPÉëAiÄÄÄ PÁ-ÉÄdÄ ªÄÄIÖzÀ°è £ÄqÉAiÄÄÄvÀÛzÉ.
- 1-1, 1-2, 1-3 : EªÄÄUÀ¼Ä §UÉÍ °ÉaÑ£Ä ªÄiÁ»wUÉ PÀ£ÄßqÄ «ªsÁUªª£ÄÄß ªÄÄ¥ÄQð,ÄÄªÄzÄÄ.

**DgÀ£ÉAiÄÄ ZÀvÄÄªÄiÁð,Ä**

**LaÒPÀ PÀ£ÄßqÄ**

**r.J.i.E - ¥ÄwæPÉ -6.5(DSE)**

**Course code : ELF25823/ELF25826**

**PÀ£ÄßqÄªsÁµÉªÄÄvÄÄÛ,ÄªÄÄÆªÄªÄiÁzsÄªÄÄ**

**WÀIPÀ - 1 :**

**ªsÁµÉªÄÄvÄÄÛ,ÄªÄÄÆªÄªÄiÁzsÄªÄÄ : CAvÀgi,ÄA§AzsÄ**

C) ªªÄÄÆªÄªÄzsÄªÄÄzÄ,ÄégÄÆ¥ÄªÄÄvÄÄÛ ©PÀëtUÀ¼ÄÄ

D) ªÄiÁzsÄªÄÄUÀ¼Ä ª¼ÄªÄtÄUÉAiÄÄ EwªÄªÄÄvÄÄÛªÄÄªÄvÄé

E) «ªzsÄ ¥ÄæPÁgÄzÄ,ÄªÄÄÆªÄªÄiÁzsÄªÄÄUÀ¼ÄÄ

**WÀIPÀ - 2**

**PÀ£ÄßqÄ ¥ÄwæPÁªÄiÁzsÄªÄÄ : ÄégÄÆ¥Ä - ©PÀëtUÀ¼ÄÄ**

C. ¥ÄwæPÁªsÁµÉªÄÄvÄÄÛ §gªÄUÀ¼ÄªÄÉÊ²µÄÖöª: ªgÄç, ªÄçÝ - ÉÄR£Ä, £ÄÄravÄæ, ²Ä¶ðPÉ §gªÄ, CAPÀt §gªÄ

ªÄªAUÄª avÄæ, gÉÄSÁavÄæ, NzÄÄUÄgÄ ¥ÄvÄæUÀ¼ÄÄ

D. ªªvÄª ¥ÄÄgÄªÄtÄUÀ¼Ä,ÄégÄÆ¥ÄªÄÄvÄÄÛªÄÄªÄvÄé, ªÈd£Ä²Ä© §gªÄUÀ¼ÄÄ, ¥ÄÄ,ÄÛPÀ CªÄ-ÉÆÄPÀ£Ä,

ªÄzÄªÄð£Ä, ªÄªQUavÄæ

E. „Á»vÀâ ¥ÀwæPÉUÀ¼À „ÀégÀÆ¥À °ÀÄvÀÄÛ ¥ÀæPÁgÀUÀ¼ÀÄ : °ÀÁâ¹  
¥ÀvÀæPÀvÀðgÀÄ, ¥ÀÄ, ÀÛPÀ ¥ÀæPÁ±À£À

**WÀIPÀ : 3**

**PÀ£ÀßqÀ °sÁµÉ : ±ÀæªÀª °ÀÄvÀÄÛ zÀÈ±Àª °ÀiÁzsÀªªÀÄ**

C) °Á£ÀÄ°, (DPÁ±ÀªÁtÁ) °sÁµÉAiÀÄ „ÀégÀÆ¥À : „ÀA°sÁµÀuÉ, ægÀÆ¥ÀuÉ,  
GzÉÆiÀµÀuÉAiÀÄ°è GZÁÒgÀuÉ

ªÀÄvÀÄÛ zsÀéæ«£Áª, ÀzÀ °ÀÄ°ÀvÀé

D) °Á£ÀÄ° §gÀ°ÀzÀ „ÀégÀÆ¥À : °ÁvÀðªÁZÀ£À, £ÁIPÀ, aAvÀ£É, PÀxÁªÁZÀ£À,  
UÀªÀÄPÀ °ÁªSÁª£À

E) zÀÆgÀzÀ±Àð£ÀzÀ°è °sÁµÉ °ÀÄvÀÄÛ §gÀ°À : °ÁvÉð, „ÀAzÀ±Àð£À,  
ægÀÆ¥ÀuÉAiÀÄ°è GZÁÒgÀuÉAiÀÄ

„ÀégÀÆ¥À, ²Ä¶ðPÉ, eÁ»gÁvÀÄ, ZÀ°, Äªª §gÀ°À (ÉÆiÇª°AUi) „ÀA¥ÁzÀ£Á  
„Á»vÀªzÀ°è

§gÀ°ÀzÀ „ÁÜ£À °ÀÄvÀÄÛ °ÀÄ°ÀvÀé

**WÀIPÀ : 4**

**¥ÀÆgÀPÀ ¥ÀoÀª : °ÀiÁzsÀªªÀÄ „ÀAUÁw**

**PÀ£ÀßqÀ °sÁµÉ °ÀÄvÀÄÛ £ÀªªªÀiÁzsÀªªÀÄ : °ÀiÁzÀj CzsÀªAiÀÄ£À DAIÀÄÝ  
°sÁUÀUÀ¼ÀÄ**

C) CAvÀeÁð®zÀ°è PÀ£ÀßqÀ §¼ÀPÉAiÀÄ „ÀégÀÆ¥À

D) °sÁµÉ °ÀÄvÀÄÛ °sÁµÁAvÀgÀ vÀAvÁæA±ÀUÀ¼ÀÄ £ÀÄr, §gÀ°À,

PÀªªÉA¥ÀÄ, d, jÖ PÀ£ÀßqÀ, AiÀÄªæPÉÆÄqi, «Q|rAiÀiÁ

**WÀIPÀ : 5**

**PÀ£ÀßqÀ „ÀªªÆ°À °ÀiÁzsÀªªÀÄ : °ÀiÁzÀj CzsÀªAiÀÄ£À (DAIÀÄÝ  
°sÁUÀUÀ¼ÀÄ)**

C) ¥ÀwæPÉAiÀÄ ZÀvÀÄgÀAUÀ : r.«.f

D) DPÁ±ÀªÁtÁ : °À, ÀAvÀPÀªªÀiÁgï ¥É®ð

E) zÀÆgÀzÀ±Àð£À : r.©. £ÁAiÀÄPÀ

F) °ÀiÁzsÀªªÀÄ – °ÀvÀðªÀiÁ£ÀzÀ ©PÀiÄÖUÀ¼ÀÄ : ¥ÀzÀägÁd zÀAqÁªAw

**WÀIPÀ – 6 °ÀÄvÀÄÛ WÀIPÀ 7 : ¥ÀoÁªsÁjvÀ ZÀiªªÀnPEUÀ¼ÀÄ**

**(iÄmÉÆÄjAiÀÄ~i)**

➤ PÀ£ÀßqÀ ¥ÀwæPÉUÀ¼À£ÀÄß Nç, ÄªªÀzÀÄ

➤ PÀ£ÀßqÀ ¥ÀwæPÉUÀ¼À£ÀÄß „ÀAUÀæ», ÄªªÀAvÉ „À®É æÄqÀªªÀzÀÄ

- PÀ£ÀßqÀ ¥ÀwæPÉUÀ½UÉ ¥ÁæAiÉÆãVPÀªÁV - ÉÄR£À §gÉ,ÀÄªÀzÀÄ
- ¥ÁæAiÉÆãVPÀ ¥ÀwæPÉUÀ¼À£ÀÄß gÀÆ!,À®ÄªÀiÁUÀðzÀ±Àð£À  
 rÄqÀÄªÀzÀÄ.
- PÀ£ÀßqÀzÀ ,Á»vÀªªÀvÀÄÛ ¥ÀwæPÉUÀ¼À «ZÁgÀ,ÀAQgÀªÀ£ÀÄß  
 K¥Àðr,ÀÄªÀzÀÄ
- ¥ÀwæPÉUÀ¼À - ÉÄR£ÀUÀ½UÉ ,ÀA§AzsÀ¥ÀlÖAvÉ C©ü¥ÁæAiÀÄ  
 ªÀÄAqÀ£ÉUÉ CªÀPÁ±À PÀª,ÀÄªÀzÀÄ.

**¥ÀgÁªÀÄ±Àð£À UÀæAxÀUÀ¼ÀÄ**

- 1.ªÀÈvÀÛ ¥ÀwæPÉ : r.«,f
  - 2.ªÀsÁgÀwÄAiÀÄ ¥ÀwæPÉÆãzÀªªÀÄzÀ EwªÁ,À : £ÁrUÀ  
 PÀÈµÀÛªÀÄÆwð
  3. EzÀÆ ¥ÀwæPÉÆãzÀªªÀÄ : £ÁgÉÄzÀæ gÉÈ  
 zÉÄ®ð
  - 4.ªÀ£ÀÄªÀ° §gªÀ : r. PÉ. gÀ«
  - 5.ªÀªÀÄÆªÀ ,ÀA¥ÀPÀðªÀiÁzsÀªªÀÄUÀ¼ÀÄ : ©.J.ï. ZÀAzÀæ±ÉÄRgï
  6. eÁ»ÁgÁvÀÄ : PÉ. «. £ÁUÀgÁdÄ
  - 7.ªÀZÀPÀgÀªÀÁtÂ : ,Á»vÀªªÀ£ÀÄzÀ
  8. ¥ÀwæPÉÆãzÀªªÀÄ PÉÈ|r . «. D£ÀAzÀªÀÄÆwð
  9. DPÁ±ªÀÁtÂ ,Á»vÀª : J£ï. J.ï. «dAiÀÄªÀgÀ£ï
  10. §gªÀªtÂUÉ MAzÀÄ PÀ-É : rÄgÀAd£ÀªÀ£À½i
  - 11.ªÀiÁzsÀªªÀÄ aAvÀ£À : -ÉÆã»vï. eÉ
  12. ¥ÀwæPÉÆãzÀªªÀÄ ¥ÀjZÀAiÀÄ : PÉ. eÉ. eÉÆã,É¥sï
  - 13.ªÀÈd£À²®vÉªÀvÀÄÛ ,ÀªÀÆªÀªÀiÁzsÀªªÀÄUÀ¼ÀÄ : qÁ. J£ï.
- JA. VjeÁ¥Àw

**¥Àæ±ÉB ¥ÀwæPÉªÀiÁzÀj**

ªÉÆzÀ®£ÉAiÀÄ, JgÀqÀ£ÉAiÀÄ,ªÀÄÆgÀ£ÉAiÀÄªÀvÀÄÛ £Á®l£ÉAiÀÄ  
 ZÀvÀÄªÀiÁð,ÀUÀ¼À (,É«Ä,ÀÖgï) - ¹©¹J,ï

¥ÀoÀâPÀæªÀÄzÀ PÀ£ÀßqÀ LZÀÒPÀ ¥ÀwæPÉUÀ¼À ¥Àæ±Éß ¥ÀwæPÉªÀiÁzÀj

r.J.ï.ªªÀvÀÄÛ r.J.ï.E ¥ÀwæPÉUÀ½UÉ C£ÀéAiÀÄªÀÁUÀÄªÀAvÉ

ªÀªÀÄAiÀÄ: 3 UÀAmÉUÀ¼ÀÄ

UÀjµÀÖ CAPÀUÀ¼ÀÄ: 70

**MAzÀÄ JgÀqÀÄªÀªÀÆgÀÄ WÀIPÀUÀ½UÉ**

**CAPÀUÀ¼ÀÄ: 40**

1. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛjª (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)  
1 X 10 = 10
2. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛjª (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)  
1 X 10 = 10
3. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛjª (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)  
1 X 10 = 10
4. JgÀqÀÄ ¥Àæ±ÉßUÀ½UÉ GvÀÛjª (£Á®ÀÏ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)  
2 X 5 = 10

**¥ÀÆgÀPÀ ¥ÀoÀâ**

**CAPÀUÀ¼ÀÄ: 30**

5. C) MAzÀÄ ¥ÀzÀâ/UÀzÀâªªsÁUÀzÀªª±ÉµÀvÉUÀ¼À£ÀÄß UÀÄgÀÄwª.  
1 X 5 = 5  
(DAiÀÄÝ JgÀqÀÄªªsÁUÀUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)
- D) MAzÀÄªªPÀâzÀªª GvÀÛjª (LzÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)  
5 X 1 = 5
6. MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛjª (JgÀqÀÄ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)  
1 X 10 = 10
7. JgÀqÀÄ ¥Àæ±ÉßUÉ GvÀÛjª (£Á®ÀÏ ¥Àæ±ÉßUÀ¼À£ÀÄß PÉª¼ÀÄªÀªÀzÀÄ)  
2 X 5 = 10

**LzÀÉÉAiÄ ZÀvÄÄ<sup>a</sup>ÀiÁð,À**  
**PÀ£ÀβqÀ ,Á»vÀå ¥ÀjZÀAiÄÄ(GE)**

Course Code :BA- ELE26021/ELE26022/ELE26023/ELE26024/ELE26025/ELE26026

**¥ÀwæPÉ – 1 PÀ£ÀβqÀ ,Á»vÀå ¥ÀjZÀAiÄÄ**

**WÀIPÀ – 1 ¥ÀæaÄ£À PÀ£ÀβqÀ ,Á»vÀå ¥ÀjZÀAiÄÄ**

C) PÀ£ÀβqÀ ,Á»vÀåzÀ ¥ÀæaÄ£ÀvÉ; PÀ«gÁd<sup>a</sup>ÀiÁUÀð, <sup>a</sup>ÀqÁØgÁzsÀ£É, ZÀA¥ÀÆ ,Á»vÀå

C) zÁ<sup>1a</sup>ÄÄAiÄÄå, C@è<sup>a</sup>ÄÄ¥Àæ<sup>ˆ</sup>sÄÄ, §,À<sup>a</sup>ÀtÚ, CPÀì<sup>a</sup>ÄÄ<sup>o</sup>ÁzÉÄ«, <sup>o</sup>Àj<sup>o</sup>ÀgÀ, gÁWÀ<sup>a</sup>ÁAPÀ, ZÁ<sup>a</sup>ÄÄgÀ,À, gÀvÁBPÀgÀ<sup>a</sup>ÀtÄð, ,À<sup>a</sup>ÀðdÕ<sup>ˆ</sup>ˆsÁUÀ<sup>a</sup>vÀ<sup>a</sup>ÄÄvÀÄÜ zÁ,À,Á»vÀå; PÄÄ<sup>a</sup>ÀiÁgÀ<sup>a</sup>Áå,À, @QëöäÄ±À, ¥ÄÄgÀAzÀgÀzÀ,À, PÀ£ÀPÀzÀ,À

**WÀIPÀ 2 – DzsÄÄPÀ PÀ£ÀβqÀ ,Á»vÀå ¥ÀjZÀAiÄÄ**

C) °ÉÆ,ÀUÀ£ÀβqÀ CgÀÄuÉÆÄzÀAiÄÄ: PÉA¥ÄÄ£ÁgÁAiÄÄt, <sup>a</sup>ÄÄzÀÝt °ÉÆ,ÀUÀ£ÀβqÀ ,Á»vÀåzÀ <sup>a</sup>ÄÄRÀWÀiÖUÀ¼ÄÄ: £À<sup>a</sup>ÉÇÄzÀAiÄÄ, ¥ÀæUÀw<sup>2</sup>Ä@, £À<sup>a</sup>Äå<sup>a</sup>ÄÄvÀÄÜ

zÀ<sup>o</sup>vÀ §AqÁAiÄÄ ¥ÀAxÀUÀ¼ÄÄ ,ÀAQë¥ÀÛ ¥ÀjZÀAiÄÄ

D)©,JA,<sup>2</sup>æÄ., zÀ,gÁ, <sup>ˆ</sup>ÉÄAzÉæ, PÄÄ<sup>a</sup>ÉA¥ÄÄ, <sup>2a</sup>ÀgÁ<sup>a</sup>ÄÄ PÁgÀAvÀ, UÉÆÄ¥Á@PÀÈµÀÚ CrUÀ,

wgÄÄ<sup>a</sup>ÄÄ<sup>-</sup> ÁA§, wæ<sup>a</sup>ÉÄtÄ, ,ÁgÁ C§Æ§ìgì, E<sup>a</sup>ÀgÀ ,ÀAQë¥ÀÛ ¥ÀjZÀAiÄÄ

**¥ÀgÁ<sup>a</sup>ÄÄ±Àð£À UÀæAxÀUÀ¼ÄÄ**

1. PÀ£ÀβqÀ ,Á»vÀå ZÀjvÉæ : gÁA. <sup>2</sup>æÄ. <sup>a</sup>ÄÄÄUÀ½
2. PÀ£ÀβqÀ ,Á»vÀå ZÀjvÉæ : vÀ,ÄÄ. ±Á<sup>a</sup>ÄÄgÁAiÄÄ
3. °ÉÆ,ÀUÀ£ÀβqÀ ,Á»vÀå ZÀjvÉæ : J<sup>ˆ</sup> i. J<sup>ˆ</sup> i. ±ÉÄµÀVjgÁ<sup>a</sup>i,
4. ,Á@ÄçÄ¥ÀUÀ¼ÄÄ : PÀ£ÁðIPÀ ,Á»vÀå CPÁqÉ«Ä
5. PÀ£ÀβqÀ ,Á»vÀå PÉÆÄ±À : gÁd¥Àà zÀ¼ÄÄ<sup>a</sup>ÄÄ



DgÀ£ÉAiÄ ZÀvÄÄ<sup>a</sup>ÀiÁð,À  
PÀ£ÀβqÀ „Á»vÀå ¥ÀjZÀAiÄÄ(GE)

Course Code :BA- ELF25821/ELF25822/ELF25823/ELF25824/ELF25825/ELF25826

¥ÀwæPÉ – 1 PÀ£ÀβqÀ PÀ°PÉ – UÀ½PÉ

WÀIPÀ – 1 PÀ£ÀβqÀ „Á»vÀå PÀ°PÉ

C) PÀvÉUÀ¼À ¥ÀjZÀAiÄÄ : gÀAUÀ£À <sup>a</sup>ÄzÄÄ<sup>a</sup>É - <sup>2</sup>æÃæ<sup>a</sup>Á,À, ±À<sup>a</sup>zÀ<sup>a</sup>ÄÄ£É  
– ZÀzÄÄgÀAUÀ

C) PÀ«vÉUÀ¼À ¥ÀjZÀAiÄÄ: PÁtÂPÉ - ©,JA.<sup>2</sup>æÃ, £Á£ÄÄ §qÀ« - ``ÉÃAzÉæ,  
PÀ£ÀβqÀ ¥ÀzÀUÉÆ¼i – f.¡. gÁdgÀvÀβA, ævÉÆåvÀi<sup>a</sup>À – PÉ.J.i. æ,Ági  
C°À<sup>a</sup>ÄÄzi

D) £ÁIPÀUÀ¼À ¥ÀjZÀAiÄÄ : d@UÁgÀ – PÄÄ<sup>a</sup>ÉA¥ÄÄ, „ÀAPÁæAw - ¡.  
®APÉÄ±i (DAiÄÄÝ ``sÁUÀUÀ¼ÄÄ)

WÀIPÀ 2 – PÀ£ÀβqÀ eÁÕ£À UÀ½PÉ

C) ¥ÀzÀeÁÕ£À – <sup>a</sup>ÄÄÆ® ¥ÀzÀUÀ¼ÄÄ, vÀvÀi<sup>a</sup>ÄÄ – vÀzÀã<sup>a</sup>À, UÁZÉ,  
MUÀiÄ, £ÄÄrUÀiÄÖUÀ¼ÄÄ

C) <sup>a</sup>ÁåPÀgÀteÁÕ£À : £Á<sup>a</sup>ÄÄ. °AUÀ, <sup>a</sup>ÄZÀ£À. «``sÀQÛ, „ÀAçü, „À<sup>a</sup>ÀiÁ,À

E) <sup>a</sup>ÁPÀæeÁÕ£À : <sup>a</sup>ÁPÀå <sup>a</sup>ÄvÀÄÛ <sup>a</sup>ÁPÀåzÀ «zsÀUÀ¼ÄÄ,. ¥Àæ§AzsÀ  
gÀZÀ£É, „ÀAPÉëÃ¥À - ÉÄR£À

- ÉÄR£À <sup>a</sup>ÉßUÀ¼ÄÄ, ``sÁµÁAvÀgÀ PË±À®

**¥Àæ±Éß ¥ÀwæPÉ ºÀiÁzÀj**  
**ºÀÄÄPÀÛ LaÒPÀ ¥ÀwæPÉ**  
**f.E - Generic Elective**

¸ÀªÄÄAiÄÄ: 2 UÀAmÉU¼ÄÄ  
**UÀjµÀÖ CAPÀU¼ÄÄ: 35**

**WÀIPÀ -1**

**(CAPÀU¼ÄÄ: 20)**

1. MAzÄÄ ¥Àæ±ÉßUÉ GvÀÛj¹ (JgÀqÄÄ ¥Àæ±ÉßU¼ÄÄ£ÄÄß PÉÄ¼ÄÄªÄÄzÄÄ)  
1 X10 = 10
2. JgÀqÄÄ ¥Àæ±ÉßU¼UÉ GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßU¼ÄÄ£ÄÄß  
PÉÄ¼ÄÄªÄÄzÄÄ) 2 X 5 = 10

**WÀIPÀ – 2**

**(CAPÀU¼ÄÄ: 15)**

3. JgÀqÄÄ ¥Àæ±ÉßU¼UÉ GvÀÛj¹ (£Á®ÄÌ ¥Àæ±ÉßU¼ÄÄ£ÄÄß  
PÉÄ¼ÄÄªÄÄzÄÄ) 2 X 5 = 10
4. MAzÉÆAzÄÄ ºÁPÀåzÀ°è GvÀÛj¹ (LzÄÄ ¥Àæ±ÉßU¼ÄÄ£ÄÄß  
PÉÄ¼ÄÄªÄÄzÄÄ) 5 X 1 = 5

