

JSS Mahavidyapeetha  
**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
 OOTY ROAD, MYSURU – 570 025

## POSTGRADUATE DEPARTMENT OF CHEMISTRY

Details of courses offered by the institution that focus on employability/ skill development during 2022-23

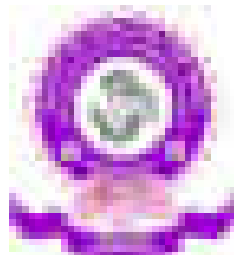
Name of the Course	Course Code	Employability/ Skill development	Highlighted Syllabus
Analytical Chemistry Practicals	21CHA50 & 21CHB50	Skill development	<ol style="list-style-type: none"> <li>1. Determination of total acidity of vinegar and wines.</li> <li>2. Determination of purity of a commercial boric acid sample, and Na<sub>2</sub>CO<sub>3</sub> content of washing soda.</li> <li>3. Determination of the pH of hair shampoos.</li> <li>4. Analysis of water/ waste water for acidity by visual, pH metric and conductometric titrations.</li> <li>5. Determination of ammonia in house-hold cleaners by visual and conductometric titration.</li> <li>6. Spectrophotometric determination of creatinine and phosphorus in urine.</li> <li>7. Flame emission spectrometric determination of sodium, potassium and calcium in river/ lake water.</li> <li>8. Mercurimetric determination of chloride in blood or urine.</li> <li>9. Determination of total hardness, calcium and magnesium hardness and carbonate and bicarbonate hardness of water.</li> <li>10. Determination of calcium in calcium gluconate/ calcium carbonate tablets/ injections and of calcium in milk powder.</li> <li>11. Determination of iron in razor blade by visual and potentiometric titration.</li> </ol>
Inorganic Chemistry Practicals	21CHA51 & 21CHB51	Skill development	<ol style="list-style-type: none"> <li>1. Determination of iron in haematite ore.</li> <li>2. Estimation of calcium and magnesium carbonates in dolomite ore.</li> <li>3. Determination of manganese dioxide in pyrolusite ore.</li> <li>4. analysis of copper-nickel in alloy/mixture.</li> <li>5. Gravimetric analysis of molybdenum with 8-hydroxyquinoline.</li> <li>6. Spectrophotometric determinations of complexes.</li> <li>7. Semimicro qualitative analysis of inorganic mixtures.</li> </ol>

Organic Chemistry Practicals	21CHA52 & 21CHB52	Skill development	<ol style="list-style-type: none"> <li>1. Preparation <i>p</i>-bromoaniline from acetanilide.</li> <li>2. Preparation of <i>n</i>-butyl bromide from <i>n</i>-butyl alcohol.</li> <li>3. Oxidation of cyclohexanol to adipic acid.</li> <li>4. Esterification: Preparation of benzocaine from <i>p</i>-nitrotoluene.</li> <li>5. Diazotization (Sandmeyer's reaction).</li> <li>6. Preparation benzilic acid from benzoin.</li> <li>7. Preparation of <i>o</i>-hydroxy benzophenone from phenyl benzoate <i>via</i> Fries rearrangement.</li> <li>8. Preparation of benzanilide from benzophenone oxime <i>via</i> Beckmann rearrangement.</li> <li>9. Preparation of benzoic acid from benzaldehyde (Cannizzaro Reaction).</li> <li>10. Preparation of chalcone.</li> <li>11. Separation of binary mixtures, identification of functional groups and preparation of suitable solid derivatives.</li> </ol>
Physical Chemistry Practicals	21CHA53 & 21CHB53	Skill development	<ol style="list-style-type: none"> <li>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.</li> <li>2. Determination of partial molar volume of salt-water system.</li> <li>3. Determination of heat of solution of organic acid (benzoic acid/salicylic acid) by variable temperature method.</li> <li>4. Analysis of a binary mixture (Glycerol &amp; Water) by measurement of refractive index.</li> <li>5. Determination of the molecular weight of a polymer material by viscosity measurements.</li> <li>6. Conductometric titration of a mixture of HCl and CH<sub>3</sub>COOH against NaOH.</li> <li>7. Potentiometric titration of KI vs KMnO<sub>4</sub> solution.</li> </ol>
Analytical Chemistry Practicals	21CHC50 & 21CHD50	Skill development	<ol style="list-style-type: none"> <li>1. Determination of calcium in limestone.</li> <li>2. Determination of vitamin C in orange juice.</li> <li>3. Determination of saccharin in tablets.</li> <li>4. Determination of iron in mustard seeds and phosphorus in peas by spectrophotometry.</li> <li>5. Determination of ethanol in wine.</li> <li>6. Analysis of waste waters for DO and COD by titrimetry.</li> <li>7. Analysis of a ground water sample for sulphate by titrimetry (EDTA) and turbidimetry.</li> <li>8. Determination of aspirin, phenacetin and caffeine in mixture and APC tablets.</li> <li>9. Ascorbic acid determination in natural orange juice by coulometry.</li> </ol>

			<p>10. Determination of fluoride in drinking water/ground water by spectrophotometry.</p> <p>11. Analysis of a soil Urine, Blood samples.</p>
Inorganic Chemistry Practicals	21CHC51 & 21CHD51	Skill development	<p>1. Determination of bismuth, cadmium and lead in a mixture.</p> <p>2. Spectrophotometric determination of chromium and manganese in a steel solution.</p> <p>3. Flame photometric determination of the metal ions.</p> <p>4. Determination of iron as the 8-hydroxyquinolate by solvent extraction method.</p> <p>5. Preparation and characterization of metal complexes.</p> <p>6. Determination of the composition of iron-phenanthroline complexes.</p>
Organic Chemistry Practicals	21CHC52 & 21CHD52	Skill development	<p>1. Fractional crystallization: separation of mixture of naphthalene and biphenyl.</p> <p>2. Thin layer chromatography: Separation of plant pigments.</p> <p>3. Column chromatography: Separation of <i>o</i>- and <i>p</i>-nitro aniline</p> <p>4. Isolation of piperine from pepper.</p> <p>5. Isolation of caffeine from tea.</p> <p>6. Isolation of azelaic acid from castor oil.</p> <p>7. Isolation of carotene from carrot.</p> <p>8. Isolation of lycopene from tomato.</p> <p>9. Isolation of cincole from eucalyptus leaves.</p> <p>10. Estimation of ketones by haloform reaction.</p> <p>11. Estimation of sugars by Bertrand's method.</p> <p>12. Estimation of nitro groups, Estimation of amino group.</p> <p>13. Determination of enol content by Meyer's method.</p> <p>14. Determination of iodine value of an oil or fat.</p> <p>15. Determination of saponification value of oil.</p> <p>16. Determination of equivalent weight of carboxylic acid by silver salt method.</p>
Physical Chemistry Practicals	21CHC53 & 21CHD53	Skill development	<p>1. Study of kinetics of autocatalytic reaction.</p> <p>2. Kinetics of saponification of ethyl acetate.</p> <p>3. Spectrophotometric kinetics of oxidation.</p> <p>4. Study the phase diagram of three component system.</p> <p>5. Conductometric titrations.</p> <p>6. Potentiometric titrations.</p> <p>7. Spectrophotometric analysis</p>
Molecular Symmetry and Spectroscopy	21CHB13	Employability	<p>Molecular symmetry and group theory</p> <p>The Point Groups Used with Molecules</p> <p>Representation of groups</p> <p>Applications of group theory</p>

			Symmetry in Chemical bonding Symmetry in Vibrational Spectroscopy Microwave spectroscopy Vibration spectroscopy Raman spectroscopy UV Visible spectroscopy Resonance Raman Spectroscopy
Chemical Spectroscopy	21CHC13	Employability	NMR Spectroscopy Multiple resonance spectroscopy Electron Spin Resonance Spectroscopy NQR Spectroscopy Mössbauer spectroscopy Photoelectron Spectroscopy IR spectroscopy Mass Spectrometry

**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)**  
**2021-22**



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>						
PHY101	Classical Mechanics	HC 1	3	-	-	03
PHY102	Mathematical Methods of Physics 1	HC 2	3	-	-	03
PHY103	Mathematical Methods of Physics 2	HC 3	3	-	-	03
PHY104	Classical Electrodynamics & Plasma Physics	HC 4	3	-	-	03
PHY105	Computer Lab CL-A	HC 5	-	-	2	02
PHY106/107	Electronics Lab/Optics Lab	SC 1	-	-	4	04
18						
<b>II Semester</b>						
PHY201	Continuum Mechanics and Relativity	HC 6	3	-	-	03
PHY202	Thermal Physics	HC 7	3	-	-	03
PHY203	Quantum Mechanics 1	HC 8	3	-	-	03
PHY204	Spectroscopy and Fourier Optics	HC 9	3	-	-	03
PHY205	Computer Lab CL-B	HC 10	-	-	2	02
PHY206/207	Optics Lab / Electronics Lab	SC 2	-	-	4	04
18						
<b>III Semester</b>						
PHY301	Quantum Mechanics 2	HC 11	3	-	-	03
PHY302	Condensed Matter Physics	HC 12	3	-	-	03
PHY303	Nuclear and Particle Physics	HC 13	3	-	-	03
PHY311/312	Condensed Matter Physics Lab / Nuclear and Particle Physics Lab	HC 14	-	-	4	04
Students are permitted to choose any one of the following (special paper) and corresponding practical coupled to the special paper						
PHY304	Solid State Physics 1	SC 3	3	-	-	03
PHY313	Solid State Physics Lab 1	SC 4	-	-	2	02
PHY305	Nuclear Physics 1	SC 3	3	-	-	03
PHY314	Nuclear Physics Lab 1	SC 4	-	-	2	02
PHY306	Theoretical Physics 1	SC 3	3	-	-	03
PHY315	Theoretical Physics Lab 1	SC 4	-	-	2	02
Students from other departments can register for any one of the following						
PHY321/322	Modern Physics/Energy Science	OE	3	1	-	04
22						

<b>IV Semester</b>						
PHY421/422	Nuclear and Particle Physics Lab/ Condensed Matter Physics Lab	HC 15	-	-	4	04
A student has to register for one particular discipline in confirmation with the corresponding SC (special paper) opted in III semester						
PHY401	Solid State Physics 2	SC 5	3	-	-	03
PHY402	Solid State Physics 3	SC 6	3	-	-	03
PHY423	Solid State Physics Lab 2	SC 7	-	-	2	02
PHY403	Nuclear Physics 2	SC 5	3	-	-	03
PHY404	Nuclear Physics 3	SC 6	3	-	-	03
PHY424	Nuclear Physics Lab 2	SC 7	-	-	2	02
PHY405	Theoretical Physics 2	SC 5	3	-	-	03
PHY406	Theoretical Physics 3	SC 6	3	-	-	03
PHY425	Theoretical Physics Lab 2	SC 7	-	-	2	02
Students are permitted to choose any one of the following (Elective papers 1)						
PHY407	Accelerator Physics	SC 8	2	-	-	02
PHY408	Liquid Crystals		2	-	-	02
PHY409	Atmospheric Physics		2	-	-	02
PHY410	Numerical Methods		2	-	-	02
Students are permitted to choose any one of the following (Elective papers 2)						
PHY411	Nuclear Spectroscopy Methods	SC 9	3	1	-	04
PHY412	Modern Optics					
PHY413	Electronics					
PHY414	Minor Project					
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;

**Syllabus for the 4-Semester M.Sc., (Physics)  
Choice Based Credit Scheme (CBCS)**

**PHY-101: Classical Mechanics**

**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

## PHY-102: Mathematical Methods of Physics 1

**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:** Partial differential equation 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.



## PHY-103: Mathematical Methods of Physics 2

**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  $D^j$  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.

## PHY-104: Classical Electrodynamics, Plasma Physics and Optics

**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]

**Total work load**

**48 hours**

### 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

### PHY-105: Computer Lab CL-A

- 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**

### PHY-106: Electronics Lab

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**

### PHY-107: Optics Lab

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 × 4 hours × 16 weeks = **128 hours**

## PHY-201: Continuum Mechanics and 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.

## PHY-202: Thermal Physics

**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.

## PHY-203: Quantum Mechanics 1

**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.

## PHY-204: Spectroscopy and Fourier 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. and 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

### PHY-205: Computer Lab CL-B

#### 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**

### PHY-206: Optics Lab

For those who have completed PHY-106

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**

### PHY-207: Electronics Lab

For those who have completed PHY-107

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. Op-amp as an integrator and differentiator.
7. Op-amp as a summing and log amplifier.
8. Op-amp as an inverting and non-inverting amplifier.
9. Coder and encoder.
10. Half adder and full adder.
11. Boolean algebra-Logic gates.
12. Op-amp astable multivibrator.

Total work load : 2 day(s) per week  $\times$  4 hours  $\times$  16 weeks = **128 hours**



## PHY-301: Quantum Mechanics 2

**The time-independent perturbation theory:** Nondegenerate 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:** The 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, AddisonWesley, 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.

### PHY-302: 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 **(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.

### PHY-303: Nuclear and Particle Physics

**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 & Tayal)**. **[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 (Tl) 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 & Tayal)**. **[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. Tayal 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

**PHY-304: Solid State Physics 1**

**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)**. **[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.

### PHY-305: Nuclear Physics 1

**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

**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

**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. Large Hadron Collider experiment, consequences. Higgs Boson. **[16 hours]**

**Tutorial** **[16 hours]**

**Total work load** **64 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

**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 Pyrhelimeter. **[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** **[16 hours]**

**Total work load** **64 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.



### PHY-311: Condensed Matter Physics Lab

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**

### PHY-312: Nuclear and Particle Physics Lab

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 Pradyumnan P. P., Advanced experimental techniques in Modern Physics, Pragati Prakashan, 2011

### **PHY-313: Solid State Physics Lab 1**

*For those who have opted for Solid State Physics Specialisation*

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. Thermoluminescence.
8. Curie temperature of a ferroelectric material.
9. Dielectric constant and its temperature variation.
10. Determination of the polarisabilities of the molecules of an uniaxial crystal using spectrometer.
11. Photoelasticity in crystalline solids.
12. Thermal expansion coefficient in solids.
13. Determination of Stefan's constant using Photo Cell
14. Calibration of Si Diode
15. Measurement of Electrical and Thermal Conductivity of Copper
16. Verification of Curie-Weiss law
17. BH Curve in a ferromagnetic Material

**Total work load : 1 day(s) per week  $\times$  4 hours  $\times$  16 weeks = 64 hours**

### **PHY-314: Nuclear Physics Lab 1**

*For those who have opted for Nuclear Physics Specialisation*

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*

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**

## PHY-401: Solid State Physics 2

**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:** Buerger'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.

### PHY-402: Solid State Physics 3

**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.

## PHY-403: Nuclear Physics 2

**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. and Edlund M.C., Elements of nuclear reactor theory, D. Van Nostrand Co., USA, 9th 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.

### PHY-404: Nuclear Physics 3

**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. **[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

**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

**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

### PHY-407: Accelerator Physics

**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

**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<sub>A</sub>-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

**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, Kosalaya 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

**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,m 2001.

## Elective Papers 2

### PHY-411: Nuclear Spectroscopy Methods

**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** **[16 hours]**

**Total work load** **64 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. Hautjarvi 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

**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** **[16 hours]**

**Total work load** **64 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.

### PHY-413: Electronics

**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  
**(Boylestad and Nashelsky) [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 [16 hours]**

**Total work load 64 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

Total work load 64 hours

### **PHY-421: Nuclear and Particle Physics Lab**

*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 × 4 hours × 16 weeks = 128 hours*

### **PHY-422: Condensed Matter Physics Lab**

*For those who have completed Nuclear Physics Lab PHY 312*

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 × 4 hours × 16 weeks = 128 hours*

### PHY-423: Solid State Physics Lab 2

For those who opted for **Solid State Physics Specialisation**

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  $\times$  4 hours  $\times$  16 weeks = **64 hours**

### PHY-424: Nuclear Physics Lab 2

For those who opted for **Nuclear Physics Lab Specialisation**

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  $\frac{\mu}{\rho}$  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  $\times$  4 hours  $\times$  16 weeks = **64 hours**

### PHY-425: Theoretical Physics Lab 2

For those who opted **Theoretical Physics Lab Specialisation**

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**



# 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 onwards

**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**

### **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

Sl. No.	Course Code	Course Title	L:T:P	Credits
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

Sl. No.	Course Code	Course Title	L:T:P	Credits
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	2
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/Social Science Perspectives for Social Work Practice	2:1:0	3
			<b>Total</b>	<b>18</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/Employee Relations and Legislation	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/Society and Social Work	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	Organizational Behaviour and Organizational Development	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. response to people's needs, problems and social issues.
  - iii. 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.

## PG Department of Social Work

1. Name of the programme offered:
    - a. PG Programme in Social Work
    - b. PhD programme in Social Work
- Programme Code: 13 MSW

### 2. Lists of PO, PSO and Cos

POID	PO	
		20 20- 21
44609	Develop the capacity to undertake Research	42. 45
44601	Develop the skills and capacities to work in a multidisciplinary team	46. 04
44593	Develop the capacity to project self as a professional.	54. 89
44599	Equipped with the knowledge of Social dynamism	44. 28
44594	Equipped to work in various fields of Social Work	43. 40
44605	Imbibed with the core values and principles of Social Work	59. 44

Sl. No.		PSO
1	P S O 1	Equip to work in the Community Development Programmes
2	P S O 2	Develop the capacity to work in the field of Human Resource as Labour Welfare Officers, HR Executives and liaison officers
3	P S O 3	Develop the skill to work as medical and psychiatric social workers
4	P S O 4	Equip with the skill to work in family and Child Welfare Centres
5	PSO5	Develop the capacity to work in correctional settings

### CO Attainment

Title of the Paper	COID	CO	2020-21
Social Work – History and Ideologies	44679	Learn the details of Indian History of Social work Profession	20.86
Social Work – History	44689	Understand in depth Values and	28.04

and Ideologies		principles of Social work	
Social Work – History and Ideologies	44714	Deliberate the details of Contemporary Ideologies for Social change	41.75
Social Work – History and Ideologies	44731	44731 Learn the details of Western Ideologies for Social Change and History of Social Work	14.52
Work with Individuals and Families	44748	Learn in details with application of social case work as method of Social Work	30.28
Work with Individuals and Families	44790	Learn in detail the Values and principles of Social Case work	10.33
Work with Individuals and Families	44807	Learn the details of theories and process of Casework	29.71
Work with Individuals and Families	44820	Specify in depth application of Social Case work in different settings	10.04
Work with Groups	44837	Identify in detail the concept of group and group work	25.18
Work with Groups	44859	Learn the process of Group Work	28.00
Work with Groups	44865	Understand in depth Group dynamics and skills in group work	29.88
Work with Communities	44891	Learn in details with examples concept of Community and Community organization	29.45
Work with Communities	44945	Learn in depth models and strategies of Community Organization	49.89
Work with Communities	44953	Understand the skills of Community organize	36.98
Work with Communities	44983	Understand in depth Micro and macro policies of community Organizaion	37.89
Human Growth & Development	45022	Learn in detail Human life span and principles of growth and development	74.22
Human Growth & Development	45042	Understand the details of Developmental stages of Human Life span	55.56
Human Growth & Development	45060	Understand the theories of Human Development and learning	51.87
Human Growth & Development	45085	Understand the theories of Basic Human Needs, motivation, Personality	52.86
Social Work Research and Statistics	45174	Understand the meaning, objectives and scope of Social Work Research	51.00
Social Work Research and Statistics	45213	Understand in detail the Process of Social Work Research	25.00
Developmental and Welfare Services	45334	Deliberate in depth need for social welfare organization	43.0
Developmental and Welfare Services	45355	Learn the procedure of establishment of Human Service	36.00

		Organizations	
Developmental and Welfare Services	5378	Understand the process of Management	50.1
Developmental and Welfare Services	45402	Learn in detail the concepts of Programme Development and Public Relations	32.00
Communication and Counselling	45444	Understand the meaning, importance, purpose and process of communication	61.00
Communication and Counselling	45459	Learn the use of Visual aids in communication	34.00
Communication and Counselling	45527	Understand the counselling situations and approaches	35.10
Personal and Professional Growth	45605	Understand self and developing self awareness	42.00
Personal and Professional Growth	45661	Understand the details of emotions and emotional expressions	23.00
Personal and Professional Growth	45704	Understand in depth life skills	41.00
Personal and Professional Growth	45715	Identify in depth Values, attitudes and professional ethics	25.00
Human Resource Management	45966	Learn the concept and philosophy of Human Resource Management	74.00
Human Resource Management	45983	understand the policies, sources and methods of talent acquisition	74.00
Human Resource Management	46039	Deliberate in details with examples Compensation Management	72.00
Human Resource Management	46057	Deliberate the changing scenario of strategic Human Resource Management 70	73.00
Organizational Behaviour and Organizational Behaviour	46090	Specify the significance of transactional analysis and theories of motivation	85.00
Organizational Behaviour and Organizational Behaviour	46124	Understand group dynamics and organization development	67.50
Organizational Behaviour and Organizational Behaviour	46144	Deliberate in depth on organizational change, stress and burnout	74.500
Preventive and Social Medicine and Medical Social Work	46153	Learn in depth concept of health and health care	53.00
Preventive and Social Medicine and Medical Social Work	46179	Learn in details with application Medical Social Work and Rehabilitation of Patients	62.50

Social Policy, Planning and Development	46236	Understand in detail concept and purpose of social policies and values underlying social policy	47.00
Social Policy, Planning and Development	46255	Learn in detail sectoral policies in India	38.00
Social Policy, Planning and Development	46288	Learn the social planning process	43.00
Social Policy, Planning and Development	46309	Learn in detail the concept of social development and Indicators of development	49.00
Legal System in India	46337	Learn in depth concept of social justice and understanding of Rights	38.00
Legal System in India	46365	Understand the divisions of law and chapters under IPC and CRPC	49.00
Legal System in India	46421	Understand the details of structure and functions of District Court, High Court and Supreme Court	53.00
Employee Relations and Legislations	46589	Identify in details with application concept, philosophy and principles of employee relations	81.00
Employee Relations and Legislations	46599	Deliberate on functioning of trade unions in India	74.00
Employee Relations and Legislations	46619	Learn the employee legislations	76.500
Employee Relations and Legislations	46641	Understand in depth process of collective bargaining	68.50
Mental Health and Psychiatric Social Work	6656	Learn the details of concept of Mental Health, Mental Illness and its classification	56.00
Mental Health and Psychiatric Social Work	46696	Understand the concept of psychiatric Social Work and Multidisciplinary approach and team work	56.00
Mental Health and Psychiatric Social Work	46710	Learn about the institutional care of mentally ill and role of social workers	52.60
Mental Health and Psychiatric Social Work	46737	Understand the psycho social rehabilitation and legislations related to mental Health	57.00
Human Resource Development and Employee Wellness	46743	Understand concept, approaches and dimensions of Human resource development	75.00
Mental Health and Psychiatric Social Work	46747	Deliberate in depth on HRD Interventions	84.00
Mental Health and Psychiatric Social Work	46755	Learn in details with examples concept and importance of talent development	82.00
Mental Health and Psychiatric Social Work	46760	Deliberate on employee wellness and standardization of systems	93.50
Society and Social Work	53286	Understand in depth on society and its institutions	61.00

Mental Health and Psychiatric Social Work	53304	Understand in details on the different concepts of psychology	59.00
Mental Health and Psychiatric Social Work	53341	Specify the characteristics of mental health and mental disorders	48.50
Social Science Perspectives for Social Work Practice	62739	Deliberate the characteristics of sociology and its relationship with other social sciences	62.55
Social Science Perspectives for Social Work Practice	62741	Specify the characteristics of social movements in India	58.5

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.

## REFERENCES

1. Agarwal, M. M. 1998 Ethics and Spirituality, Shimla: Indian Institute of Advanced Study
2. Alastair, Christie (Ed.) 2001 Men and Social Work: Theories and Practices, New York, Palgrave.
3. Banerjee, G. R. Papers on Social Work: An Indian Perspective, Bombay, Tata Institute of Social Sciences.
4. Banks, S. 1995 Ethics and Values in Social Work: Practical Social Work Series, London: Macmillan Press Ltd.
5. Borgatta, E. F. (Ed.) 1992 Encyclopedia of Sociology, New York: Macmillan.
6. Brieland, Donald; Costin Lela B.; Atherton, Charles R. and Contributors 1975 Contemporary Social Work - An Introduction to Social Work and Social Welfare, New York, McGraw-Hill Book Company.
7. Butrym, Zofia T. 1976 The Nature of Social Work, London, Macmillan Press Ltd.
8. Chatterjee, P. 1996 Approaches to the Welfare State, Washington, D.C.: National Association of Social Workers.
9. Congress, E. P. 1998 **Social Work Values and Ethics, Chicago:** Nelson- Hall Publishers.
10. Desai, Armaity S. 1994 A Study of Social Work Education in India, Bombay, Tata Institute of Social Sciences, Vol. I and II
11. Desai, M. 2000 Curriculum Development on History of Ideologies for Social Change and Social Work, Mumbai: Social Work Education and Practice Cell.
12. Diwakar, V. D. (Ed.) 1991 Social Reform Movements in India: A Historical Perspective, Bombay: Popular Prakashan.
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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.

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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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### **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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Changes in the Family and the Process of  
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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.

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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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**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.

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### **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.

### **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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| 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

**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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| 27. Yoder, D. 1972                                | Personnel Management an Industrial Relations, New York, Prentice-Hall India.               |

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:**

1. Barnabas, A. P. 1987

Rural Community Development in India, In Encyclopedia of Social Work in India, Vol. II, New Delhi: Ministry of Welfare, Government of India,

2. Bhalla, Alok and Bumke, Peter J. (Eds) 1992 Images of Rural India in the 2nd Century, New Delhi; Sterling Publishers Pvt. Ltd.
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  8. Singh, K. 1986 Rural Development: Principles, Policies and Management, New Delhi: Sage Publications.
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  20. Sodhi, J. S. 1990 Poverty Alleviation of Rural Development, New Delhi: Criterion Publications.
  21. Swaminathan, M. S. 1982 Science and Integrated Rural. Development, New Delhi: Concept Publishing company.

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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Work in India, Bombay: Allied Publishers.
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H. Publishing Corporation.
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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.

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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

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### **JOURNALS.**

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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**Open Elective**  
**Paper Code: SWOE**  
**Paper Title: SOCIETY AND SOCIAL WORK**

## **INTRODUCTION**

This course aims at introducing the learner to the dynamics of society, nature of human behavior, basic concepts of social work and its interventions. Understanding of these concepts in this course will help the students to understand the Individual

## **OBJECTIVES**

- a) To develop an understanding of the basic structure of society, its institutions and the inequalities prevalent therein.
- b) To familiarize the learner to the intervention strategies that may be adopted to deal with societal problems.
- c) To introduce the learner to the basic concepts of Social work, its methods & interventions.
- d) To develop an overall understanding of the principles of Human Behaviour, adjustment & mal adjustment.

## **Course content**

### **UNIT I**

Society & its Institutions: Meaning and components of society, origin and development, characteristics of Indian society; Social Institutions: concept, forms - Family, Marriage, Kinship, Religion, Education, Media & Culture, Emerging trends.

Social Inequalities & Problems : Concept, causes and consequences, disadvantaged & marginalized groups : SC, ST & OBC, women, children, aged, unorganized labour, physically and mentally challenged, substance abuse, HIV / AIDS, sexual harassment, human trafficking, alienation - causes, consequences, preventive & remedial measures.

### **UNIT II**

Psychology : concept, scope & importance; Basic Human Needs : Physical, psychological, social and intellectual. Motivation, frustration and conflicts - their impact on behaviour; Stress - concept, coping and social support; Group psychology, attitudes, public opinion, mob behavior, leadership.

### UNIT III

Mental Health : Concept of mental health and mental illness, common misconceptions about mental illness; types of disorders - Neurosis, Psychosis, Psychosomatic disorders, Psychopathic personalities and perversions, Personality disorders, Delusional disorder, Epilepsy, Suicide, Organic psychotic conditions - signs, symptoms & intervention.

### UNIT IV

Social Work Interventions : Social Work: concept, definition, principles, values, ethics, methods and interventions of Social Work ; Different fields of Social Work, Social Service, Social Services, Social Welfare, Social Reform and Social Development; Welfare and developmental services in Indian Society, role of government, NGOs and the corporate sector.

### REFERENCES

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| Hurlock, Elizabeth B. 1978            | <i>Child Growth and Development</i> , New Delhi, Tata McGraw-Hill Publishing Company Ltd. |
| Hurlock, Elizabeth B. 1975            | <i>Developmental Psychology</i> , New Delhi, Tata McGraw-Hill Publishing Company Ltd.     |
| Nataraj P.                            | <i>Introduction to Psychology</i> , Chetana Book House, Mysore.                           |

**Even semester (IV Semester)**

**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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2. Aswathappa K, 2008                          Organisational Behaviour- Text, Cases and Games, Mumbai, Himalaya Publication House.
3. Donald, Hislop, 2007                        Knowledge Management in Organisation- A Critical Introduction, Oxford University Press.
4. Khanka, S S, 2008                            Organisational Behaviour, New Delhi, S Chand and Co., Ltd.
5. Hellriegel Don and                          Organisational Behaviour, New Delhi,  
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6. ICFAI, 2004                                    Organisational Behaviour, Hyderabad, Centre for Management Research.
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Meenakshi N, 2009                            Approach, NIILM Center for Management Studies, New Delhi.
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Griffin Ricky W, 2005                        People and Organisations, New Delhi, Biztantra Publications.
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Quick, James Compbell, 2007              Realities and Challenges, New Delhi, Thomson South-Western,.
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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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**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.

## 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).

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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**

<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	<b>HARD CORE 1.1</b>	<b>Virology, Bacteriology, Mycology and Plant Pathology</b>	<b>2:2:2</b>	2:1:1
2	<b>HARD CORE 1.2</b>	<b>Phycology, Bryophytes, Pteridophytes and Gymnosperms</b>	<b>2:2:2</b>	2:1:1
3	<b>HARD CORE 1.3</b>	<b>Systematics of Angiosperms</b>	<b>2:2:2</b>	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
** Any two soft core papers shall be studied.				

THIRD SEMESTER				Credits: 16	
No.	Course/Paper Code	Title of the Course /Paper	Hrs/Week L:T:P	Credits	
1	HARD CORE 3.1	Biochemistry and Plant Physiology	2:2:2	2:1:1	
2	HARD CORE 3.2	Molecular Biology	2:2:2	2:1:1	
3	HARD CORE 3.3	Plant Biotechnology	2:2:2	2:1:1	
4	SOFT CORE 3.1*	Molecular Genetics of Plants	2:2:2	2:1:1	
5	SOFT CORE 3.2*	Molecular Plant Pathology	2:2:2	2:1:1	
6	SOFT CORE 3.3*	Plant Propagation and Plant Breeding	2:2:2	2:1:1	
7	SOFT CORE 3.4*	Phyto-chemistry and Herbal Technology	2:2:2	2:1:1	
8	OPEN ELECTIVE 3.1	Plant Propagation Techniques	2:2:0	2:1:0	
	OPEN ELECTIVE 3.2	Medicinal Plants	2:2:0	2:1:0	
	OPEN ELECTIVE 3.3	Plant Diversity and Human Welfare	2:2:0	2:1:0	
* Any one soft core, one open elective courses/papers shall be studied.					

FOURTH SEMESTER				Credits: 16	
No.	Course/Paper Code	Title of the Course /Paper	Hrs/Wk L:T:P	Credits	
1	HARD CORE 4.1	Ecology, Conservation Biology and Phytogeography	2:2:2	2:1:1	
2	HARD CORE 4.2	Project Work *	4:2:2	8	
3	SOFT CORE 4.1*	Seed Technology	2:2:2	2:1:1	
4	SOFT CORE 4.2*	Seed Pathology	2:2:2	2:1:1	
5	SOFT CORE 4.3*	Bio -Analytical Techniques	2:2:2	2:1:1	
*Project Work: 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.					

**Important Note:**

Student is required to earn the credit for qualifying 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 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**

Q I. 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



**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.

**References:**

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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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2. Simpson, M.G. 2006. Plant Systematics. Elsevier, Amsterdam.

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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 B<sub>1</sub>
- 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*

**References:**

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- 2) Deacon, J. W. 1997. Modern Mycology 3rd edn. Blackwell Science publishers, London.

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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*.  
Rhodophyceae: *Gracilaria*, *Gelidium*.
- 6) Cyanophyceae: *Microcystis*, *Nostoc*, *Spirulina*.
- 7) Estimation of carotene content in algal cells .
- 8) Culturing of microalgae: *Spirulina*/*Chlorella*/*Scenedesmus*/*Dunaliella*.
- 9) Applications of algal products: Agar, spirulina tablets/powder, beta-carotene, phycobiliproteins, triglycerides, Mycosporine like amino acids (MAA), diatom silica as nanoparticles.
- 10) Visit to National Institute of Oceanography, Goa.
- 11) Study of algal herbaria.

## References

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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 foliicolous 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:**

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- 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.
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- 4) Sally E. Smith and David J. Read (2008). Mycorrhizal Symbiosis. 3rd edn. Academic Press, New York.
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**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.

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- 2) Dickinson, M. 2003. Molecular Plant Pathology, Garland Publishing Inc, CT.
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- 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.
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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 embryosac; 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.
- 6) Maheshwari, P. 1963. Recent advances in the embryology of angiosperms. ed. New Delhi
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- 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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- 7) Brown, T.A. 1989. Genetics a molecular approach. Van Nostrand Reinhold (intn) Co., Ltd. London.
- 8) Winchester, A.M. 1969. Genetics. 3rd edn. Oxford and IBH, New Delhi.
- 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.
- 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 Ed., Jones & Bartlett Publishers, Inc. 40 Tall PineDrive Sudbury, MA 01776, United States of America
- 10) Futuyma, Douglas J. 2005. Evolution. Sinauer Associates, Inc., 23 Plumtree Road, Sunderland, MA 01375, United States of America
- 11) Dodson E. O. and Dodson P. 1976. Evolution: Process and Product. 2nd Ed., D. Van Nostrand Company, 450 West 33rd Street, New York, N.Y. 10001
- 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. Pergamon Press. Oxford.
- 2) Cariquist, S. 1967. Comparative Plant Anatomy- Holt Reinert and Winston, New York.
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- 7) James, D. Mauseth, 1998. Plant anatomy The Benjamin/ Cummins Publishing Co.Inc.
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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.

- 5) Colton C.M. 1997. Ethno botany – Principles and applications. John Wiley and sons –
- 6) Rama Ro, N and A.N. Henry (1996). The Ethno-botany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
- 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: 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:**

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- 6) Mukherji, S., and GHosh, A.K. 1996. Plant Physiology. New Central Book Agency Pvt. Ltd. Kolkatta, India.
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- 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.
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- 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.
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**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 Tm value of DNA.
- 9-12) Photo graphs/ charts related to molecular biology/Molecular Biologists.

**References:**

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- Walter. 2008. Molecular biology of the cell, 5th edn., Garland science, Taylor & Francis Group, LLC, 270 Madison Avenue, New York, 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 Bartlett 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.
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- 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.
- 6) Gilmartin, P.M., and Bowler, C. 2002. Molecular Biology of Plants. Vol. I & II, Oxford University Press.
- 7) Karchar, S.J. 1995. Molecular Biology- A Project Approach, Academic Press, New York.
- 8) Sambrook, J., Fritch, E.F., and Maniatis, T. 1989. Molecular cloning- a laboratory manual.
- 9) Slater, A., Scott, N., and Flower, M. 2000. Plant Biotechnology- the Genetic Manipulation of Plants, Oxford University Press, Oxford.

- 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 pathogenicity 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 of 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: II SEMESTER- OPEN ELECTIVE 3.2**  
**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) Yoganarasimhan, S.N. Medicinal Plants of India- Vol 1- Karnataka, Interline Publishing Pvt. Ltd.

**BOTANY: II SEMESTER - OPEN ELECTIVE 3.3**  
**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.

**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. **Visit:** 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, Tayler 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.

## HC04: MCA100      STRATEGIC MARKETING

### 1. Course Outcome:

- CO1      To understand the strategy formulation
- CO2      To learn the steps in implementation of strategies.
- CO3      To learn evaluation of strategy
- CO4      To analyze 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 Behaviour - Buyer Behavior – buying Influencing Factors – Buyer Behaviour Models – Online Buyer Behaviour - Building And Measuring Customer Satisfaction – Customer Relationships Management – 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 Kotler 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

**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 Outcome:**

- CO1 To aimed at equipping the students with the knowledge and skill relating to marginal costing.
- CO2 To evaluate a wide range of managerial decisions involving make-or-buy, pricing, export offers, temporary short-term of operations, discontinuance of a product line.

**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 & Sort 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 Manorial Emphasis: C.T.Hornigel :
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 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 Outcome:**

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**Module 2:** Contribution Concepts & Sort 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 Manorial Emphasis: C.T.Hornigel :
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

## **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	To understand the incidence of based on residential status of the companies
CO2	To understand the deferent types of companies under corporate income tax act.
CO3	To known the deferent sources of income for corporate assesses.
CO4	To educate as a manger of a company/as tax consultant how reduce the tax burden and maximize the company wealth
CO5	To 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.

**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.

**Module 4: Procedure for assessment-** Deduction of Tax at Source, Advance payment of Tax, Tax returns, refunds appeals and revision.

### **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, Lakhota, Vision Publishers.  
Taxman's Direct Tax Laws and Practice, Dr.Vinod K Singhanian and Kapil Singania Taxman's Publications(p)Ltd., New Delhi.

**Course Outcome:**

- CO1 To expose the students to the foundations and different dimensions of Entrepreneurial Development
- CO2 To make students to become Entrepreneurs
- CO3 To plan a project proposal

**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: Project Objectives and Policies, 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. Manscusa, 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.



## 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 To understand the importance of indirect taxes (GST) in the Indian and global economy and its contribution for the economic development.
- CO2 To comprehend the principles of taxations, objectives of taxes and its impact, shifting and incidence process of indirect taxes in market orientated economy
- CO3 To understand the implications of indirect taxes on the taxable capacity consumers, dealers and of the society at large and its changes
- CO4 To make them to be a tax consultant in preparing the tax planning, tax management. Payment of tax and filling of tax returns
- CO5 To understand the impact of GST on Domestic, National and International Trade and educating the students as a tax audit, consultant and managers.

#### 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 works: 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, structure of Indian tax system. Public finance, public expenditure and public revenue. Principle and objectives of taxations in the modern welfare governments. 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. -**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. - **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 Finance- 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 Beginners –Jayaram Hiregange and Deepak Rao
- 12) CA Practical Manuals
- 13) [www.gstindia.com](http://www.gstindia.com)

## SC05: MCB240 HUMAN RESOURCE MANAGEMENT

### 1. Course Outcome:

- CO1 To provide the student the knowledge about human resources, their significance and managing them in organizations
- CO2 To learn the steps in HRD
- CO3 To analysis human resources planning
- CO4 To familiarize recruitment and selection procedures

### 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



**J S S COLLEGE OF ARTS, COMMERCE & SCIENCE**

**(AUTONOMOUS)**

**OOTY ROAD, MYSORE-570 025**

**(Autonomous under University of Mysore :: Re-accredited by NAAC with 'A' Grade)**

**Choice Based Credit System**

**MASTERS DEGREE**

**in**

**COMPUTER SCIENCE**

**Syllabus (Employability Courses)**

## JAVA Programming

Course Code :CSA 270

### 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, Autotokens, 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.

## **DATABASE MANAGEMENT SYSTEM:**

**Course Code CSC 060**

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, Relational database design by ER – and EER – to – Relational mapping, 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

### **TEXT BOOKS:**

1. Fundamentals of database system – 5<sup>th</sup> Edition – Ramez elmari, Navathe – Person edition

### **REFERENCE BOOKS:**

1. An introduction to database system – 8<sup>th</sup> Edition – C. J. Date, Kannan – Person Education
2. Database system concepts – 5<sup>th</sup> Edition – Korth, Sudarshan – McGraw Bill Edition

## **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



## **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

**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 Vs 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 Scheldt: 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: 12  
Hours

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 cloudonomics, 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 Namespaces 10 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://mrajacse.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





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/>

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
**OOTY ROAD, MYSURU**  
**PG DEPARTMENT OF ZOOLOGY**  
**Syllabus 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	4
	HC - 1.2	Biological Chemistry	2	0	2	4
	HC - 1.3	Cytogenetics	2	0	2	4
	SC - 1.4	Tools and techniques in Biology	3	1	0	4
	SC - 1.5	Chronobiology	3	1	0	4
	SC - 1.6	Histology and Histopathology	3	0	1	4
<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	4
	HC - 2.2	Animal Physiology	2	0	2	4
	HC - 2.3	Entomology	2	0	2	4
	SC - 2.4	Developmental Biology	3	0	1	4
	SC - 2.5	Immunology	3	1	0	4
	SC - 2.6	Evolutionary Biology	3	1	0	4
<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	4
	HC - 3.2	Reproductive Biology	2	0	2	4
	HC - 3.3	Ecology and Wildlife**	2	0	2	4
	SC - 3.4	Ethology *	3	1	0	4
	SC - 3.5	Pollution and Toxicology *	3	1	0	4
	OE - 3.6	concepts of Zoology	3	1	0	4
*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	4
	HC - 4.2	Applied Zoology*	2	0	2	4
	HC - 4.3	Project	0	2	6	8
* 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 Biosystematics & Non Chordata**

**32hrs**  
**8 hrs**

**UNIT I Basic concepts of animal taxonomy:**

- 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. 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) Cypraea 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**

**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., Stumpt, 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**

**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**

**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**

**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, Barends 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**

<b>UNIT – I Basics of Histology</b>	<b>48 Hrs</b>
A. Objectives and applications	<b>8Hrs</b>
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	
<b>UNIT-II Functional Morphology (mammalian)</b>	<b>8 Hrs</b>
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.	
<b>Unit-III Histochemistry</b>	<b>8 Hrs</b>
A. Principles and methods of application	
B. Classical histochemical Techniques: for localization of glycoproteins (PAS), nucleic acids (Feulgen) and steroid dehydrogenase activity.	
<b>Unit-IV Immunohistochemistry</b>	<b>8 Hrs</b>
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	
<b>UNIT-V Histopathology</b>	<b>8 Hrs</b>
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.	
<b>Unit-VI Histopathology of tumors</b>	<b>8 Hrs</b>
A. Malignant and non-malignant	
B. Types of carcinoma	
C. histopathology of breast and prostate tumors	
<b>PRACTICALS</b>	<b>2x8= 16 Hrs</b>
<b>I. Histology:</b>	
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.	
<b>II. Histometry:</b>	<b>2x3=6hrs</b>
Histometrical measurements and statistical analysis of some tissues.	
<b>III. Histopathology:</b>	<b>2x1=2hrs</b>
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, Philadephia.
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**

**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. **Urogenital 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**

**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. Freeman
5. Guyton. A.G. 1986, Text book of Medical Physiology, 7th Edn., Saunders Publication

**M.Sc., II SEMESTER**  
**HC – 2.3 ENTOMOLOGY**

**Unit I: General Entomology** **32hrs**  
**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 Manual 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**

**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 transplantation 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**

**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; eosinophils, basophils, 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**
- 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**

**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, cis-regulatory elements, terminators, transcription factors). ii) Post transcriptional modifications of mRNA in eukaryotes (G-cap, PolyA 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 activation.

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 medically 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
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. Solti, 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**

**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.
5. Muneeth Kainth (2005) Chordate Embryology, Dominant Publishers and Distributors, New Delhi.
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
7. Paul Wassar man and Jimmy D. Neill (2005) Knogbil and neill's physiology of reproductive volume 1st and 2nd and 3rd edition
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**

**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 DMT.
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**

<b>UNIT - I</b>	<b>48 Hrs</b>
A. Descriptive versus experimental approaches	<b>8 Hrs</b>
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.	
<b>UNIT- II</b>	<b>8 Hrs</b>
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.	
<b>UNIT- III Foraging and anti-predator behaviour</b>	<b>8 Hrs</b>
i. Anti predator behaviour – avoiding detection through colour and Markings (Mullarian mimicry)	
ii. Warning coloration	
iii. Batesian mimicry	
<b>UNIT-IV Biological communication</b>	<b>8 Hrs</b>
i. Forms of signals,	
ii. Visual communication with suitable examples,	
iii. Auditory Communication	
iv. Tactile and Chemical communication	
<b>UNIT -V Sexual Behaviour</b>	<b>8 Hrs</b>
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	
<b>UNIT-VI Social Behaviour</b>	<b>8 Hrs</b>
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**

**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, Biodetoxification of organo phosphates and organo chorines 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, Mariguana(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**

**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
3. Hyman L. H. 1940. The invertebrates Vol.1 Protozoa through Ctenophora, McGraw hill co., N. Y.
4. Hyman. L. H. 1968. The Invertebrates Vol.8 McGraw Hill Co., N. Y and London.
5. Parker, T. J. Haswell, W. A. 1961. Text book of Zoology, Vol.I, Macmillon Co., London.
6. Russel – Hunter, W.D 1969. A. biology of higher invertebrates, Mac millon Co., Ltd., London.
7. Barrington, E. J. W. 1965. The Biology of Hemichordata and Protochordata – Oliver and Boyd, Edinburgh.

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 Paleontology, 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

#### 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**

**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 Saturniidae 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 separation, 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**

**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)

**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 'Chinees' 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 attitude 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>

# NEP-2020 Model Syllabus for BSc (Basic and Honors), Semesters I and II

## Semester: I

Course Code: <b>DSC-1 [FSA450]</b>	Course Title: <b>Computer Fundamentals and Programming in C</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52Hours</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>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 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.</p>	13
<b>Unit - 2</b>	
<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>	13
<b>Unit - 3</b>	
<p><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> &amp; <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.</p> <p>Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.</p> <p>Strings: Declaring &amp; Initializing string variables; String handling functions - <i>strlen</i>, <i>strcmp</i>, <i>strcpy</i> and <i>strcat</i>; Character handling functions - <i>toascii</i>, <i>toupper</i>, <i>tolower</i>, <i>isalpha</i>, <i>isnumeric</i> etc.</p>	13

<b>Unit - 4</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>	13

### Text Books

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balaguruswamy: 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 [FSA450]</b>	Course Title: <b>C Programming Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</b>

### 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 [FSB450]</b>	Course Title: <b>Data Structures using C</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52 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 and searching

Course Content	Hours
<b>Unit - 1</b>	
Introduction to data structures: Definition; Types of data structures - Primitive & Nonprimitive, 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, Selection 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
<b>Unit - 4</b>	
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 [FSB 450]</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>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</b>

### 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

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>

# Skill Enhancement Courses (SEC) for B.A.,B.Com., BBA , B.Sc. & BCA Semester: I / II

**Course Code:** [FHA210 / FSB210 / [FAB210]

**Course Title:** SEC**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, Problemsolving, 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 Cyber security
2. Develop holistically by learning essential skills such as effective communication, problemsolving, 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**

#### **Duration**

#### **Module 1: Emerging Technologies**

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. BigData 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

**Open Elective Courses offered by the Department of Computer Science I Semesters**

Course Code: <b>Open Elective OE-1 [FSA880]</b>	Course Title: <b>Office Automation</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):**

- 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.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1</b>	
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	14
<b>Unit – 2</b>	
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.	14
<b>Unit – 3</b>	
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.	14

**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.

Course Code: <b>Open Elective OE-2 [FSA890]</b>	Course Title: <b>C Programming Concepts</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1</b>	
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.	14
<b>Unit – 2</b>	
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.	14
<b>Unit – 3</b>	
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;	14

**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)

**II Semesters**

Course Code: <b>Open Elective OE-3 [FSB880]</b>	Course Title: <b>e-Commerce</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):**

- Be familiar with different e-commerce theories and terminology.
- Assess the impact of internet and internet technology in a business electronic commerce and electronic business.
- Learn strategies for e-commerce and electronic payment system.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1</b>	
Introduction to e-commerce, the difference between e-commerce and e-business, Technological building blocks underlying e-commerce: the Internet, Web, and Mobile Platform, Major Trends in e-commerce, Unique Features of e-commerce Technology. Modes of electronic commerce: Overview, Electronic data interchange (EDI), ecommerce with WWW/Internet. Payments and Security: Electronic cash and electronic payment Schemes: Internet monetary payment and Security requirements, payment and purchase order process, Online electronic cash.	14
<b>Unit – 2</b>	
Types of e-commerce: Business-to-Consumer (B2C), Business-to-Business (B2B) , Consumer-to-Consumer (C2C), Mobile e-commerce (M-commerce), Social ecommerce, Local e-commerce. Consumer-oriented e-commerce: Introduction, Traditional retailing and e-retailing, benefits of e-retailing, Key success factors, Models of e-retailing, features of etailing, developing a consumer-oriented e-commerce system, The PASS model.	14
<b>Unit – 3</b>	
e-Commerce Infrastructure: The Internet, Technology Background, Internet — Key Technology concepts, <b>TCP/IP, IP</b> addresses, Domain names, DNS and URLs, Client Server Computing, Cloud computing model, Mobile platform. Internet and Web: Hypertext, HTML, XML, Web servers and clients, Web browsers, Communication tools — E mail, messaging apps.	14

**Text Books:**

1. Laudon, Kenneth C., and Carol Guercio Traver. *E-Commerce 2020-2021*. Pearson, 2020.
- 2.Laudon, Kenneth C., and Carol Guercio Traver. *E-commerce Essentials*. Pearson, 2014.

**References:**

1. Ravi Kalakota, Andrew B. *Frontiers of Electronic Commerce*, Addison Wesley 1996.

Course Code: <b>Open Elective OE-4 [FSB890]</b>	Course Title: <b>Web Designing</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):

- Be familiar with different web design theories and terminology.
- Analyze a web page and identify its elements and attributes.
- Create web pages using XHTML and Cascading Style Sheets.
- Build dynamic web pages using JavaScript (Client-side programming)

Course Content	Hours
<b>Unit – 1</b>	
Fundamentals: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox. Introduction to XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, <Span> and <Div> tags	14
<b>Unit – 2</b>	
The Basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples. The JavaScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling, handling events from the Body elements	14
<b>Unit – 3</b>	
Button elements, Text box and Password elements, The DOM 2 event model, the navigator object, DOM tree traversal and modification. Dynamic documents with JavaScript: Introduction, positioning elements, moving elements, Element visibility, changing colors and fonts, Dynamic content, Stacking elements, locating the mouse cursor, Reacting to a mouse click, slow movement of elements, Dragging and dropping elements.	14

### Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.

### References:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

# NEP-2020 Model Syllabus for BSc (Basic and Honors), Semesters III and IV

## Semester: III

Course Code: <b>DSC-3 [FSC 450]</b>	Course Title: <b>Object Oriented Programming in Java</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52Hours</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 object-oriented concepts and JAVA.
- Write JAVA programs using OOP concepts like Abstraction, Encapsulation, Inheritance and Polymorphism.
- Implement Classes and multithreading using JAVA.
- Demonstrate the basic principles of creating Java applications with GUI.

Course Content	Hours
<b>Unit – 1</b>	
<b>Introduction to Java:</b> Basic OOPs concepts, 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.	13
<b>Unit – 2</b>	
Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference. <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.	13
<b>Unit – 3</b>	
<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, Exception handling mechanism.	13
<b>Unit – 4</b>	
<b>I/O programming:</b> Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, Collections in java, Network Programming	13

### References:

Object Oriented Programming with Java: Somashekara M.T., Guru, D.S., Manjunatha K.S, 1<sup>st</sup> Edition, PHI Learning 2017.

Programming with Java, By E Balagurusamy – A Primer, 4<sup>th</sup> Edition, McGraw Hill Publication.

Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall.

Java 2 - The Complete Reference, Herbert Schildt, 5<sup>th</sup> Edition, McGraw Hill Publication, 2017. Java - The Complete Reference, Herbert Schildt, 7<sup>th</sup> Edition, McGraw Hill Publication, 2017.



Course Code: <b>DSC-3L [FSC 450]</b>	Course Title: <b>Java Programming Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</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

### Java Programming Lab

#### PART A: Fundamentals of 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, 3 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.

## **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 creates 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. Demonstrate the various mouse handling events using suitable example.

Note: Student has to execute a minimum of 8 programs in each part to complete the Lab course.

### **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

## Semester: IV

Course Code: <b>DSC-4 [FSD 450]</b>	Course Title: <b>Database Management System</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52Hours</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>	
<b>Database Architecture:</b> 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. <b>E-R Model:</b> Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute.	13
<b>Unit – 2</b>	
Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E-R diagram. <b>Relational Data Model:</b> 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.	13
<b>Unit – 3</b>	
<b>Data Normalization:</b> Anomalies in relational database design. Decomposition. Functional dependencies - Axioms, Minima and Maxima covers. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form.	13
<b>Unit – 4</b>	
<b>Query Processing Transaction Management:</b> 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.	13

### 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>DSC-4L [FSD 450]</b>	Course Title: <b>DBMS Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</b>

**Course Outcomes (COs):**

Student would be able to create tables, execute queries

1. Execute a single line query and group functions.
2. Execute DDL Commands.
3. Execute DML Commands 4. Execute DCL and TCL Commands.
4. Implement the Nested Queries.
5. Implement Join operations in SQL
6. Create views for a particular table
7. Implement Locks for a particular table

**Activity 1:**

**Database: Student (DDL, DML Statements) Table: Student**

Name	Reg. No	Class	Major
Smith	17	1	CS
Brown	8	2	CS

**Table: Course**

Course Name	Course Number	Credit Hours	Department
Introduction to Computer Science	CS1310	4	CS
Data Structure	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database Management System	CS3380	3	CS

**Table: Section**

Section Identifier	Course Number	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**

Reg. No	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**

EMPID	FIRSTNAME	LASTNAME	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:EMP SALARY**

EMPID	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 TOTALSALARY 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

Book_Id	Book_name	Author_Name	Publishers	Price	Type	Quantity
C0001	The Kloner and I	Lata Kappor	EPP	355	Novel	5
F0001	The Tears	WilliamHopkins	First Publ	650	Fiction	20
T0001	My First C++	Brain & Brooke	ERP	350	Text	10
T0002	C++ Brainwork's	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

### 6: Database Activity: 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)

Create Following **table** and insert **tuples** with suitable constraints

**Database: Bank system Table: Account**

Account_No	Cust_Name	Branch_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	Bangalore
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 branchid
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



**Skill Enhancement Course: SEC for B.Sc. & other Subject Students**  
**Semester: III / IV**

Course Code: <b>SEC-2</b>	Course Title: <b>Artificial Intelligence</b>
Course Credits: 1 + 1 = <b>02</b>	Hour of Teaching / Week: Theory ( <b>1Hour</b> ) + Practical ( <b>2Hours</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>
<b>[FHC210 / FSD210 / FAD210]</b>	

**Course Outcomes (COs):**

At the end of the course, students will be able to:

- Appraise the theory of Artificial intelligence and list the significance of AI.
- Discuss the various components that are involved in solving an AI problem.
- Illustrate the working of AI Algorithms in the given contrast.
- Analyze the various knowledge representation schemes, Reasoning and Learning techniques of AI.
- Apply the AI concepts to build an expert system to solve the real-world problems.

Course Content	Hours
<b>Unit – 1</b>	
<b>Overview of AI:</b> Definition of Artificial Intelligence, Philosophy of AI, Goals of AI, Elements of AI system, Programming a computer without and with AI, AI Techniques, History of AI. <b>Intelligent Systems:</b> Definition and understanding of Intelligence, Types of Intelligence, Human Intelligence vs Machine Intelligence.	06
<b>Unit – 2</b>	
<b>AI Applications:</b> Virtual assistance, Travel and Navigation, Education and Healthcare, optical character recognition, E-commerce and mobile payment systems, Image based search and photo editing. <b>AI Examples in daily life:</b> Installation of AI apps and instructions to use AI apps. Introduction to Robotics.	07
<b>Unit – 3</b>	
<b>Laboratory Activities:</b> <b>Amazon Alexa:</b> <a href="https://play.google.com/store/apps/details?id=com.amazon.dee.app&amp;hl=en&amp;gl=US">https://play.google.com/store/apps/details?id=com.amazon.dee.app&amp;hl=en&amp;gl=US</a> <b>Google Lens:</b> <a href="https://play.google.com/store/search?q=google+lens&amp;c=apps&amp;hl=en&amp;gl=US">https://play.google.com/store/search?q=google+lens&amp;c=apps&amp;hl=en&amp;gl=US</a> <b>Image to Text to Speech ML OCR:</b> <a href="https://play.google.com/store/apps/details?id=com.mlscanner.image.text.spech&amp;hl=en_IN&amp;gl=US">https://play.google.com/store/apps/details?id=com.mlscanner.image.text.spech&amp;hl=en_IN&amp;gl=US</a> <b>Google Pay:</b> <a href="https://play.google.com/store/apps/details?id=com.google.android.apps.nbu.paisauser&amp;hl=enIN&amp;gl=US">https://play.google.com/store/apps/details?id=com.google.android.apps.nbu.paisauser&amp;hl=enIN&amp;gl=US</a> <b>Grammarly:</b> <a href="https://play.google.com/store/search?q=grammarly&amp;c=apps&amp;hl=enIN&amp;gl">https://play.google.com/store/search?q=grammarly&amp;c=apps&amp;hl=enIN&amp;gl</a> <b>Google Map:</b> <a href="https://play.google.com/store/search?q=google+maps&amp;c=apps&amp;hl=en&amp;gl=US">https://play.google.com/store/search?q=google+maps&amp;c=apps&amp;hl=en&amp;gl=US</a> <b>FaceApp:</b> <a href="https://play.google.com/store/apps/details?id=io.faceapp&amp;hl=en_IN&amp;gl=US">https://play.google.com/store/apps/details?id=io.faceapp&amp;hl=en_IN&amp;gl=US</a> <b>Socratic:</b> <a href="https://play.google.com/store/apps/details?id=com.google.socratic&amp;hl=en_IN&amp;gl=US">https://play.google.com/store/apps/details?id=com.google.socratic&amp;hl=en_IN&amp;gl=US</a> <b>Google Fit:</b> <b>Activity Tracking:</b> <a href="https://play.google.com/store/apps/details?id=com.google.android.apps.fitness&amp;hl=enIN&amp;gl=US">https://play.google.com/store/apps/details?id=com.google.android.apps.fitness&amp;hl=enIN&amp;gl=US</a> <b>SwiftKey Keyboard:</b> <a href="https://swiftkey-keyboard.en.uptodown.com/android">https://swiftkey-keyboard.en.uptodown.com/android</a> <b>E-commerce App:</b> <a href="https://play.google.com/store/apps/details?id=com.jpl.jiomart&amp;hl=enIN&amp;gl=US">https://play.google.com/store/apps/details?id=com.jpl.jiomart&amp;hl=enIN&amp;gl=US</a>	26

### **Text Books:**

1. Wolfgang Ertel, "Introduction to Artificial Intelligence", 2nd Edition, Springer International Publishing 2017.
2. Michael Negnevitsky, "Artificial Intelligence A Guide to Intelligent Systems", 2nd Edition, Pearson Education Limited 2005.

### **References:**

1. [https://www.tutorialspoint.com/artificial\\_intelligence/artificial\\_intelligence\\_tutorial.pdf](https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_tutorial.pdf)
2. Kevin Knight, Elaine Rich, Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, July 2017.

### **Reference Links:**

1. Voice Assistant: <https://alan.app/blog/voiceassistant-2/>
2. Browse with image: <https://www.pocket-lint.com/apps/news/google/141075-what-is-google-lens-and-how-does-it-work-and-which-devices-have-it>
3. OCR: <https://aws.amazon.com/what-is/ocr/>
4. Mobile Payment system: <https://gocardless.com/en-us/guides/posts/how-do-mobile-paymentsystems-work/>
5. Grammarly: <https://techjury.net/blog/how-to-use-grammarly/#gref>
6. Travel & Navigation: <https://blog.google/products/maps/google-maps-101-ai-power-newfeatures-io-2021/>
7. AI in photo editing: <https://digital-photography-school.com/artificial-intelligence-changed-photoediting/>
8. AI in education: <https://www.makeuseof.com/what-is-google-socratic-how-does-it-work/>
9. AI in health and fitness: <https://cubettech.com/resources/blog/implementing-machine-learning-and-ai-in-health-and-fitness/>
10. E-commerce and online shopping: <https://medium.com/@nyxonedigital/importance-of-ecommerce-and-online-shopping-and-why-to-sell-online-5a3fd8e6f416>

## Open Elective Courses offered by the Department of Computer Science Semester: III

Course Code: <b>OE-5 [FSC 880]</b>	Course Title: <b>Python Programming Concepts</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):

- Explain the fundamentals of Computers.
- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and the creation of functions.
- Identify the methods to create and store strings.

Course Content	Hours
<b>Unit – 1 Fundamentals of Computers</b>	
Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organization 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. Python Basics: - Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association;	14
<b>Unit – 2 Data types and control structure</b>	
Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples; Illustrative programs. 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; Illustrative programs.	14
<b>Unit – 3 Functions and Strings</b>	
Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Illustrative programs. Strings: Creating and Storing Strings; Accessing String Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods; Illustrative programs.	14

### References

1. Computer Fundamentals (BPB), P. K. Sinha & Priti Sinha
2. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, Green Tea Press. Freely available online 2015.  
@<https://www.greenteapress.com/thinkpython/thinkCSpy.pdf>
3. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
4. <http://www.ibiblio.org/g2swap/byteofpython/read/>
5. <http://scipy-lectures.org/intro/language/python language.html>
6. <https://docs.python.org/3/tutorial/index.html>

Course Code: <b>OE-6 [FSC 890]</b>	Course Title: <b>Fundamentals of Multimedia</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):

- Students will learn about multimedia, which is a field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images(video), animation, audio and any other media where every type of information can be represented, stored, transmitted and processed digitally.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1 Introduction to Multimedia</b>	
Concepts of Multimedia, Multimedia applications, Advantage of Digital Multimedia, Multimedia system Architecture, Objects of Multimedia. Introduction to Compression and Decompression Techniques and its types. File format standards- RTF, TIFF, RIFF, MIDI, JPEG, AVI, JPEG, TWAIN Architecture.	14
<b>Unit – 2 Multimedia input and output technologies</b>	
Key Technology Issues, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Video Images and Animation, Full Motion Video.	14
<b>Unit – 3 Secured Multimedia and Authentication</b>	
Secured Multimedia, Digital Rights Management Systems, and Technical Trends - Multimedia encryption - Digital Watermarking – Security Attacks. Multimedia Authentication - Pattern, Speaker and Behavior Recognition – Speaker Recognition - Face Recognition	14

References

1. Wenjun Zeng, Heather Yu and Ching – Yung Lin, “Multimedia Security technologies for Digital rights Management”, Elsevier Inc 2006.
2. Chun-Shien Lu, “Multimedia Security : Steganography and Digital Watermarking techniques for Protection of Intellectual Property”, Springer Inc 2007.
3. Andleigh PK and Thakrar K, “Multimedia Systems”, Addison Wesley Longman, 1999.
4. Fred Halsall, “Multimedia Communications”, Addison Wesley, 2000.
5. [https://www.tutorialspoint.com/multimedia/multimedia\\_introduction.html](https://www.tutorialspoint.com/multimedia/multimedia_introduction.html)
6. [https://www.tutorialspoint.com/multimedia/multimedia\\_images\\_graphics.html](https://www.tutorialspoint.com/multimedia/multimedia_images_graphics.html)

## Semester: IV

Course Code: <b>OE-7 [FSD 880]</b>	Course Title: <b>Cloud Computing</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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 successful completion of the course, the student is able to
- Learn in depth Fundamentals of Cloud Computing
- Understand the details of Cloud Services and File System
- Learn in depth Concept of Collaborating with Cloud
- Understand the details of Virtualization in cloud
- Learn the classification and characteristics of Security challenges in Cloud Computing
- Specify the classification and characteristics of Security challenges in Cloud Computing

Course Content	Hours
<b>Unit – 1</b>	
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.	14
<b>Unit – 2</b>	
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.	14
<b>Unit – 3</b>	
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.	14

### 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

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  
Webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.pptop ennebula.org,  
www.cloudbus.org/cloudsim/, <http://www.eucalyptus.com/> [hadoop.apache.org](http://hadoop.apache.org)  
[http://hadoop.apache.org/docs/stable/hdfs\\_design.html](http://hadoop.apache.org/docs/stable/hdfs_design.html)  
[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)

Course Code: <b>OE-8 [FSD 890]</b>	Course Title: <b>Fundamentals of Mobile Application</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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 successful completion of the course, the student is able to

- Deliberate the details of Concepts of Event Driven Programming
- Learn in details with examples issues of Mobile applications
- Specify the details of Mobile applications Development tools and Frameworks
- Deliberate in details with examples common Mobile device UI's

Course Content	Hours
<b>Unit – 1</b>	
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)	14
<b>Unit – 2</b>	
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. Common UI's for mobile devices: Navigation Controllers, Tab Bars, Table Views, Modal views, UI Layout.	14
<b>Unit – 3</b>	
Data Persistence: Maintaining state between application invocations, File system, Property Lists, SQLite, Core Data. 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	14

### 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.

# NEP-2020 Model Syllabus for BSc (Basic and Honors), Semesters I and II

## Semester: I

Course Code: <b>DSC-1 [FSA450]</b>	Course Title: <b>Computer Fundamentals and Programming in C</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52Hours</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>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 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.</p>	13
<b>Unit - 2</b>	
<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>	13
<b>Unit - 3</b>	
<p><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> &amp; <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.</p> <p>Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.</p> <p>Strings: Declaring &amp; Initializing string variables; String handling functions - <i>strlen</i>, <i>strcmp</i>, <i>strcpy</i> and <i>strcat</i>; Character handling functions - <i>toascii</i>, <i>toupper</i>, <i>tolower</i>, <i>isalpha</i>, <i>isnumeric</i> etc.</p>	13

<b>Unit - 4</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>	13

### Text Books

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. E. Balaguruswamy: 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 [FSA450]</b>	Course Title: <b>C Programming Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</b>

### 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 [FSB450]</b>	Course Title: <b>Data Structures using C</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52 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 and searching

Course Content	Hours
<b>Unit - 1</b>	
Introduction to data structures: Definition; Types of data structures - Primitive & Nonprimitive, 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, Selection 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
<b>Unit - 4</b>	
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 [FSB 450]</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>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</b>

### 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

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>

# Skill Enhancement Courses (SEC) for B.A.,B.Com., BBA , B.Sc. & BCA Semester: I / II

**Course Code:** [FHA210 / FSB210 / [FAB210]

**Course Title:** SEC **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, Problemsolving, 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 Cyber security
2. Develop holistically by learning essential skills such as effective communication, problemsolving, 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**

#### **Duration**

#### **Module 1: Emerging Technologies**

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. BigData 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

**Open Elective Courses offered by the Department of Computer Science I Semesters**

Course Code: <b>Open Elective OE-1 [FSA880]</b>	Course Title: <b>Office Automation</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):**

- 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.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1</b>	
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	14
<b>Unit – 2</b>	
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.	14
<b>Unit – 3</b>	
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.	14

**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.

Course Code: <b>Open Elective OE-2 [FSA890]</b>	Course Title: <b>C Programming Concepts</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1</b>	
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.	14
<b>Unit – 2</b>	
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.	14
<b>Unit – 3</b>	
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;	14

**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)

**II Semesters**

Course Code: <b>Open Elective OE-3 [FSB880]</b>	Course Title: <b>e-Commerce</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):**

- Be familiar with different e-commerce theories and terminology.
- Assess the impact of internet and internet technology in a business electronic commerce and electronic business.
- Learn strategies for e-commerce and electronic payment system.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1</b>	
Introduction to e-commerce, the difference between e-commerce and e-business, Technological building blocks underlying e-commerce: the Internet, Web, and Mobile Platform, Major Trends in e-commerce, Unique Features of e-commerce Technology. Modes of electronic commerce: Overview, Electronic data interchange (EDI), ecommerce with WWW/Internet. Payments and Security: Electronic cash and electronic payment Schemes: Internet monetary payment and Security requirements, payment and purchase order process, Online electronic cash.	14
<b>Unit – 2</b>	
Types of e-commerce: Business-to-Consumer (B2C), Business-to-Business (B2B) , Consumer-to-Consumer (C2C), Mobile e-commerce (M-commerce), Social ecommerce, Local e-commerce. Consumer-oriented e-commerce: Introduction, Traditional retailing and e-retailing, benefits of e-retailing, Key success factors, Models of e-retailing, features of etailing, developing a consumer-oriented e-commerce system, The PASS model.	14
<b>Unit – 3</b>	
e-Commerce Infrastructure: The Internet, Technology Background, Internet — Key Technology concepts, <b>TCP/IP, IP</b> addresses, Domain names, DNS and URLs, Client Server Computing, Cloud computing model, Mobile platform. Internet and Web: Hypertext, HTML, XML, Web servers and clients, Web browsers, Communication tools — E mail, messaging apps.	14

**Text Books:**

1. Laudon, Kenneth C., and Carol Guercio Traver. *E-Commerce 2020-2021*. Pearson, 2020.
- 2.Laudon, Kenneth C., and Carol Guercio Traver. *E-commerce Essentials*. Pearson, 2014.

**References:**

1. Ravi Kalakota, Andrew B. *Frontiers of Electronic Commerce*, Addison Wesley 1996.

Course Code: <b>Open Elective OE-4 [FSB890]</b>	Course Title: <b>Web Designing</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):

- Be familiar with different web design theories and terminology.
- Analyze a web page and identify its elements and attributes.
- Create web pages using XHTML and Cascading Style Sheets.
- Build dynamic web pages using JavaScript (Client-side programming)

Course Content	Hours
<b>Unit – 1</b>	
Fundamentals: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox. Introduction to XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, <Span> and <Div> tags	14
<b>Unit – 2</b>	
The Basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples. The JavaScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling, handling events from the Body elements	14
<b>Unit – 3</b>	
Button elements, Text box and Password elements, The DOM 2 event model, the navigator object, DOM tree traversal and modification. Dynamic documents with JavaScript: Introduction, positioning elements, moving elements, Element visibility, changing colors and fonts, Dynamic content, Stacking elements, locating the mouse cursor, Reacting to a mouse click, slow movement of elements, Dragging and dropping elements.	14

### Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.

### References:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.



# NEP-2020 Model Syllabus for BSc (Basic and Honors), Semesters III and IV

## Semester: III

Course Code: <b>DSC-3 [FSC 450]</b>	Course Title: <b>Object Oriented Programming in Java</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52Hours</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 object-oriented concepts and JAVA.
- Write JAVA programs using OOP concepts like Abstraction, Encapsulation, Inheritance and Polymorphism.
- Implement Classes and multithreading using JAVA.
- Demonstrate the basic principles of creating Java applications with GUI.

Course Content	Hours
<b>Unit – 1</b>	
<b>Introduction to Java:</b> Basic OOPs concepts, 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.	13
<b>Unit – 2</b>	
Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference. <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.	13
<b>Unit – 3</b>	
<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, Exception handling mechanism.	13
<b>Unit – 4</b>	
<b>I/O programming:</b> Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, Collections in java, Network Programming	13

### References:

Object Oriented Programming with Java: Somashekara M.T., Guru, D.S., Manjunatha K.S, 1<sup>st</sup> Edition, PHI Learning 2017.

Programming with Java, By E Balagurusamy – A Primer, 4<sup>th</sup> Edition, McGraw Hill Publication.

Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall.

Java 2 - The Complete Reference, Herbert Schildt, 5<sup>th</sup> Edition, McGraw Hill Publication, 2017. Java - The Complete Reference, Herbert Schildt, 7<sup>th</sup> Edition, McGraw Hill Publication, 2017.

Course Code: <b>DSC-3L [FSC 450]</b>	Course Title: <b>Java Programming Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</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

### Java Programming Lab

#### PART A: Fundamentals of 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, 3 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.

## **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 creates 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. Demonstrate the various mouse handling events using suitable example.

Note: Student has to execute a minimum of 8 programs in each part to complete the Lab course.

### **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

## Semester: IV

Course Code: <b>DSC-4 [FSD 450]</b>	Course Title: <b>Database Management System</b>
Course Credits: <b>04</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>40</b>	Total Contact Hours: <b>52Hours</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>	
<b>Database Architecture:</b> 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. <b>E-R Model:</b> Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute.	13
<b>Unit – 2</b>	
Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E-R diagram. <b>Relational Data Model:</b> 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.	13
<b>Unit – 3</b>	
<b>Data Normalization:</b> Anomalies in relational database design. Decomposition. Functional dependencies - Axioms, Minima and Maxima covers. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form.	13
<b>Unit – 4</b>	
<b>Query Processing Transaction Management:</b> 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.	13

### 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>DSC-4L [FSD 450]</b>	Course Title: <b>DBMS Lab</b>
Course Credits: <b>02</b>	Hour of Teaching / Week: <b>04Hours</b>
Formative Assessment Marks: <b>25</b>	Total Contact Hours: <b>52Hours</b>
Exam Marks: <b>25</b>	Exam Duration: <b>03Hours</b>

**Course Outcomes (COs):**

Student would be able to create tables, execute queries

1. Execute a single line query and group functions.
2. Execute DDL Commands.
3. Execute DML Commands 4. Execute DCL and TCL Commands.
4. Implement the Nested Queries.
5. Implement Join operations in SQL
6. Create views for a particular table
7. Implement Locks for a particular table

**Activity 1:**

**Database: Student (DDL, DML Statements) Table: Student**

Name	Reg. No	Class	Major
Smith	17	1	CS
Brown	8	2	CS

**Table: Course**

Course Name	Course Number	Credit Hours	Department
Introduction to Computer Science	CS1310	4	CS
Data Structure	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database Management System	CS3380	3	CS

**Table: Section**

Section Identifier	Course Number	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**

Reg. No	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**

EMPID	FIRSTNAME	LASTNAME	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:EMP SALARY**

EMPID	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 TOTALSALARY 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

Book_Id	Book_name	Author_Name	Publishers	Price	Type	Quantity
C0001	The Kloner and I	Lata Kappor	EPP	355	Novel	5
F0001	The Tears	WilliamHopkins	First Publ	650	Fiction	20
T0001	My First C++	Brain & Brooke	ERP	350	Text	10
T0002	C++ Brainwork"s	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

### 6: Database Activity: 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)

Create Following **table** and insert **tuples** with suitable constraints

**Database: Bank system Table: Account**

Account_No	Cust_Name	Branch_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	Bangalore
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 branchid
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

**Skill Enhancement Course: SEC for B.Sc. & other Subject Students**  
**Semester: III / IV**

Course Code: <b>SEC-2</b>	Course Title: <b>Artificial Intelligence</b>
Course Credits: 1 + 1 = <b>02</b>	Hour of Teaching / Week: Theory ( <b>1Hour</b> ) + Practical ( <b>2Hours</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>
<b>[FHC210 / FSD210 / FAD210]</b>	

**Course Outcomes (COs):**

At the end of the course, students will be able to:

- Appraise the theory of Artificial intelligence and list the significance of AI.
- Discuss the various components that are involved in solving an AI problem.
- Illustrate the working of AI Algorithms in the given contrast.
- Analyze the various knowledge representation schemes, Reasoning and Learning techniques of AI.
- Apply the AI concepts to build an expert system to solve the real-world problems.

Course Content	Hours
<b>Unit – 1</b>	
<b>Overview of AI:</b> Definition of Artificial Intelligence, Philosophy of AI, Goals of AI, Elements of AI system, Programming a computer without and with AI, AI Techniques, History of AI. <b>Intelligent Systems:</b> Definition and understanding of Intelligence, Types of Intelligence, Human Intelligence vs Machine Intelligence.	06
<b>Unit – 2</b>	
<b>AI Applications:</b> Virtual assistance, Travel and Navigation, Education and Healthcare, optical character recognition, E-commerce and mobile payment systems, Image based search and photo editing. <b>AI Examples in daily life:</b> Installation of AI apps and instructions to use AI apps. Introduction to Robotics.	07
<b>Unit – 3</b>	
<b>Laboratory Activities:</b> <b>Amazon Alexa:</b> <a href="https://play.google.com/store/apps/details?id=com.amazon.dee.app&amp;hl=en&amp;gl=US">https://play.google.com/store/apps/details?id=com.amazon.dee.app&amp;hl=en&amp;gl=US</a> <b>Google Lens:</b> <a href="https://play.google.com/store/search?q=google+lens&amp;c=apps&amp;hl=en&amp;gl=US">https://play.google.com/store/search?q=google+lens&amp;c=apps&amp;hl=en&amp;gl=US</a> <b>Image to Text to Speech ML OCR:</b> <a href="https://play.google.com/store/apps/details?id=com.mlscanner.image.text.spech&amp;hl=en_IN&amp;gl=US">https://play.google.com/store/apps/details?id=com.mlscanner.image.text.spech&amp;hl=en_IN&amp;gl=US</a> <b>Google Pay:</b> <a href="https://play.google.com/store/apps/details?id=com.google.android.apps.nbu.paisauser&amp;hl=enIN&amp;gl=US">https://play.google.com/store/apps/details?id=com.google.android.apps.nbu.paisauser&amp;hl=enIN&amp;gl=US</a> <b>Grammarly:</b> <a href="https://play.google.com/store/search?q=grammarly&amp;c=apps&amp;hl=enIN&amp;gl">https://play.google.com/store/search?q=grammarly&amp;c=apps&amp;hl=enIN&amp;gl</a> <b>Google Map:</b> <a href="https://play.google.com/store/search?q=google+maps&amp;c=apps&amp;hl=en&amp;gl=US">https://play.google.com/store/search?q=google+maps&amp;c=apps&amp;hl=en&amp;gl=US</a> <b>FaceApp:</b> <a href="https://play.google.com/store/apps/details?id=io.faceapp&amp;hl=en_IN&amp;gl=US">https://play.google.com/store/apps/details?id=io.faceapp&amp;hl=en_IN&amp;gl=US</a> <b>Socratic:</b> <a href="https://play.google.com/store/apps/details?id=com.google.socratic&amp;hl=en_IN&amp;gl=US">https://play.google.com/store/apps/details?id=com.google.socratic&amp;hl=en_IN&amp;gl=US</a> <b>Google Fit:</b> <b>Activity Tracking:</b> <a href="https://play.google.com/store/apps/details?id=com.google.android.apps.fitness&amp;hl=enIN&amp;gl=US">https://play.google.com/store/apps/details?id=com.google.android.apps.fitness&amp;hl=enIN&amp;gl=US</a> <b>SwiftKey Keyboard:</b> <a href="https://swiftkey-keyboard.en.uptodown.com/android">https://swiftkey-keyboard.en.uptodown.com/android</a> <b>E-commerce App:</b> <a href="https://play.google.com/store/apps/details?id=com.jpl.jiomart&amp;hl=enIN&amp;gl=US">https://play.google.com/store/apps/details?id=com.jpl.jiomart&amp;hl=enIN&amp;gl=US</a>	26

### **Text Books:**

1. Wolfgang Ertel, "Introduction to Artificial Intelligence", 2nd Edition, Springer International Publishing 2017.
2. Michael Negnevitsky, "Artificial Intelligence A Guide to Intelligent Systems", 2nd Edition, Pearson Education Limited 2005.

### **References:**

1. [https://www.tutorialspoint.com/artificial\\_intelligence/artificial\\_intelligence\\_tutorial.pdf](https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_tutorial.pdf)
2. Kevin Knight, Elaine Rich, Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, July 2017.

### **Reference Links:**

1. Voice Assistant: <https://alan.app/blog/voiceassistant-2/>
2. Browse with image: <https://www.pocket-lint.com/apps/news/google/141075-what-is-google-lens-and-how-does-it-work-and-which-devices-have-it>
3. OCR: <https://aws.amazon.com/what-is/ocr/>
4. Mobile Payment system: <https://gocardless.com/en-us/guides/posts/how-do-mobile-paymentsystems-work/>
5. Grammarly: <https://techjury.net/blog/how-to-use-grammarly/#gref>
6. Travel & Navigation: <https://blog.google/products/maps/google-maps-101-ai-power-newfeatures-io-2021/>
7. AI in photo editing: <https://digital-photography-school.com/artificial-intelligence-changed-photoediting/>
8. AI in education: <https://www.makeuseof.com/what-is-google-socratic-how-does-it-work/>
9. AI in health and fitness: <https://cubettech.com/resources/blog/implementing-machine-learningand-ai-in-health-and-fitness/>
10. E-commerce and online shopping: <https://medium.com/@nyxonedigital/importance-2-of-ecommerce-and-online-shopping-and-why-to-sell-online-5a3fd8e6f416>

## Open Elective Courses offered by the Department of Computer Science Semester: III

Course Code: <b>OE-5 [FSC 880]</b>	Course Title: <b>Python Programming Concepts</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):

- Explain the fundamentals of Computers.
- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and the creation of functions.
- Identify the methods to create and store strings.

Course Content	Hours
<b>Unit – 1 Fundamentals of Computers</b>	
Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organization 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. Python Basics: - Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association;	14
<b>Unit – 2 Data types and control structure</b>	
Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples; Illustrative programs. 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; Illustrative programs.	14
<b>Unit – 3 Functions and Strings</b>	
Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Illustrative programs. Strings: Creating and Storing Strings; Accessing String Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods; Illustrative programs.	14

### References

1. Computer Fundamentals (BPB), P. K. Sinha & Priti Sinha
2. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, Green Tea Press. Freely available online 2015.  
@<https://www.greenteapress.com/thinkpython/thinkCSpy.pdf>
3. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
4. <http://www.ibiblio.org/g2swap/byteofpython/read/>
5. <http://scipy-lectures.org/intro/language/python language.html>
6. <https://docs.python.org/3/tutorial/index.html>

Course Code: <b>OE-6 [FSC 890]</b>	Course Title: <b>Fundamentals of Multimedia</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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):

- Students will learn about multimedia, which is a field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images(video), animation, audio and any other media where every type of information can be represented, stored, transmitted and processed digitally.

<b>Course Content</b>	<b>Hours</b>
<b>Unit – 1 Introduction to Multimedia</b>	
Concepts of Multimedia, Multimedia applications, Advantage of Digital Multimedia, Multimedia system Architecture, Objects of Multimedia. Introduction to Compression and Decompression Techniques and its types. File format standards- RTF, TIFF, RIFF, MIDI, JPEG, AVI, JPEG, TWAIN Architecture.	14
<b>Unit – 2 Multimedia input and output technologies</b>	
Key Technology Issues, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Video Images and Animation, Full Motion Video.	14
<b>Unit – 3 Secured Multimedia and Authentication</b>	
Secured Multimedia, Digital Rights Management Systems, and Technical Trends - Multimedia encryption - Digital Watermarking – Security Attacks. Multimedia Authentication - Pattern, Speaker and Behavior Recognition – Speaker Recognition - Face Recognition	14

References

1. Wenjun Zeng, Heather Yu and Ching – Yung Lin, “Multimedia Security technologies for Digital rights Management”, Elsevier Inc 2006.
2. Chun-Shien Lu, “Multimedia Security : Steganography and Digital Watermarking techniques for Protection of Intellectual Property”, Springer Inc 2007.
3. Andleigh PK and Thakrar K, “Multimedia Systems”, Addison Wesley Longman, 1999.
4. Fred Halsall, “Multimedia Communications”, Addison Wesley, 2000.
5. [https://www.tutorialspoint.com/multimedia/multimedia\\_introduction.html](https://www.tutorialspoint.com/multimedia/multimedia_introduction.html)
6. [https://www.tutorialspoint.com/multimedia/multimedia\\_images\\_graphics.html](https://www.tutorialspoint.com/multimedia/multimedia_images_graphics.html)

## Semester: IV

Course Code: <b>OE-7 [FSD 880]</b>	Course Title: <b>Cloud Computing</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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 successful completion of the course, the student is able to
- Learn in depth Fundamentals of Cloud Computing
- Understand the details of Cloud Services and File System
- Learn in depth Concept of Collaborating with Cloud
- Understand the details of Virtualization in cloud
- Learn the classification and characteristics of Security challenges in Cloud Computing
- Specify the classification and characteristics of Security challenges in Cloud Computing

Course Content	Hours
<b>Unit – 1</b>	
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.	14
<b>Unit – 2</b>	
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.	14
<b>Unit – 3</b>	
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.	14

### 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

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  
Webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.pptop ennebula.org,  
www.cloudbus.org/cloudsim/, <http://www.eucalyptus.com/> [hadoop.apache.org](http://hadoop.apache.org)  
[http://hadoop.apache.org/docs/stable/hdfs\\_design.html](http://hadoop.apache.org/docs/stable/hdfs_design.html)  
[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)

Course Code: <b>OE-8 [FSD 890]</b>	Course Title: <b>Fundamentals of Mobile Application</b>
Course Credits: <b>03</b>	Hour of Teaching / Week: <b>03Hours</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 successful completion of the course, the student is able to

- Deliberate the details of Concepts of Event Driven Programming
- Learn in details with examples issues of Mobile applications
- Specify the details of Mobile applications Development tools and Frameworks
- Deliberate in details with examples common Mobile device UI's

Course Content	Hours
<b>Unit – 1</b>	
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)	14
<b>Unit – 2</b>	
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. Common UI's for mobile devices: Navigation Controllers, Tab Bars, Table Views, Modal views, UI Layout.	14
<b>Unit – 3</b>	
Data Persistence: Maintaining state between application invocations, File system, Property Lists, SQLite, Core Data. 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	14

### 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.

**SEMESTER V**

Course code: DME2003

**DSE BA: Elective: Computer Science – V  
Database Management Systems****Credits: Theory – 04****60 Hours****Course Outcome:**

- After successful completion of the course, the student is able to
- CO1: Understand the characteristics of DBMS with examples
  - CO2: Explain 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 depth with examples MySQL Commands
  - CO6: Learn in depth with examples in PL-SQL.

**Unit - 1****15 Hours**

**Introduction to Database Management Systems:** Definition of Data, Information, DBMS; Data base system application, Purpose of database systems, Characteristics of DB – how describing users, Interaction between programs, data and data. Abstraction Data Independence, support of multiple views of the data, sharing of data and strategies, restriction processing, Storage management, Database language - DDL, DML, DCL. . . . .  
File processing system vs 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 Hours**

**Entity-Relationship and Relational ER Modeling:** Entity types, Entity Sets, Attributes, and Keys, Normalization, Relationship Types, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, RDBMS, Schema Definition, constraints, and other modeling.

**Unit - 3****15 Hours**

**Relational Data Model:** Basic concepts, Relational Constraints and Relational Database Software, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations.

**Database design:** ER and EER to relational mapping, Functional dependencies, normal form: first normal form, second normal form, third normal form BCNF

**Unit - 4****15 Hours**

**MySQL, DDL/PL-SQL: SQL VS, SQL \* PLUS, SQL COMMANDS ANDRAES TYPES, OPERATORS AND EXPRESSIONS, INSTRUCTION TO SQL \* PLUS.**



**MANAGING TABLES AND DATA:**

- CREATING AND ALTERING TABLES (INCLUDING CONSTRAINTS)
- DATA MANIPULATION COMMANDS (i.e. INSERT, UPDATE, DELETE)
- WHERE STATEMENT WITH WHERE, ORDER BY AND HAVING, ORDER BY DESCEND, SPATIAL OPERATOR LIKE, IN, ANY, ALL, BETWEEN, START, LIKE
- JOIN, JOIN IN SPATIAL OPERATOR DATABASE OBJECTS
- VIEW + OPERATIONS, INDEX, TRANSACTION CONTROL STATEMENTS
- COMMIT, ROLLBACK, REVERSE AND INITIALIZATION TO PLSQL
- SQL FOR PL/SQL + PL/SQL BLOCK STRUCTURE
- LOGIC WILL CONSIST OF PL/SQL VARIABLES, NAME AND COMMENTS DATA, TYPE, CONDITIONS (IF/WHEN/ETC)
- %TYPE, %ROWTYPE
- OBJECT ORIENTED (IMPL, EXT, ABSTRACT)

**References:**

1. E. Elmasri, S.H. Navati, Fundamentals of Database Systems 4th Edition, Addison Education, 2003
2. R. Ramakrishnan, J. Gehrke, Database Management Systems 3rd Edition, MA Jones, 2002
3. R. Ramakrishnan, J.E. Borra, R. Srikar, Database System Concepts 4th Edition, McGraw Hill, 2003
4. R. Elmasri, S.H. Navati, Database Systems: Models, Languages, Design and Application Programming, 4th Edition, Prentice Hall, 2002

**SEMESTER V****Course code: DMC23103****DSE 6A: Elective Computer Science – V****Database Management Systems Lab****Credits: Practical – 02****60 Hours****Software Lab based on Database Management Systems**

The following concepts need to be introduced to the students

Note: All languages/SQL may be used.

**DDL Commands**

- Create table, alter table, drop table

**DML Commands**

- Select, update, delete, and insert operations
- Conditions specification using Primary and composite keys (i.e. on, not on, etc., etc.)
- Aggregate operators and aggregate functions (i.e. sum, avg, min, max)
- Multiple table queries (Join as different and inner table) + Nested select statements

Practical Assignment (2020)



1. Explain the different types of organizational structure.
2. Explain the different types of organizational structure.
3. Explain the different types of organizational structure.
4. Explain the different types of organizational structure.
5. Explain the different types of organizational structure.
6. Explain the different types of organizational structure.
7. Explain the different types of organizational structure.
8. Explain the different types of organizational structure.
9. Explain the different types of organizational structure.
10. Explain the different types of organizational structure.
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12. Explain the different types of organizational structure.
13. Explain the different types of organizational structure.
14. Explain the different types of organizational structure.
15. Explain the different types of organizational structure.
16. Explain the different types of organizational structure.
17. Explain the different types of organizational structure.
18. Explain the different types of organizational structure.
19. Explain the different types of organizational structure.
20. Explain the different types of organizational structure.

16. Increase the salary of all employees working on the Project's project by 10%. Remove employees whose old increased salary of their employees.
17. Remove a list of employees and the project name such as to reduce by the employees' department and return each department ordered alphabetically by employee department.
18. Select the names of employees whose salary does not match with salary of any employee in department.
19. Increase the name of employees whose has a dependent with the same first name and return only the employees.
20. Remove the employee number of all employees who work on project (Project ID: History, History or History).
21. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. (Check 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 (2).
24. For each department, return the department number, the number of employees in the department, and their average salary.
25. For each project, return the project number, the project name, and the number of employees who work on that project.
26. I change the location and promoting department number for all projects having more than 3 employees in "History" and "Computer".
27. For each department having more than 10 employees, return the department name of employees earning more than 40,000 as salary.
28. Create a report in Project table which relates employee's budget, maximum salary, project ID, Department number, how remove the relation by making necessary records in the Department table.
29. Delete all departments of employees whose salary is '123456789'.
30. Delete an employee from Employee table with salary as '123456789' such that the employee has some dependents, is working on some project, is a manager of some department and is supporting some employees. Check and delete the remaining after an Employee and delete on table. In Department table MGRIDID should be set to default value and in Employee table SUPERVISOR should be set to NULL.
31. Perform a query using star connect to insert data into a constraint in Employee table.

**SEMESTER V****Course Code: BMEED02****B.A. (P.H.) of Computer Science - V  
Computer Networks****Credits: Theory – 04****48 Hours****Course Objectives**

After successful completion of the course, the student will be able to

- CO1: Understand the Elements of Data Communications and network Systems
- CO2: Learn in-depth Hierarchical Models
- CO3: Understand in-depth with examples Network Models
- CO4: Understanding the various data Formats and characteristics of Protocols
- CO5: Learn in-depth Error Detection and Correction Algorithms
- CO6: Learn in-depth of Network Security

**Unit - 1****15 Hours**

Basic concepts: Elements of data communication, standards and organizations, Terminology Classification, Network Topologies, network protocol, network security applications, overview of OSI reference model, overview of TCP/IP protocol suite.

**Unit - 2****15 Hours**

Physical Layer: Cabling, Network Interface Card, Transmission Media: Twisted-Pair, Coaxial, Fibre Optic, Bus, Mesh, Ring, Star

Data Link Layer: Framing techniques, Error Control, Flow Control, Protocols: sliding window protocols - CSMA/CD and CSMA/CA.

**Unit - 3****15 Hours**

Network Layer: Packet Classification and Scheduling approach, IP addressing methods – Sub netting, Routing Algorithms (adaptive and non-adaptive)

Transport Layer: Transport services, Transport Layer protocols of TCP and UDP

**Unit - 4****15 Hours**

Application Layer: Application layer protocols and services – Domain name system, HTTP, WWW, telnet, FTP, SMTP

Network Security: Encryption, Firewall, Intrusion, Virtual Private Networks

**References**

1. R.S. Prasad: Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2001
2. D.L. Comer: Networking with TCP/IP, Vol. 1, Prentice Hall of India, 1998
3. W. Stallings: Data & Computer Communications, 8th edition, Prentice Hall of India, 2000
4. G. Korth and R. Gallager, Data Networks, 2nd edition, Prentice Hall of India, 1982.

**SEMESTER V**Course code: **ENR 1502****ENR1502: Electives: Computer Science - V  
Computer Networks****Credits: Practicals = 02****00 Hours****Notes are Self based on Computer Networks****Assignment for students of Computer Networks (10 Marks)**

1. Describe Flooding Algorithm
2. Describe CSMA Algorithm
3. Describe Stop & Wait, Stop Protocol
4. Describe Ethernet II Protocol
5. Describe Internet Group Protocol

**Self answer**

**SEMESTER VI**Course Code: **DSR2802****DSR2A: Elective Computer Science - VI  
Programming in JAVA****Credits: Theory – 04,****00 Hours****Course Outcomes:**

After successful completion of the course, the student is able to

- CO1. Understand in depth Java programming fundamentals
- CO2. Handle in details with examples Basic Java OOPs Concepts
- CO3. Understand in depth OOPs Concepts
- CO4. Understand in depth Java Interface and packages
- CO5. Understand the details of Exception handling in Java
- CO6. Understand the details of Multithreading & I/O operations in Java
- CO7. Identify the characteristics and characteristics of File handling in Java
- CO8. Learn the details of File handling in Java
- CO9. Learn the characteristics of Applet Programming

**Unit-1****15 Hours**

**Introduction to Java:** Features of Java, JRE, Environment, Object Oriented Programming, Concept Overview of Programming, Packages, Classes, Abstraction, Encapsulation, inheritance, Polymorphism, Difference between C++ and JAVA, JDC Environment.

**Java Programming Fundamentals:** Structure of Java program, Data types, Declaration of Variables, scope of variables, Constants, operators, operators, Arrays, Math class, PTH, Constant class, operators, Decision Making: statements, nested statements, jumping statements, type conversion and casting.

**Unit-2****15 Hours**

**Classes and Objects:** Defining a Class, Field Declaration, Methods Declaration, Creating an Object, Initializing class members, Assigning Object Reference Variables, Access modifiers, Constructors, Type of Constructors, the keyword instance variable hiding, Package Collection, Finaler method, nested overloading, overloading Constructors, Understanding Static, Accessing final, Enums.

**Subclasses:** Definition, Type of Inheritance, Member Access, Type of Access, Method Overriding, Dynamic Method Dispatch, Abstract class and Methods, final final, Object Class, Final and final classes.

**Arrays and String:** Arrays, Creating an array, Type of Arrays, array accessing methods/operators using class Methods, Array Index methods.

**Unit-3****15 Hours**

**Abstract Class, Interface and Packages:** Modifiers and Access Control, Access classes and methods, Interfaces, Package Concept- definition, JAVA I/O packages, naming conventions,

Creating packages, naming Packages using package, adding a class to a package, adding the main method

Interfaces: Introduction, Defining Interface, implementing Interfaces, Nested Interface, Extending Interface, overriding interface methods

Exception Handling: Introduction, Types of Errors, Exceptions, Types of Exception handler, try and catch statement, multiple catch statements, finally, Superclass, finally, handling a Java exception, finally keyword, java built in exception classes

Unit - 4

10 Hours

Multi-threading: Introduction, Creating Thread, Extending the Thread Class, implementing runnable interface, Declaring the Class, implementing the run () Method, starting new thread, mapping and linking thread thread objects, thread priority

Input and Output: Concept of Streams, Source Classes, Sink Stream classes, Character Stream classes, reading/writing input, Writing Console Output, wrapper Classes

Applet Programming: Introduction, Types of Applet, How applets differ from applications, Applet Lifecycle: Creating Applet, Applet tag

### Reference Books:

1. Java Success: With Essential Commercial Applications Development Using the Object-Oriented Model, 2nd Ed., EBS Publications, 2009
2. Cay Horstmann, William, Wiley Publications, 2nd Edition, 2009
3. Thomas Hachtel, Java 7: The Complete Reference, 8th Edition, 2009
4. E. Rajaguru, Programming with JAVA, TETL, 2007

## SEMESTER VI

Course code: BME25162

ISE664: Elective: Computer Science - VI

Programming in JAVA Lab

Credit: Practical – III

60 Hours

Software Lab based on Java

### PART A

1. Write a java program to find whether given number is positive, negative or zero
2. Write a java program to find the signs of three numbers using ternary operator
3. Write a java program to find minimum of the numbers: Input: 10, 20, 30
4. Write a java program to check whether given date is valid or not
5. Write a java program to implement ATM Transaction Using Switch statement

8. Write a java program to generate the following pattern:

```

      A
     A B
    A B C
   A B C D
  A B C D E
 A B C D E F

```

9. Write a java program to find sum of all digits of a given number and print number formed a single digit.

10. Write a program to create an array of 10 integers. Assign values from the user to the array. Input another number from 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.

11. Write a java program to sort the given array using selection sort.

12. Write a java program to find the sum and count of the given square matrix.

### PART-B

1. Write a java program to Generate Employee Salary Slip Using Class and Object

2. Write a java program to check whether entered character is a vowel or consonant using Constructor

3. Write a java program to demonstrate Abstract Overloading

4. Write java program to generate Student marks card Using Inheritance

5. Write a java program to calculate bonus for different departments using abstract class

6. Write a java program to demonstrate Method Overloading

7. Write a java program to find two integer numbers for the variables a and b. Display other abstract except number of 0 is entered then the error is caught by NumberFormatException class. After that use JOptionPane() prints the information about the error handling class.

8. Write a java program to demonstrate multiple Inheritance using Interface

9. Write a java program to demonstrate static keyword

10. Write a java program to generate the following pattern





**SEMESTER IV - V / VI**Course code: **IT2101001 - ITSC21001 - ITSC21002****ITC 1A - Electronic Computer Application (Practical)  
Office Automation****Credits: Practical - 02****60 Hours****Course Prerequisites**

The candidate should have the knowledge of the following subjects

- 101. Introduction to the Basics of Computers (IT Computer)
- 102. Study of Input Hardware and Software
- 103. Study of Output Hardware and Software
- 104. Introduction to the Basics of Programming Language
- 105. Difference in word with examples of the following types
- 106. Difference in word Operating System and the following features
- 107. Difference in word of Internet and its usage

**Practical List for ITSC1A**

1. Create a telephone directory
    - The heading should be Telephone Directory
    - The use of the document should use Windows font size
    - Other headings should use 14-point Courier New font
    - The layout should have the page number as well as the date (predefined).
  2. Design a letterhead form for your college
    - The first line should contain the name of the college in Courier New font and should be bold
    - The second line should give the address (name, location) and the department of Computer A/c.
    - Use a size of Courier
    - The use of the document should use 14-point Courier New font size
    - The layout should contain your specifications in the design and use of printer.
- Create the following document. It resembles with a header and 2 columns in portrait orientation, including a header and page number, etc.

**Practical List for ITSC2A**

1. Create a word document containing the following text and apply various styles of document. Text and layout should be well defined design.

10. (10 marks)

10.1. (5 marks)

10.1.1. (5 marks)

The table below shows the staff employed at a factory for the year 2019. The employees are divided into 4 categories: *Senior*, *Intermediate*, *Junior* and *Trainee*. The table also shows the number of employees in each category and the number of employees who are employed in each category for the year 2019. The number of employees who are employed in each category for the year 2019 is given in the table below. The number of employees who are employed in each category for the year 2019 is given in the table below.

10.2. (5 marks) Complete the following contingency table:

Year	Senior	Intermediate	Junior	Trainee	Total	Total
2018						
2019						
Total						

10.2.1. (5 marks) Complete the following contingency table:

10.2.2. (5 marks) Complete the following contingency table:

- (i) The number of employees who are employed in each category for the year 2019 is given in the table below.
- (ii) The number of employees who are employed in each category for the year 2019 is given in the table below.
- (iii) The number of employees who are employed in each category for the year 2019 is given in the table below.
- (iv) The number of employees who are employed in each category for the year 2019 is given in the table below.
- (v) The number of employees who are employed in each category for the year 2019 is given in the table below.

10.3. (10 marks) The probability of a randomly selected employee being employed in each category for the year 2019 is given in the table below. The number of employees who are employed in each category for the year 2019 is given in the table below.

10.4. (5 marks) Complete the following contingency table for 2019 (10 marks)

Year	Senior	Intermediate	Junior	Trainee	Total	Total
2018						
2019						
Total						

10.4.1. (5 marks) Complete the following contingency table:

274452 - 274453 - 2019	Course ID
274452 - 274453 - 2019	Course
274452 - 274453 - 2019	Level

Information systems will be delivered by:

1. Evaluate the quality of service
2. Apply the user modelling to real world
3. Apply the description of models of the students having more than 274452/2019
4. Apply user modelling to make a model to study subject to the support of the user
5. Apply the description of user of the system to user
6. Apply the user modelling to make a model to study subject to the support of the user
7. Apply the user modelling to make a model to study subject to the support of the user
8. Apply the user modelling to make a model to study subject to the support of the user
9. Apply the user modelling to make a model to study subject to the support of the user
10. Apply the user modelling to make a model to study subject to the support of the user
11. Apply the user modelling to make a model to study subject to the support of the user
12. Apply the user modelling to make a model to study subject to the support of the user
13. Apply the user modelling to make a model to study subject to the support of the user
14. Apply the user modelling to make a model to study subject to the support of the user
15. Apply the user modelling to make a model to study subject to the support of the user
16. Apply the user modelling to make a model to study subject to the support of the user
17. Apply the user modelling to make a model to study subject to the support of the user
18. Apply the user modelling to make a model to study subject to the support of the user
19. Apply the user modelling to make a model to study subject to the support of the user
20. Apply the user modelling to make a model to study subject to the support of the user

### Practical List for Power Point

1. Create the Power point slides. Each slide should support different format. In your slide

(explain some of applications of IT. Make slide structure like as 10 minutes)

2. Create the Power Point slides to give advantages/disadvantages of computer, software

processors and logical structure of computer

3. Create the Power Point slides. Making the process of internal operations. It should be a following form.

**SEMESTER IV / V / VI****Course code: (E) Design / (M) Design / (P) Design****(E) (M) Electronic Computer Application (Practical)****Elective: XML Programming****Credits: Practical - 02****02****Course Contents**

After successful completion of the course, the student is able to:

- (E) 1. Identify the syntax of Elements of XML programming
- (M) 2. Apply knowledge learnt with examples (E)
- (P) 3. Differentiate tags with examples XML Schema
- (E) 4. Define the characteristics of XML
- (M) 5. Learn to write XML applications (E)
- (P) 6. Differentiate to write XML examples (M)
- (E) 7. Learn the syntax of XML Schema
- (M) 8. Learn to write XML examples, XSL and XPath
- (P) 9. Learn to write XML examples XSL and XPath

**Software Lab Based on XML****Exercise 01 - Information System**

In this exercise, student will practice identifying the structure of an information system from the sample structure provided below.

- (I) Label the information structure you see, including identifying structure.
- (II) Draw a tree representation of the system.

**Exercise 02 - Understanding XML Document**

In this exercise, student will practice identifying the correct structure within an XML document. This is the reverse of what was done in Exercise 01. For the sample XML document, create a tree representation or a similar drawing for the given XML content for (E) page.

**Books:****References:**

1. The ACM Handbook of

2. Charles F. Tompkins

3. Paul

4. The ACM Handbook of

5. The ACM Handbook of

6. The ACM Handbook of

7. The ACM Handbook of

8. The ACM Handbook of

**Example 45 – Creating XML Markup**

In this exercise, create some XML markup based on the first representation from Exercise 44 above, and be creative from the original sample document.

**Example 46 – XML Formatters**

This exercise checks your understanding of the capabilities of XML formatters. For the following document, create well-formatted XHTML and PDF outputs.

1. The first formatter: `xmllint --format`

2. The second formatter: `xmllint --format --noindent`

3. Making a list in a template: `<ul style="list-style-type: none;">`

4. How to handle a character: `<code>`

**Example 47 – XML Formatters**

This exercise is a bit more challenging than the previous examples. Here is a fragment of an XML document. Assume that all the places where it fails to match the constraints for well-formation.

1. `<DOCUMENT>`

2. `<ITEM>`

3. `<ITEM>`

4. `<ITEM>`

5. `<ITEM>`

6. `<ITEM>`

Note: Cover more exercises based on XML Programming theory concepts.

**SEMESTER VI**Course code: **19CE2202****Web Application: Elective: Web Programming (Practical)****Credits (L: T: P = 0: 0: 2)****Practical Theory: 00****00 Hours****Practical Experiments:**

The practical component of the course, the student is able to

- CE11: Create the details of HTML tags.
- CE12: Understand the details of Basic CSS and its properties.
- CE13: Understand the details of Basic Conceptual Java Script.
- CE14: Write codes in details with application and Design of Java Script.
- CE15: Understand in details with conceptual Discussion about Model.
- CE16: Understand in-depth Basic of XML.

**Web programming Lab**

1. Program for Accounting tags.
2. Creating a Webpage having Hyperlink.
3. Creating Types of Lists (Ordered, Unordered, Definition).
4. Creating a Table Link.
5. Creating a Form Table.
6. Creating a HTML document having vertical layout.
7. Creating Modern Application Form.
8. Program to insert audio & video files.
9. Creating Horizontal & Vertical Style Sheets.
10. Program on Margins & Padding.
11. Program to create a Floating card.
12. Program to Image Transparency.
13. Program to generate Fibonacci series in JavaScript.
14. Program to display Fibonacci Culture in JavaScript.
15. Program to create Pop-Up Boxes.
16. Program to generate web application table.
17. Program to find even and odd numbers.
18. Program to add 2 numbers.
19. Program to find factorial of a number.
20. Program to generate J-shaped patterns.
21. Program to change background color when I see of page load.
22. Display square of a given number.
23. Program to generate random numbers.
24. Program to find the sum of individual numbers.
25. Program to display Basic information in XML.

**SEMESTER VI**Course code: **CYR18702****SEC 4B: Elective Computer Science - VII  
PHP Programming**Credits: **Practical - 8)****60 Hours**

Course Outcome:

After successful completion of the course, the student is able to:

- (CO1) Learn in depth Concepts of PHP
- (CO2) Learn in depth Instruction Methods: Browser HTML and PHP
- (CO3) Understand in depth PHP Features
- (CO4) Understand in depth String Manipulations
- (CO5) Learn the characteristics of Regular Expressions
- (CO6) Learn the basics of Developing PHP Web Application

**PHP Programming Lab****Software Lab Based on PHP:**

1. Create a PHP page using functions for computing three angles and print the largest angle.
2. Write a function to calculate the factorial of a number (non-negative integer). The function accepts the number as its argument.
3. Write a script to check whether the given number is prime or not.
4. Create a PHP page which accepts string from user. After submission this page displays the reverse of provided string.
5. Write a PHP function that checks if a string is all lowercase.
6. Write a PHP script that checks whether a provided string is palindrome or not? (A palindrome is word, phrase, or sequence that reads the same backward or forward, e.g., madam or turbo turbo).
7. Write a script to split an array.
8. Write a PHP script that removes the whitespace from a string.  
Sample string: "The quick brown fox jumps over the lazy dog."  
Expected Output: "Therquickbrownfoxjumpsoverthelazydog"
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 message should be displayed if the user is already registered. A notice is present in the database's table. An error message should be displayed.
11. Write a PHP script that checks if a string contains another string.
12. Create a simple calendar application where the script will accept the number of days between current day and future day.
13. Create a script to construct the following pattern, using nested for loop.

10

11

12

13

14. Write a simple PHP program to do a SQL insert into table.

15. Write PHP program to do a delete.

16. Write a program to print 'good' and '!

Write a PHP script that will display the following table

Table

Table good and

Table

Table

Table

17. Write a PHP script to display a 'table' message depending on the language selected in dropdown list.

18. Write a PHP program to print 'Welcome' when using condition.

19. Write a PHP script to make the first line of the following string with 'That' except 'the good' from the jump over the last line.

Expected Output: That good from the jump over the last line.

#### References:

1. Eran Erez, *PHP: Scripts and Code Snippets*. Andrew STE, The Characters, Wiley, 2011.
2. Catherine Lee, *PHP for Dummies*, and William Stoltz, *Mobile Applications: Architecture, Design, and Development*, Prentice Hall, 2008.
3. Brian King, *Mobile Design and Development*, O'Reilly Media, 2009, Massachusetts.
4. Eran Erez, *Programming the Mobile Web*, O'Reilly Media, 2010.
5. Eran Erez, *Introduction to PHP*, Programming Social Interfaces, O'Reilly Media, 2009.



Semester:3  
Code: ELC27025

## Media Industry and Management

Course Out comes: On completion of the Course, students are able to:

- CO: 1 Become an owner of the media
- CO: 2 Become an Administrator or coordinator
- CO: 3 Become TRP agent
- CO: 4 Assistant for media managing Directors
- CO: 5 to set up the newspaper industry

Unit: I Concept of Management- Origin and growth of Media  
Management

Fundamentals of management - Management School of Thought

Unit: 2 Media Industry & Challenges • Media industry as  
manufacturers- news and I!

content management.- Market Forces- performance evaluation TRP,  
BARC

and HITS - Changing Ownership patterns

Unit 3. Structure of media organizations — Role and  
responsibilities - Workflow & Shift Patterns- Guidelines-  
Qualities and Functions of media managers.

Unit 4. Media Economics- Strategic Management and Marketing -  
Capital inflow,-

Budgeting- Financial management-personnel  
Management- Strategic 1

Management,-Market forces

Reference

1. Indian Media Business by Vinita Kohli Khandeka,
2. Political Economy of Communications in India by Pradip Ninan Thomas,
3. Strategic management in media by Lucy Kung
4. Media Management in the age of Giant by Dennis F. Herrick

5. Media industries-History, Theory and Method , by Jennifer Holt and Alisa

Perron,, (Edited )

Semester: 6

Code: ELF 27025

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

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**(Autonomous)**

**B N ROAD, MYSURU- 570 025**

**DEPARTMENT OF ZOOLOGY**

**Syllabus**

**CHOICE BASED CREDIT SYSTEM**

**For B.Sc programmes**

**Chemistry, Botany, Zoology**

**Chemistry, Zoology, Biotechnology**

## 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.
- Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm-  
submission of any 1 Report.

## 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**

## 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.

## **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

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**(Autonomous)**

**B N ROAD, MYSURU- 570 025**

**DEPARTMENT OF ZOOLOGY**

**Syllabus**

**CHOICE BASED CREDIT SYSTEM**

**For B.Sc programmes**

**Chemistry, Botany, Zoology**

**Chemistry, Zoology, Biotechnology**



## 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.
- Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm-  
submission of any 1 Report.

## V SEMESTER ZOOLOGY

### PRACTICAL –V

#### **PRACTICAL** **INSECT VECTORS AND DISEASES** **(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**

## **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.

## **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.
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6. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
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**DEPARTMENT OF ZOOLOGY**

**Syllabus for**

**B.Sc. Hons ZOOLOGY (UG)**

**I & II SEMESTERS**

**Framed According to the National Educational Policy (NEP 2020)**

**(2021-22 Batch Onwards)**

## I SEMESTER ZOOLOGY

### PRACTICAL –I

#### Zoology paper-I: cytology, genetics, and infectious diseases.

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 *Allium cepa*.
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) and permanent stained slides (Fish scales), with available mounting material.
8. Study of wild *Drosophila melanogaster* (male & female) and Mutant Phenotypes of *Drosophila* sp, – White eye, bar eye, sepia eye, vestigial wing & yellow body. (From Cultures or Photographs).
9. Study of polytene chromosomes (Chironomus larva or *Drosophila* larva).
10. Preparation of *Drosophila* Karyotype and study (identification) of the chromosomal structural (Chriduchat syndrome (Deletion), pallister killian 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.

## II SEMESTER ZOOLOGY

## PRACTICAL –I

### Zoology paper-I: Zoology paper- Biochemistry and physiology

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.	

### **III SEMESTER ZOOLOGY**

#### **PRACTICAL –I**

#### **Zoology paper-I: Molecular biology and bioinstrumentation.**

1. To study the principle and applications of simple, compound and binocular microscopes.
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.
3. To prepare Buffer solutions (Phosphate, Citrate, Tris-HCl buffer)
4. To estimate amount of RNA by Orcinol method.
5. Demonstration of differential centrifugation to fractionate components in a given mixture.
6. To estimate amount of protein by Lowry's method.
7. To identify different unknown amino acids using ascending paper chromatography.
8. Extraction of DNA from the given animal tissue sample.
9. To estimate amount of DNA by di-phenyl amine (DPA) method.



## IV SEMESTER ZOOLOGY

### PRACTICAL –I

#### Zoology paper-I: Immunology and Biostastics

1. Calculate the mean, median, mode and standard deviation (with suitable examples).
  2. Measure the height and weight of all students in the class and apply statistical measures (Frequency distribution, Bar diagram, pie diagram, histogram)
  3. With Suitable data, apply tests of significance : Chi-square test and student t-test
  4. Determination of ABO Blood group and Rh factor.
  5. Demonstration of agarose gel electrophoresis for detection of DNA.
  6. To study Restriction enzyme digestion using teaching kits (Demonstration only).
  7. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits (Demonstration only).
  8. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins.
  9. To calculate molecular weight of unknown DNA and protein fragments from gel pictures. (<https://youtube/mCiCiO0cfbg>)
  10. To learn nucleotide sequence database.
- To learn sequence alignment: Pairwise alignment (Protein/ DNA).



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## Content with a direct bearing on Employability

DME22005/DME22006

### 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)

## Content with a direct bearing on Employability

DME22005/DME22006

### SEMESTER V

DSE: IMMUNOLOGY AND MEDICAL BIOTECHNOLOGY

(4 CREDITS)

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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.

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NO. HOURS

#### UNIT I

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Antigens: Definition, chemical nature, haptens, epitops, antigenicity, blood group antigens.

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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.

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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, exvivo, in vivo and antisense gene therapy -one example each, principle and applications.

Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

**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)**

**Effective from 2021 - 2022**

## 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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### Reference Websites

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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 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>1. define the field of climatology and to understand the atmospheric composition and structure.</li> <li>2. 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>3. to illustrate and explain the air pressure system, wind regulating forces and the formation of the Atmospheric Disturbance.</li> <li>4. 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>1. to define the field of climatology and components of the climate system</li> <li>2. to introduce various dimensions of climatology like structure and composition.</li> <li>3. to understand the global atmospheric pressure, temperature, and wind system.</li> <li>4. 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
<p>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</p>			
<b>Unit – 2 Atmospheric Temperature</b>			14
<p>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.</p>			
<b>Unit – 3 Atmospheric Pressure and Winds</b>			14

<p>Atmospheric Pressure: Influencing factors on atmospheric pressure. Vertical and Horizontal Distribution of the atmospheric pressure and Pressure Belts, Pressure Gradient.</p> <p>Tri-cellular-Hadley, Ferrel's and Polar Cells.</p> <p>Winds: influencing factors, Types - planetary, seasonal, local wind</p> <p>Variable winds-Cyclones and anti-cyclones.</p> <p>Air-Masses and Fronts: Definition, Nature, Source Regions, Classification.</p>	
<b>Unit – 4 Atmospheric Moisture</b>	14
<p>Humidity: Sources, influencing factors and types-Absolute, Relative and Specific.</p> <p>Hydrological cycle: process of evaporation, condensation. Clouds and its types</p> <p>Precipitation and its forms.</p> <p>Climate Change: Causes and consequences, recent issues-floods, drought,</p>	

### 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)
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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
<p><b>Course Outcomes:</b></p> <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>	
<p><b>Course Objectives:</b></p> <p>This course aims to</p> <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>	
Content of Theory Course 1	45Hrs
<b>Unit – 1 Introduction to Human Geography</b>	11
<p>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</p>	
<b>Unit – 2 Geographical Analysis of Population</b>	11
<p>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</p>	
<b>Unit – 3 Cultural Patterns and Processes</b>	11
<p>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.</p>	

<b>Unit – 4 Human Economic Activities, Development and Settlements</b>	<b>12</b>
<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

Formative Assessment	
Assessment Occasion/type	Weightage in Marks
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
3	39 or 42
<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>	
Content of Theory Course 1	52/56Hrs
<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)

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1. IIRS MOOC programme: <https://isat.iirs.gov.in/mooc.php>
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>	<b>100%</b>



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**Effective from 2021 - 2022**

## 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
<b>4</b>	<b>52 or 56</b>	<b>2</b>	<b>52 or 56</b>
<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

1. Ahmed E. (1985) Geomorphology, Kalyani Publishers, New Delhi.
2. Bloom A.L. (1978) Geomorphology: A Systematic Analysis of Late Cenozoic Landforms Prentice – Hall of India, New Delhi.
3. Brunson D. (1985) Geomorphology in the Service of Man: The Future of Geography, Methuen, U.K.
4. Chorley, R.J., Schumm, S. A. and Sugden, D.E. 1984: Geomorphology, Methuen, London
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11. Kolhapure and S S Nanjan, Physical Geography (Kannada Version)
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17. Verstappen H. (1983) Applied Geomorphology, Geomorphological Surveys for Environmental Development, Elsevier, Amsterdam

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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 a report on their effectiveness.

## 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>1. define the field of climatology and to understand the atmospheric composition and structure.</li> <li>2. 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>3. to illustrate and explain the air pressure system, wind regulating forces and the formation of the Atmospheric Disturbance.</li> <li>4. 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>1. to define the field of climatology and components of the climate system</li> <li>2. to introduce various dimensions of climatology like structure and composition.</li> <li>3. to understand the global atmospheric pressure, temperature, and wind system.</li> <li>4. 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
<p>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</p>			
<b>Unit – 2 Atmospheric Temperature</b>			14
<p>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.</p>			
<b>Unit – 3 Atmospheric Pressure and Winds</b>			14

<p>Atmospheric Pressure: Influencing factors on atmospheric pressure. Vertical and Horizontal Distribution of the atmospheric pressure and Pressure Belts, Pressure Gradient.</p> <p>Tri-cellular-Hadley, Ferrel's and Polar Cells.</p> <p>Winds: influencing factors, Types - planetary, seasonal, local wind</p> <p>Variable winds-Cyclones and anti-cyclones.</p> <p>Air-Masses and Fronts: Definition, Nature, Source Regions, Classification.</p>	
<b>Unit – 4 Atmospheric Moisture</b>	14
<p>Humidity: Sources, influencing factors and types-Absolute, Relative and Specific.</p> <p>Hydrological cycle: process of evaporation, condensation. Clouds and its types</p> <p>Precipitation and its forms.</p> <p>Climate Change: Causes and consequences, recent issues-floods, drought,</p>	

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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>	
Content of Theory Course 1	45Hrs
<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>	<b>12</b>
<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

Formative Assessment	
Assessment Occasion/type	Weightage in Marks
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
3	39 or 42
<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>	
Content of Theory Course 1	52/56Hrs
<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

1. IIRS MOOC programme: <https://isat.iirs.gov.in/mooc.php>
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>	<b>100%</b>

**DEPARTMENT OF MICROBIOLOGY**  
**SEC**  
**TITLE: MICROBIAL DIAGNOSIS IN HEALTH CLINICS**  
**SEMESTER – V**

**TOTAL HOURS: 30hrs (2hrs/week)**

**CREDITS: 2**

**COURSE CODE-DME28406 / DME28407**

**Course outcome**

**CO1.**Student will gain experience in health clinics such as examination, collection of clinical samples and diagnosis.

**CO2.**Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers.

**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**

**N o 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

**DSE**  
**VI SEMESTER**  
**TITLE: INDUSTRIAL AND FOOD MICROBIOLOGY**  
**THEORY**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 4**

**COURSE CODE-DMF28006 / DMF28007**

**Course outcome**

Enable the students to get sufficient knowledge about:

- CO1.** Food related microorganisms, their contamination, spoilage and preservation
- CO2.** Understand the beneficial role of microorganisms in fermented dairy products.
- CO3.** Know the significance and activities of microorganisms in food
- CO4.** Understand the food borne intoxication and infections.
- CO5.** Learn about food safety and quality control.
- CO6.** Know the principles involving various methods of food preservation.
- CO7.** Understand how microbiology is applied in manufacture of industrial products
- CO8.** Know about design of bioreactors, medium formulation & design for microbial fermentation, the different types of fermentation processes
- CO9.** Identify techniques applicable for strain improvement of microorganism
- CO10.** The underlying principles in downstream processing

**UNIT: I**

**No of Hours: 15**

**INDUSTRIAL MICROBIOLOGY**

- 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.
- E. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation (in brief).  
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.  
Downstream processing: Steps in recovery and purification of fermented products –  
Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, chromatography, Drying and crystallization.

**UNIT: II**

**No of Hours: 15**

## 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. 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: III

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 FPO, HACCP, Food laws and Food standards (in brief)

### UNIT:IV

No of Hours: 15

#### 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.
- A. Preservation of milk and milk products – Pasteurization and Sterilization. Microbiological standard for milk and milk products (in brief).

**DEPARTMENT OF MICROBIOLOGY**  
**SEC**  
**TITLE: MICROBIAL DIAGNOSIS IN HEALTH CLINICS**  
**SEMESTER – V**

**TOTAL HOURS: 30hrs (2hrs/week)**

**CREDITS: 2**

**COURSE CODE-DME28406 / DME28407**

**Course outcome**

**CO1.** Student will gain experience in health clinics such as examination, collection of clinical samples and diagnosis.

**CO2.** Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers.

**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**

**N o 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

**DSE**  
**VI SEMESTER**  
**TITLE: INDUSTRIAL AND FOOD MICROBIOLOGY**  
**THEORY**

**TOTAL HOURS: 60hrs (4hrs/week)**

**CREDITS: 4**

**COURSE CODE-DMF28006 / DMF28007**

**Course outcome**

Enable the students to get sufficient knowledge about:

- CO1.** Food related microorganisms, their contamination, spoilage and preservation
- CO2.** Understand the beneficial role of microorganisms in fermented dairy products.
- CO3.** Know the significance and activities of microorganisms in food
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- CO5.** Learn about food safety and quality control.
- CO6.** Know the principles involving various methods of food preservation.
- CO7.** Understand how microbiology is applied in manufacture of industrial products
- CO8.** Know about design of bioreactors, medium formulation & design for microbial fermentation, the different types of fermentation processes
- CO9.** Identify techniques applicable for strain improvement of microorganism
- CO10.** The underlying principles in downstream processing

**UNIT: I**

**No of Hours: 15**

**INDUSTRIAL MICROBIOLOGY**

- 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.
- E. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation (in brief).  
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.  
Downstream processing: Steps in recovery and purification of fermented products –  
Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, chromatography, Drying and crystallization.

**UNIT: II**

**No of Hours: 15**



## 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. 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: III

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 FPO, HACCP, Food laws and Food standards (in brief)

### UNIT:IV

No of Hours: 15

#### 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.
- A. Preservation of milk and milk products – Pasteurization and Sterilization. Microbiological standard for milk and milk products (in brief).



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**(Autonomous)**

**OOTY ROAD, MYSURU- 570 025**

**DEPARTMENT OF PHYSICS**

**Curriculum for I and II Semester BSc/BSc (Honours) Degree under  
NEP- from the Academic year 2021-22**

**PC, PM, PE, PCs**

**AND**

**Curriculum for Choice Based Credit System**

**PCM, PMCS, PME**

**2021-22**

Course Content Semester – I

**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)**

<b>Course Outcomes (COs) (UGC guidelines)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
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
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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>	

<b>Unit - 3</b>		
<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>\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

## 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></p> <p>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.</p> <p>Distribution of winds.</p>	(13 hours)
Module 2:	<p><b>Climate Science</b></p> <p>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.</p> <p>Modelling of the atmosphere: General principles, Overview of General Circulation Models (GCM) for weather forecasting and prediction. Limitations of the models.</p> <p>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></p> <p>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.</p> <p>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.</p> <p>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>	
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	<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		Hr s
<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: Observations of the Solar System</b>		
Chapter 7.	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, 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/nightskyshankar.pdf">https://www.arvindguptatoys.com/arvindgupta/nightskyshankar.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

<b>Sl No</b>	<b>Experiment</b>
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>	<p><b>Human Anatomy and Physiology</b></p> <p>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</p>	(13 hours)
<b>Unit II:</b>	<p><b>Physics of Medical Diagnostics</b></p> <p>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.</p>	(13 hours)
<b>Unit III:</b>	<p><b>Physics of Radiotherapy</b></p> <p>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.</p>	(13 hours)
	<p><b>Class Room Activities</b></p> <p>Unit I: Students can demonstrate the shape, size, positions and functions of different organs in the body with the help of models.</p> <p>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.</p> <p>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.</p> <p>(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.</p> <p><b>Other related activities/projects:</b></p> <ol style="list-style-type: none"> <li>1. Visit to nearby hospitals/diagnostic centers to study the working of X-ray machines.</li> <li>2. Visit to ultrasound diagnostic centers to study the principle and use of ultrasound in diagnosis.</li> <li>3. Project on principle and use of X-ray films in imaging.</li> <li>4. Visit to radiotherapy centers to study the modalities of radiotherapy.</li> </ol>	

### **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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**Semester – II**

**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

### 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 Kirchoff'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>	1. Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. 2. A small project report on production of electricity as a source of energy: Different methods	
<b>Activity No. 2</b>	1. Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. 2. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	
<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>1. Learn about electrical appliances which work with AC and DC electricity</li> <li>2. 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>1. Learn about power transmission: 3-phase electricity, voltage and phase</li> <li>2. 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>3. Prepare a small project report on street lighting and types of electrical bulbs.</li> </ol>	

### Unit – 3

<b>Chapter No.6</b>	<p><b>Topics to be covered</b></p> <p>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.</p>	7
<b>Chapter No. 7</b>	<p><b>Topics to be covered</b></p> <p>Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.</p>	6
<b>Topics for self study( If any)</b>	Hall Effect	
<b>Suggested Activities</b>		
<b>Activity No. 5</b>	<p><b>Activity:</b></p> <ol style="list-style-type: none"> <li>1. Prepare a small project report on street lighting and types of electrical bulbs.</li> <li>2. Learn the measurement of electric current using tangent galvanometer.</li> </ol>	
<b>Activity No.6</b>	<p><b>Activity:</b></p> <p>Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.</p>	
<b>Unit - 4</b>		
<b>Chapter No. 8</b>	<p>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.</p>	8
<b>Chapter No. 9</b>	<p><b>Topics to be covered:</b></p> <p>Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.</p>	5
<b>Topics for self study( If any)</b>	<p><i>B-H curves and its characteristics</i> <i>Ferrites</i></p>	



	<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)

# CBCS

## SEMESTER I

**Course code:** DMA29001/ DMA29002/ DMA29003/ DMA29004

**Credits: Theory – 04, Practical – 02**

**Theories: 60 Lectures**

### COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Learn the details of Elasticity

CO2.Understand the classification and characteristics of motion of a point particle

CO3.Understand in details with examples Frames of reference and relative motion

CO4.Deliberate the classification and characteristics of Dynamics of particle in conservative field

CO5.Specify the classification and characteristics of Special theory of relativity and gravitation

CO6.Write down the characteristics of Surface tension and viscosity

## MECHANICS: DSC1

### Unit-1

**Vectors:** Vector algebra(with special reference to the rules of addition and multiplication), Scalar and vector products with specific examples.

**Motion of a point particle:** The position vector  $r(t)$  of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivatives of a vector with respect to a parameter; Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion-centripetal force. **(05 Lectures)**

### Frames of references and relative motion:

Newton's laws of motion and inertial mass. Galilean transformation; Galilean principle of relativity, Plumb line accelerometer and a freely falling elevator, Non-inertial frames and fictitious force, uniformly rotating frame of reference and coriolis force. Effect of rotation of earth on acceleration due to gravity. **(07 Lectures)**

### Dynamics of a particle in conservative fields:

Work done by force acting on a particle, work-energy theorem. Conservative and non conservative force field. Conservation of energy. Conservative force as a negative gradient of potential, central force as an example of conservative force field. **(05 Lectures)**

**Conservation of momentum:** Conservation of linear momentum, centre of mass, rocket equation. Angular momentum and torque, law of conservation of angular momentum, angular momentum of a system taking centre of mass of the system. **(06 Lectures)**

**Dynamics of rigid bodies:** Moment of inertia, radius of gyration, calculation of moment of inertia of rectangular plate, circular plate and solid sphere, kinetic energy of rotation. **(04 Lectures)**

**Oscillations:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. **(03 Lectures)**

## Unit-2

**Gravitation:** Newton's 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, derivations of Kepler's law, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS). **(08 Lectures)**

**Special Theory of Relativity:** Postulates of Special Theory of Relativity. Lorentz transformation equations, Length contraction, time dilation, relativistic addition of velocities. Mass-Energy relation, energy-momentum relation. **(06 Lectures)**

## Elasticity:

Review of concepts of moduli of elasticity, Hooke's Law and Poisson's ratio ( $\sigma$ ). Relation between the elastic constants  $q$ ,  $k$ ,  $n$  and  $\sigma$ , limiting values for  $\sigma$ . Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion; calculation of couple per unit twist. The Torsional pendulum, Static torsion, Searle's double bar experiment.

**Surface Tension:** Review of basic concepts. Pressure inside curved liquid surface. Surface tension and interfacial tension by drop-weight method. Surface tension and angle of contact of mercury by Quincke's method.

**Viscosity:** Review of basic concepts; Variation of Viscosity of liquids with temperature and pressure. **(16 Lectures)**

## Reference Books:

- Halliday, Resnick, Jearl Walker, "Principles of Physics" 9th edition, Wiley, 2013.

- Berkeley Physics Course, Vol-1 “Mechanics”, 2nd edition, Charles Kittel, Walter D Knight, Malvin A
- D S Mathur, “Elements of properties of matter”, S Chand and company, New Delhi, Reprint-2007.
- D S Mathur, “Mechanics”, S Chand and company, New Delhi, Reprint-2001.
- BrijLal and N Subrahmanyam, “Properties of matter”, 6th edition, Eurasia publishing house Ltd. New Delhi, Reprint-1993.
- Mechanics by ShankaraNarayana&Chopra.
- Mechanics by Bhargava and Sharma.

### **PHYSICS LAB: DSC 1A LAB: MECHANICS**

**Course code: DMA29101/ DMA29102/ DMA29103/ DMA29104**

**(Minimum of eight is to be conducted)**

1. Bar pendulum: Determination of the acceleration due to gravity and radius of gyration (Both graphical and calculation methods).
2. To determine the Moment of Inertia of a Flywheel.
3. Determination of the Young’s modulus by Dynamic method (graphical and calculation method).
4. Torsional pendulum; Determination of the rigidity modulus.
5. Oscillations of a spiral Spring and calculate a) Spring Constant b) Value of g
6. Young’s modulus by the single cantilever method.
7. Determination of rigidity modulus by the static torsion method.
8. To determine g by Kater’s Pendulum.
9. Determination of young’s modulus by the method of uniform bending.
10. Drop weight method; Determination of surface tension of liquid and the interfacial tension between two liquids.
11. To determine the Elastic Constants of a Wire by Searle’s method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell’s needle
13. To determine g and velocity for a freely falling body using Digital Timing Technique
14. To determine the Height of a Building using a Sextant.

### **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.

- Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11<sup>th</sup> Edition, 2011, KitabMahal, New Delhi.

## SEMESTER II

**Course code: DMB29001/ DMB29002/ DMB29003/ DMB29004**

**Credits: Theory – 04, Practical – 02**

**Theories: 60 Lectures**

### COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1. Deliberate in detail with examples vector analysis

CO2. Write down in detail with application, electrostatics and magneto static

CO3. Write down the classification and characteristics of AC Circuits

CO4. Specify in details with application, if applicable, properties of magnet material

CO5. Understand the characteristics of electromagnetic theory

CO6. Write down the characteristic of galvanometer

## ELECTRICITY AND MAGNETISM: DSC 2

### Unit-1

**Vector Analysis:** Review of vector algebra (Scalar and Vector product), Scalar and vector fields, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **(07 Lectures)**

**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics and applications; 1) infinite line of charge and 2) plane charged sheet. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate

capacitor completely filled with dielectric.

**Galvanometers:** Construction, theory and working of Helmholtz galvanometer. **(15 Lectures)**

**Alternating current:** R M S values, Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the  $j$  symbol), Series and parallel resonance, Half-power frequencies, bandwidth and Q-factor, Power in electrical circuits, power factor and Maximum power transfer theorem.

**(08 Lectures)**

## Unit-2

**Applications of ac circuits - ac bridges; Anderson's bridge and De-Sauty's bridge**

**(02 Lectures)**

**Magneto statics:** Biot-Savart's law & its applications; long straight conductor, circular coil and solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

**Magnetic properties of materials:** Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-magnetic, Para-magnetic and Ferro-magnetic materials.

**(10 Lectures)**

**Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, self inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy stored in magnetic field. **(06 Lectures)**

**Electromagnetic Theory:** Equation of continuity, Displacement current, setting up of Maxwell's equations, wave equation in free space, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through free space and isotropic dielectric medium, Transverse nature of electromagnetic waves, polarization. **(12 Lectures)**

### Reference Books:

- D. C. Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
- K. K. Tewari: Electricity and magnetism, S. Chand Co. Ltd., New Delhi, Reprint 2007.
- B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.
- David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
- Brij Lal and N. Subramanian: Electricity and Magnetism, 19th edition - Ratan Prakashan Mandir, Educational and University Publishers, Agra.
- D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition - S.Chand and Co. Ltd., New Delhi

**PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM**

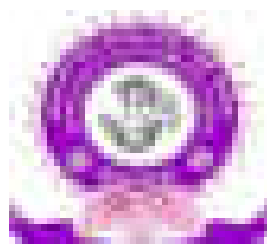
**Course code: DMB29101 / DMB29102 / DMB29103 / DMB29104**

**(Minimum of eight is to be conducted)**

1. LCR series circuits – Determination of L & Q factor
2. LCR parallel circuits – Determination of L & Q factor
3. Anderson's Bridge – Determination of the self-inductance of the coil.
4. De-Sauty's bridge – Verification of laws of combination of capacitances, unknown capacitance.
5. To verify the Thevenin's theorem.
6. Maximum Power Transfer Theorem.
7. Maxwell's bridge-determination of mutual inductance.
8. Low resistance-determination of the resistivity of the material.
9. Determination of capacitance by measuring impedance of RC circuit.
10. Determination of inductance by measuring impedance of RL circuit.
11. Low pass and High pass filters.
12. Black box – Identification of L,C & R .
13. Measurement of Magnetic field strength B and its gradient in a Solenoid (Determine  $\frac{dB}{dx}$ ).
14. To determine a Low Resistance by Carey Foster's Bridge.
15.  $B_H$  using Helmholtz double coil galvanometer.

#### **Reference Books**

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11<sup>th</sup> Edition, 2011, KitabMahal, New Delhi.
- Edition, reprinted 1985, Heinemann Educational Publishers



**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**(Autonomous)**

**OOTY ROAD, MYSURU- 570 025**

**DEPARTMENT OF PHYSICS**

**Curriculum for I and II Semester BSc/BSc (Honours) Degree under  
NEP- from the Academic year 2021-22**

**PC, PM, PE, PCs**

**AND**

**Curriculum for Choice Based Credit System**

**PCM, PMCS, PME**

**2021-22**



Course Content Semester – I

**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)**

<b>Course Outcomes (COs) (UGC guidelines)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
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
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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>	

<b>Unit - 3</b>		
<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>\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

## 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></p> <p>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.</p> <p>Distribution of winds.</p>	(13 hours)
Module 2:	<p><b>Climate Science</b></p> <p>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.</p> <p>Modelling of the atmosphere: General principles, Overview of General Circulation Models (GCM) for weather forecasting and prediction. Limitations of the models.</p> <p>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></p> <p>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.</p> <p>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.</p> <p>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>	
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	<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		Hr s
<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>		
Chapter 7.	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, 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/nightskyshankar.pdf">https://www.arvindguptatoys.com/arvindgupta/nightskyshankar.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

<b>Sl No</b>	<b>Experiment</b>
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>	<p><b>Human Anatomy and Physiology</b></p> <p>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</p>	(13 hours)
<b>Unit II:</b>	<p><b>Physics of Medical Diagnostics</b></p> <p>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.</p>	(13 hours)
<b>Unit III:</b>	<p><b>Physics of Radiotherapy</b></p> <p>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.</p>	(13 hours)
	<p><b>Class Room Activities</b></p> <p>Unit I: Students can demonstrate the shape, size, positions and functions of different organs in the body with the help of models.</p> <p>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.</p> <p>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.</p> <p>(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.</p> <p><b>Other related activities/projects:</b></p> <ol style="list-style-type: none"> <li>1. Visit to nearby hospitals/diagnostic centers to study the working of X-ray machines.</li> <li>2. Visit to ultrasound diagnostic centers to study the principle and use of ultrasound in diagnosis.</li> <li>3. Project on principle and use of X-ray films in imaging.</li> <li>4. Visit to radiotherapy centers to study the modalities of radiotherapy.</li> </ol>	



### **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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**Semester – II**

**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

### 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 Kirchoff'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>	1. Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. 2. A small project report on production of electricity as a source of energy: Different methods	
<b>Activity No. 2</b>	1. Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. 2. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	
<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>1. Learn about electrical appliances which work with AC and DC electricity</li> <li>2. 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>1. Learn about power transmission: 3-phase electricity, voltage and phase</li> <li>2. 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>3. 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> <ol style="list-style-type: none"> <li>1. Prepare a small project report on street lighting and types of electrical bulbs.</li> <li>2. Learn the measurement of electric current using tangent galvanometer.</li> </ol>	
<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)

# CBCS

## SEMESTER I

**Course code:** DMA29001/ DMA29002/ DMA29003/ DMA29004

**Credits: Theory – 04, Practical – 02**

**Theories: 60 Lectures**

### COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Learn the details of Elasticity

CO2.Understand the classification and characteristics of motion of a point particle

CO3.Understand in details with examples Frames of reference and relative motion

CO4.Deliberate the classification and characteristics of Dynamics of particle in conservative field

CO5.Specify the classification and characteristics of Special theory of relativity and gravitation

CO6.Write down the characteristics of Surface tension and viscosity

## MECHANICS: DSC1

### Unit-1

**Vectors:** Vector algebra(with special reference to the rules of addition and multiplication), Scalar and vector products with specific examples.

**Motion of a point particle:** The position vector  $r(t)$  of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivatives of a vector with respect to a parameter; Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion-centripetal force. **(05 Lectures)**

### Frames of references and relative motion:

Newton's laws of motion and inertial mass. Galilean transformation; Galilean principle of relativity, Plumb line accelerometer and a freely falling elevator, Non-inertial frames and fictitious force, uniformly rotating frame of reference and coriolis force. Effect of rotation of earth on acceleration due to gravity. **(07 Lectures)**

### Dynamics of a particle in conservative fields:



Work done by force acting on a particle, work-energy theorem. Conservative and non conservative force field. Conservation of energy. Conservative force as a negative gradient of potential, central force as an example of conservative force field. **(05 Lectures)**

**Conservation of momentum:** Conservation of linear momentum, centre of mass, rocket equation. Angular momentum and torque, law of conservation of angular momentum, angular momentum of a system taking centre of mass of the system. **(06 Lectures)**

**Dynamics of rigid bodies:** Moment of inertia, radius of gyration, calculation of moment of inertia of rectangular plate, circular plate and solid sphere, kinetic energy of rotation. **(04 Lectures)**

**Oscillations:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. **(03 Lectures)**

## Unit-2

**Gravitation:** Newton's 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, derivations of Kepler's law, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS). **(08 Lectures)**

**Special Theory of Relativity:** Postulates of Special Theory of Relativity. Lorentz transformation equations, Length contraction, time dilation, relativistic addition of velocities. Mass-Energy relation, energy-momentum relation. **(06 Lectures)**

## Elasticity:

Review of concepts of moduli of elasticity, Hooke's Law and Poisson's ratio ( $\sigma$ ). Relation between the elastic constants  $q$ ,  $k$ ,  $n$  and  $\sigma$ , limiting values for  $\sigma$ . Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion; calculation of couple per unit twist. The Torsional pendulum, Static torsion, Searle's double bar experiment.

**Surface Tension:** Review of basic concepts. Pressure inside curved liquid surface. Surface tension and interfacial tension by drop-weight method. Surface tension and angle of contact of mercury by Quincke's method.

**Viscosity:** Review of basic concepts; Variation of Viscosity of liquids with temperature and pressure. **(16 Lectures)**

## Reference Books:

- Halliday, Resnick, Jearl Walker, "Principles of Physics" 9th edition, Wiley, 2013.

- Berkeley Physics Course, Vol-1 “Mechanics”, 2nd edition, Charles Kittel, Walter D Knight, Malvin A
- D S Mathur, “Elements of properties of matter”, S Chand and company, New Delhi, Reprint-2007.
- D S Mathur, “Mechanics”, S Chand and company, New Delhi, Reprint-2001.
- BrijLal and N Subrahmanyam, “Properties of matter”, 6th edition, Eurasia publishing house Ltd. New Delhi, Reprint-1993.
- Mechanics by ShankaraNarayana&Chopra.
- Mechanics by Bhargava and Sharma.

### **PHYSICS LAB: DSC 1A LAB: MECHANICS**

**Course code: DMA29101/ DMA29102/ DMA29103/ DMA29104**

**(Minimum of eight is to be conducted)**

1. Bar pendulum: Determination of the acceleration due to gravity and radius of gyration (Both graphical and calculation methods).
2. To determine the Moment of Inertia of a Flywheel.
3. Determination of the Young’s modulus by Dynamic method (graphical and calculation method).
4. Torsional pendulum; Determination of the rigidity modulus.
5. Oscillations of a spiral Spring and calculate a) Spring Constant b) Value of g
6. Young’s modulus by the single cantilever method.
7. Determination of rigidity modulus by the static torsion method.
8. To determine g by Kater’s Pendulum.
9. Determination of young’s modulus by the method of uniform bending.
10. Drop weight method; Determination of surface tension of liquid and the interfacial tension between two liquids.
11. To determine the Elastic Constants of a Wire by Searle’s method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell’s needle
13. To determine g and velocity for a freely falling body using Digital Timing Technique
14. To determine the Height of a Building using a Sextant.

### **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.

- Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11<sup>th</sup> Edition, 2011, KitabMahal, New Delhi.

## SEMESTER II

**Course code: DMB29001/ DMB29002/ DMB29003/ DMB29004**

**Credits: Theory – 04, Practical – 02**

**Theories: 60 Lectures**

### COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1. Deliberate in detail with examples vector analysis

CO2. Write down in detail with application, electrostatics and magneto static

CO3. Write down the classification and characteristics of AC Circuits

CO4. Specify in details with application, if applicable, properties of magnet material

CO5. Understand the characteristics of electromagnetic theory

CO6. Write down the characteristic of galvanometer

## ELECTRICITY AND MAGNETISM: DSC 2

### Unit-1

**Vector Analysis:** Review of vector algebra (Scalar and Vector product), Scalar and vector fields, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **(07 Lectures)**

**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics and applications; 1) infinite line of charge and 2) plane charged sheet. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate

capacitor completely filled with dielectric.

**Galvanometers:** Construction, theory and working of Helmholtz galvanometer. **(15 Lectures)**

**Alternating current:** R M S values, Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the  $j$  symbol), Series and parallel resonance, Half-power frequencies, bandwidth and Q-factor, Power in electrical circuits, power factor and Maximum power transfer theorem.

**(08 Lectures)**

## Unit-2

**Applications of ac circuits -** ac bridges; Anderson's bridge and De-Sauty's bridge

**(02 Lectures)**

**Magneto statics:** Biot-Savart's law & its applications; long straight conductor, circular coil and solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

**Magnetic properties of materials:** Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-magnetic, Para-magnetic and Ferro-magnetic materials.

**(10 Lectures)**

**Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, self inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy stored in magnetic field. **(06 Lectures)**

**Electromagnetic Theory:** Equation of continuity, Displacement current, setting up of Maxwell's equations, wave equation in free space, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through free space and isotropic dielectric medium, Transverse nature of electromagnetic waves, polarization. **(12 Lectures)**

### Reference Books:

- D. C. Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
- K. K. Tewari: Electricity and magnetism, S. Chand Co. Ltd., New Delhi, Reprint 2007.
- B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.
- David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
- Brij Lal and N. Subramanian: Electricity and Magnetism, 19th edition - Ratan Prakashan Mandir, Educational and University Publishers, Agra.
- D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition - S. Chand and Co. Ltd., New Delhi

**PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM**

**Course code: DMB29101 / DMB29102 / DMB29103 / DMB29104**

**(Minimum of eight is to be conducted)**

1. LCR series circuits – Determination of L & Q factor
2. LCR parallel circuits – Determination of L & Q factor
3. Anderson's Bridge – Determination of the self-inductance of the coil.
4. De-Sauty's bridge – Verification of laws of combination of capacitances, unknown capacitance.
5. To verify the Thevenin's theorem.
6. Maximum Power Transfer Theorem.
7. Maxwell's bridge-determination of mutual inductance.
8. Low resistance-determination of the resistivity of the material.
9. Determination of capacitance by measuring impedance of RC circuit.
10. Determination of inductance by measuring impedance of RL circuit.
11. Low pass and High pass filters.
12. Black box – Identification of L,C& R .
13. Measurement of Magnetic field strength B and its gradient in a Solenoid (Determine dB/dx).
14. To determine a Low Resistance by Carey Foster's Bridge.
15.  $B_H$  using Helmholtz double coil galvanometer.

#### **Reference Books**

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11<sup>th</sup> Edition, 2011, KitabMahal, New Delhi.
- Edition, reprinted 1985, Heinemann Educational Publishers

**UG\_BBA- Human Resource Management 2022-23**

<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, RightSizing of Work Force, Need for Right Sizing

**Module No. 5: Employee Engagement and Psychological Contract**

**08**

**Employee Engagement (EE):** Meaning and Types of EE, Drivers of Engagement - Measurement of EE, Benefits of EE. **Psychological contract:** Meaning and features

<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 PeterDrucker.	
<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	

UG\_BBA\_ **BUSINESS ORGANISATIONS MANAGEMENT 2022-23**



## UG\_BBA\_FINANCIAL MANAGEMENT 2022-23

### **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.

## UG\_BBA\_Human Resource Management 2022-23

### **Unit 1: Employee Empowerment**

Meaning, Conditions Necessary for Empowerment, Forms of Empowerment-Quality circles, features, Developing quality circles in organizations, problems of Quality circles-Empowered Teams, Workers' Participation in Management-, Definition and Objectives, Forms of Workers' Participation, Evaluation of WPM Scheme.

### **Unit 2: Employee Health and Safety**

Meaning of Health, Importance, occupational Hazards and Diseases,-Types- protection Against hazards- preventive measures, Curative Measures, Accidents- types and Causes, Social Security, Meaning, objectives, Scope, Need for social security Types, Types of social Security

### **Unit 3: Industrial relations**

Concept, objective, , Approach Industrial Relations,- causes of Poor Industrial Relations, Steps for Good Industrial Relations, Trade Union- Meaning, Reasons for joining trade unions, problems of Trade Union and Measures to strengthen trade Union movement in India.

### **Unit 4: Industrial Disputes**

Definition, forms of Industrial disputes- primary strikes, secondary strikes, Lock-outs, Gherao, Picketing and Boycott- Causes of Disputes-Settlement of Industrial disputes- Conciliation, Arbitration, Labour court, Industrial Tribunal, National tribunal.

### **Unit 5: Strategic HRM**

HRM effectiveness and business success- Michael Porter's theory of competitive strategy- types of strategies-corporate strategies- competitive strategies, functional strategies-strategic management process, Approaches to SHRM- Resource based Approach, Strategic Fit, Universalistic Approach, Configurational Approach, Contingency Approach.

## UG\_BBA\_INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT 2022-23

### **Unit 1: Basics of risk and return:**

Concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds : present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis: EIC framework; Economic analysis: Leading lagging & coincident macro-economic indicators, Expected direction of movement of stock prices with macroeconomic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry; Company analysis.

### **Unit 2: Share valuation:**

Dividend discount models - no growth, constant growth, two stage growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows - circuit filters. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends: resistance, support, consolidation, momentum- Charts: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk, Three forms of EMH and implications for investment decisions. (No numerical in EMH and technical analysis)

### **Unit 3: Portfolio analysis:**

Portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, and anticipated inflation. Asset allocation: Asset allocation pyramid, investor life cycle approach, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

### **Unit 4: Capital Asset Pricing Model (CAPM):**

Efficient frontier with a combination of risky and risk free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds : Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures and Fama's Decomposition.

## UG\_BBA\_INVESTMENT BANKING & FINANCIAL SERVICES 2022-23

### **Unit 1: Introduction:**

An Overview of Indian Financial System, Investment Banking in India, Recent Developments and Challenges ahead, Institutional structure and Functions of Investment / Merchant Banking; SEBI guidelines for Merchant Bankers, Registration, obligations and responsibilities of Lead Managers, Regulations regarding Continuance of association of lead manager with an issue

### **Unit 2: Issue Management:**

Public Issue: classification of companies, eligibility, issue pricing, promoter's contribution, minimum public offer, prospectus, allotment, preferential allotment, private placement, Book Building process, designing and pricing, Green Shoe Option; Right Issue: promoter's contribution, minimum subscription, advertisements, contents of offer document, Bought out Deals, Post issue work & obligations, Investor protection, Broker, sub broker and underwriters

### **Unit 3: Leasing and Hire Purchase :**

Concepts of leasing, types of leasing – financial & operating lease, direct lease and sales & lease back, advantages and limitations of leasing, Lease rental determination; Finance lease evaluation problems (only Lessee's angle), Hire Purchase interest & Installment, difference between Hire Purchase & Leasing, Choice criteria between Leasing and Hire Purchase mathematics of HP, Factoring, forfaiting and its arrangement, Housing Finance : Meaning and rise of housing finance in India, Fixing the amount of loan, repricing of a loan, floating vs. fixed rate, Practical problems on housing finance.

### **Unit 4: Venture Capital, Insurance, Credit ratings and Securitization:**

Concept, history and evolution of VC, the venture investment process, various steps in venture financing, incubation financing.

**Insurance:** Concept, classification, principles of insurance, IRDA and different regulatory norms, operation of General Insurance, Health Insurance, Life Insurance.

**Credit Ratings:** Introduction, types of credit rating, advantages and disadvantages of credit ratings, Credit rating agencies and their methodology, International credit rating practices.

**Securitization:** Concept, securitization as a funding mechanism, Traditional and non traditional mortgages, Graduated-payment mortgages (GPMs), Pledged-Account Mortgages (PAMs), Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets, Securitization in India

UG\_BBA\_MARKETING MANAGEMENT 2022-23

<b>Module No. 1: INTRODUCTION TO MARKETING</b>	<b>10</b>
<p>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).</p>	
<b>Module No. 2: MARKETING ENVIRONMENT</b>	<b>10</b>
<p><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.</p>	
<b>Module No. 3: MARKET SEGMENTATION AND CONSUMER BEHAVIOUR</b>	<b>10</b>
<p>Meaning and Definition, Bases of Market Segmentation, Requisites of Sound Market Segmentation; Consumer Behavior-Factors influencing Consumer Behavior; Buying Decision Process.</p>	
<b>Module No. 4: MARKETING MIX</b>	<b>20</b>
<p>Meaning, Elements of Marketing Mix (Four P's) – Product, Price, Place, Promotion.</p> <p>Product-Product Mix, Product Line, Product Lifecycle, New Product Development, Reasons for Failure of New Product, Branding, Packing and Packaging, Labeling,</p> <p>Pricing – Objectives, Factors influencing Pricing Policy, Methods of Pricing;</p> <p>Physical Distribution–Meaning, Factors affecting Channel Selection, Types of Marketing Channels.</p> <p>Promotion – Meaning and Significance of Promotion, Personal Selling and Advertising (Meaning Only)</p>	
<b>Module No. 5: SERVICES MARKETING</b>	<b>06</b>
<p>Meaning and definition of services, difference between goods and services, features of services, seven P's of services marketing (concepts only).</p>	

## DSE -1: NUTRITIONAL BIOCHEMISTRY

(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/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. 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.

**Unit: 8** **FOOD & DRUG INTERACTIONS & NUTRICEUTICALS:** Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions.

## 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.
2. Principles of Nutritional Assessment (2005) Rosalind Gibson. Oxford University Press.





## 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

- Unit : 1 INTRODUCTION:** 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. **04 Hrs**
- Exercises**  
Collection of blood and storage.  
Separation and storage of serum.
- Unit :2 EVALUATION OF BIOCHEMICAL CHANGES IN DISEASES:** Basic hepatic, renal and cardiovascular physiology. Biochemical symptoms associated with disease and their evaluation. Diagnostic biochemical profile. **04 Hrs**
- Unit: 3 ASSESSMENT OF GLUCOSE METABOLISM IN BLOOD:** Clinical significance of variations in blood glucose. Diabetes mellitus. **04 Hrs**
- Exercises**  
Estimation of blood glucose by glucose oxidase peroxidase method.
- Unit :4 LIPID PROFILE: Composition and functions of lipoproteins.** Clinical significance of elevated lipoprotein. **04 Hrs**
- Exercises**  
Estimation of triglycerides.
- Unit :5 LIVER FUNCTION TESTS** **04 Hrs**
- Exercises**  
Estimation of bilirubin (direct and indirect).
- Unit: 6 RENAL FUNCTION TESTS & URINE ANALYSIS:** Use of urine strip / dipstick method for urine analysis. **06 Hrs**
- Exercises**  
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.

## 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

- Unit : 1 BIOCHEMICAL REAGENTS & SOLUTIONS:** 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. **06 Hrs**  
**Exercise**  
Preparation of a buffer of given pH and molarity.
- Unit : 2** Chromatography- Definition, types, Principles of Adsorption and Partition chromatography. Techniques of circular, 2D chromatography, Thin Layer Chromatography- and its advantages **07 Hrs**  
Column chromatography – Principle and applications of Gel Filtration chromatography, HPLC
- Unit : 3** Electrophoresis: Principle and applications of electrophoresis technique- PAGE, SDS - PAGE **03 Hrs**
- Unit : 4** Centrifugation: Principle of differential and density gradient centrifugation. Ultra centrifuge – construction and applications **03 Hrs**
- Unit: 5 SPECTROPHOTOMETRIC TECHNIQUES:** Principle and instrumentation of UV-visible and fluorescence spectroscopy. **05 Hrs**  
**Exercises**  
Determination of the absorption maxima and molar extinction coefficient (of a relevant organic molecule).  
Measurement of fluorescence spectrum.  
Determination of concentration of a protein solution by Lowry/BCA method.
- Unit :6** Introduction and importance of virtual labs in biochemistry **06 Hrs**

**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.
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.

## DSE -1: NUTRITIONAL BIOCHEMISTRY

(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.  
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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/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.

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.

**Unit: 8** **FOOD & DRUG INTERACTIONS & NUTRICEUTICALS:** Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions.

## 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.**

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## 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

- Unit : 1 INTRODUCTION:** 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. **04 Hrs**
- Exercises**  
Collection of blood and storage.  
Separation and storage of serum.
- Unit :2 EVALUATION OF BIOCHEMICAL CHANGES IN DISEASES:** Basic hepatic, renal and cardiovascular physiology. Biochemical symptoms associated with disease and their evaluation. Diagnostic biochemical profile. **04 Hrs**
- Unit: 3 ASSESSMENT OF GLUCOSE METABOLISM IN BLOOD:** Clinical significance of variations in blood glucose. Diabetes mellitus. **04 Hrs**
- Exercises**  
Estimation of blood glucose by glucose oxidase peroxidase method.
- Unit :4 LIPID PROFILE: Composition and functions of lipoproteins.** Clinical significance of elevated lipoprotein. **04 Hrs**
- Exercises**  
Estimation of triglycerides.
- Unit :5 LIVER FUNCTION TESTS** **04 Hrs**
- Exercises**  
Estimation of bilirubin (direct and indirect).
- Unit: 6 RENAL FUNCTION TESTS & URINE ANALYSIS: Use of urine strip / dipstick method for urine analysis.** **06 Hrs**
- Exercises**  
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. Exercises** **04 Hrs**  
**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.
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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

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CO3: Deliberate the characteristics of centrifugation

CO4: Understand in detail with examples spectrophotometry

- Unit : 1 BIOCHEMICAL REAGENTS & SOLUTIONS:** 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. **06 Hrs**  
**Exercise**  
Preparation of a buffer of given pH and molarity.
- Unit : 2** Chromatography- Definition, types, Principles of Adsorption and Partition chromatography. Techniques of circular, 2D chromatography, Thin Layer Chromatography- and its advantages **07 Hrs**  
Column chromatography – Principle and applications of Gel Filtration chromatography, HPLC
- Unit : 3** Electrophoresis: Principle and applications of electrophoresis technique- PAGE, SDS - PAGE **03 Hrs**
- Unit : 4** Centrifugation: Principle of differential and density gradient centrifugation. Ultra centrifuge – construction and applications **03 Hrs**
- Unit: 5 SPECTROPHOTOMETRIC TECHNIQUES:** Principle and instrumentation of UV-visible and fluorescence spectroscopy. **05 Hrs**  
**Exercises**  
Determination of the absorption maxima and molar extinction coefficient (of a relevant organic molecule).  
Measurement of fluorescence spectrum.  
Determination of concentration of a protein solution by Lowry/BCA method.
- Unit :6** Introduction and importance of virtual labs in biochemistry **06 Hrs**

**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.
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.

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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 VI Semester B. Sc.**  
**Program in Biochemistry**

**Biotechnology & Biochemistry -BScBtBc40**  
**Microbiology & Biochemistry -BScMbBc42**

**Under**

**NATIONAL EDUCATION**  
**POLICY -2020(NEP-2020)**

**Reviewed Syllabus 2021-2022 Onwards**

# 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>
Couse 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>1. Advanced Inorganic Chemistry: A comprehensive Text,1999, Cotton A and Geoffrey Wilkinson, 6th edition, Wiley publication</li> <li>2. Inorganic Chemistry, 2014, Miessler GL, Paul Fischer PJ, and Tarr DA, 5th edition,Pearson Publication</li> <li>3. Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication</li> <li>4. Inorganic Chemistry, 2015, Overton, Rourke, Weller , Armstrong and Hagerman,Oxford Press</li> <li>5. Physical Chemistry: A molecular approach ,2019, Donald A, McQuarrie and Simon JD,Viva Books Publication</li> <li>6. 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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# 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

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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.

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**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.

Addition reactions - Aldehydes and Ketones - nucleophilic addition of acetals & ketals. Addition of Ammonia, primary amines, and other ammonia derivatives. Conjugate addition. Conjugation 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.

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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.

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.
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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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## 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 chromatography, 2. based on types of mobile and/or liquid phase adsorption and partition-

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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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# 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 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. Colorimetric estimation of glucose by DNS method
  9. Estimation of DNA by diphenylamine method
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10. Estimation of RNA by orcinol method
  11. Electrophoretic separation of plasma proteins



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**Program in Biochemistry**

**Biotechnology & Biochemistry -BScBtBc40**  
**Microbiology & Biochemistry -BScMbBc42**

**Under**

**NATIONAL EDUCATION**  
**POLICY -2020(NEP-2020)**

**Reviewed Syllabus 2021-2022 Onwards**

# 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>
Couse 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>1. Advanced Inorganic Chemistry: A comprehensive Text,1999, Cotton A and Geoffrey Wilkinson, 6th edition, Wiley publication</li> <li>2. Inorganic Chemistry, 2014, Miessler GL, Paul Fischer PJ, and Tarr DA, 5th edition,Pearson Publication</li> <li>3. Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication</li> <li>4. Inorganic Chemistry, 2015, Overton, Rourke, Weller , Armstrong and Hagerman,Oxford Press</li> <li>5. Physical Chemistry: A molecular approach ,2019, Donald A, McQuarrie and Simon JD,Viva Books Publication</li> <li>6. 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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# 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>Total credits = 4</b>	<b>56 hr</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

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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.

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**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.

Addition reactions - Aldehydes and Ketones - nucleophilic addition of acetals & ketals. Addition of Ammonia, primary amines, and other ammonia derivatives. Conjugate addition. Conjugation 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.

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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.

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.
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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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## 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 chromatography, 2. based on types of mobile and/or liquid phase adsorption and partition-

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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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# 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 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. Colorimetric estimation of glucose by DNS method
  9. Estimation of DNA by diphenylamine method
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10. Estimation of RNA by orcinol method
  11. Electrophoretic separation of plasma proteins



**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)**

## **FSA460 P 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 – Barrbodies
- 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
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## **FSB460P Course 1: Practicals: DSC-2P, 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
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5. Preparation of culture media for bacteria, fungi and their cultivation.
6. Plating techniques: Spread plate, pour plate and streak plate.
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Fungi – Lactophenol cotton blue staining
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13. - hanging drop technique



## FSC460P

### Content

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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
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7. Estimation of amino acid by Ninhydrin method
8. Extraction of protein from soaked/sprouted green gram by salting out method
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11. Determination of iodine number of lipids

# FSD460P

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1. Preparation of DNA model
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**CURRICULUM FOR  
For B.Sc., (Basic/ Hons.) Degree  
BIOTECHNOLOGY  
(As per NEP-2020 Model Curriculum)**

## **FSA460 P 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 – Barrbodies
- 7) Karyotype analysis - Human and Onion  
Human – Normal and Abnormal – Down and Turner’s syndromes
- 8) Isolation and staining of Mitochondria
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- 10) RBC cell count by Haemocytometer
- 11) Simple genetic problems based on theory

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## **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 credits	Total hours		Maximum Marks in exam/Assessment				
						L	T	P		Th	Pr	IA(Theory)		Total		
												C-1	C-2			
I B.Sc	I	DSC-I :Theory	Biodiversity of Microbes and Archegoniate	DMA23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-I: Pract.	Biodiversity of Microbes and Archegoniate	DMA23107/08	04	0	0	2				35	7.5	7.5	50	3h
	II	DSC-II: Theory	Plant Ecology Morphology and Angiosperm Taxonomy	DMB23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-II: Pract.	Plant Ecology Morphology and Angiosperm Taxonomy	DMB23107/08	04	0	0	2				35	7.5	7.5	50	3h
II B.Sc	III	DSC-III:Theory	Plant Anatomy and Embryology of Angiosperm	DMC23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-III:Pract.	Plant Anatomy and Embryology of Angiosperm	DMC23107/07	04	0	0	2				35	7.5	7.5	50	3h
	IV	DSC-IV: Theory	Plant Physiology and Metabolism	DMD23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-IV:Pract.	Plant Physiology and Metabolism	DMD23107/08	04	0	0	2				35	7.5	7.5	50	3h
III B.Sc.	V	DSEA: Theory	No. of courses:1 DSE- A: Cell and Molecular Biology	DME23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSE:Practicals	Based on theory	DME23107/08												
		DSEB: Theory	DSE-B: Economic Botany and Biotechnology	DME23207/08												
		DSE:Practicals	Based on theory	DME23307/08												
	SEC	No. of courses:1 SEC-A : Ethnobotany	DME23407/08	02	2	0	0	02	30	-	35	7.5	7.5	50	2h	
		SEC-B : Floriculture	DME23607/08													
	VI	DSEB: Theory	No. of courses:1 DSE-A: Genetics and Plant Breeding	DMF23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSE:Practicals	Based on theory	DMF23107/08												
DSEB: Theory		DSE -B : Analytical Techniques and Plant Sciences	DMF23207/08													
DSE:Practicals		Based on theory	DMF23307/08													



**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**

---

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:

---

**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.

---

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.

---

**Agenda 2:** To prepare the Panel of Examiners for the examinations for the year 2019-20.

---

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.

---

**Agenda 3:** Approval of Reference Books

---

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*.

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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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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DMC23008/DMC23007

**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 Rhoeo 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)****\*\*\*****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>

DME23408 /DME23407

III B.Sc., V Semester SEC-II

**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
Total	30	8X2=16	5X6=30	10X4=40	86

**DMF23008/ DMF23007**

**III B.Sc., VI Semester DSE-III**

**Genetics and Plant Breeding**

**Theory (4 credits)**

**Lectures: 60 Hours**

**(4 hours/week)**

**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.

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**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.

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**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	
Kumar, M.A and Kashyap.	Recent advances in physiology	Cambridge University Press

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	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	Introduction to Plant Anatomy  Anatomy of seed plants Introduction to Plant Anatomy Anatomy of seed plants  Plant anatomy College Botany Vol. I Cytology and Anatomy	Wiley Eastern, New Delhi. S. Chand and Company. Rastogi publications, Meerat.  Rastogi publications, Meerat.
<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.
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Chandrasekharn, S.N., Parthasarathy, S.V. 1973	Cytogenetics and Plant Breeding	Macmillan & Co., New York.
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Naik, V.N. 1984	Taxonomy of Angiosperms	Tata-McGraw Hill publishing Co. New Delhi.
Johri, B.M. & Bhatnagar, S.P.	Taxonomy of Angiosperms	Narosa publishing House New Delhi.
Pullaiah, T. 1998	Taxonomy of Angiosperms	Regency Publications, New Delhi.
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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.
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**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 credits	Total hours		Maximum Marks in exam/Assessment				
						L	T	P		Th	Pr	IA(Theory)		Total		
												C-1	C-2			
I B.Sc	I	DSC-I :Theory	Biodiversity of Microbes and Archegoniate	DMA23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-I: Pract.	Biodiversity of Microbes and Archegoniate	DMA23107/08	04	0	0	2				35	7.5	7.5	50	3h
	II	DSC-II: Theory	Plant Ecology Morphology and Angiosperm Taxonomy	DMB23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-II: Pract.	Plant Ecology Morphology and Angiosperm Taxonomy	DMB23107/08	04	0	0	2				35	7.5	7.5	50	3h
II B.Sc	III	DSC-III:Theory	Plant Anatomy and Embryology of Angiosperm	DMC23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-III:Pract.	Plant Anatomy and Embryology of Angiosperm	DMC23107/07	04	0	0	2				35	7.5	7.5	50	3h
	IV	DSC-IV: Theory	Plant Physiology and Metabolism	DMD23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSC-IV:Pract.	Plant Physiology and Metabolism	DMD23107/08	04	0	0	2				35	7.5	7.5	50	3h
III B.Sc.	V	DSEA: Theory	No. of courses:1 DSE- A: Cell and Molecular Biology	DME23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
		DSE:Practicals	Based on theory	DME23107/08												
		DSEB: Theory	DSE-B: Economic Botany and Biotechnology	DME23207/08												
		DSE:Practicals	Based on theory	DME23307/08												
	SEC	No. of courses:1	DME23407/08	02	2	0	0	02	30	-	35	7.5	7.5	50	2h	
		SEC-A : Ethnobotany	DME23607/08													
	VI	DSEB: Theory	No. of courses:1 DSE-A: Genetics and Plant Breeding	DMF23007/08	04	4	0	0	06	60	60	70	15	15	100	3h
			DSE:Practicals	Based on theory												
DSEB: Theory		DSE -B : Analytical Techniques and Plant Sciences	DMF23207/08													
		DSE:Practicals	Based on theory	DMF23307/08												

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)  
OOTY ROAD, MYSURU-25**

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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:

---

**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.

---

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*.



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 labelled 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 labelled 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, Caesalpinaceae and Mimosaceae), Apocynaceae Asteraceae and Arecaceae.

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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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DMC23008/DMC23007

**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)****\*\*\*****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>

DME23408 /DME23407

III B.Sc., V Semester SEC-II

**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>

**DMF23008/ DMF23007**

**III B.Sc., VI Semester DSE-III**

**Genetics and Plant Breeding**

**Theory (4 credits)**

**Lectures: 60 Hours**

**(4 hours/week)**

**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:**

Author	Title of the Book	Publisher
<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
Pelzar Michael.J	General Microbiology. Vol. II	
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	Prentice Hall of India N.Delhi
Rangaswamy.G.	Microbiology	Vardaman Publishers , Bangalore. Vol. III & Vol. IV.
Sundar Rajan	Diseases of crop plants in India. 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. <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.  <b>BRYOPHYTA</b> Pandey. B.P.  Vashista. B. P.  Parihar. N.S. G. M. Smith G. L. Chopra  Chauhan D.K.S.  <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 <b>EMBRYOLOGY OF ANGIOSPERMS &amp; TAXANOMY</b> Bhojwani. S. S. & Bhatnagar, S. P.	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  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  Bryophyta  Bryophyta  Bryophyta Cryptogamic Botany vol. I Class Book and Pteridophytes  Bryophytes and Pteridophytes  Introduction to Plant Anatomy  Anatomy of seed plants Introduction to Plant Anatomy Anatomy of seed plants  Plant anatomy College Botany Vol. I Cytology and Anatomy  The Embryology of Angiosperms  The Embryology of Angiosperms	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.  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.  MC Graw Hill, New York.  Wiley Eastern, New Delhi. S. Chand and Company. Rastogi publications, Meerat.  Rastogi publications, Meerat.  Vikas publishing HOUSE, New Delhi. Rastogi publications, Shivaji Road, Meerat, 250002. MC Graw Hill publishing
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Singh, Pandey, Jain	The Embryology of Angiosperms	Company, New Delhi.
Maheshwari , P	Comparative Embryology of Angiosperms	Ind. Sci. Acad. Bull. No.41, New Delhi.
Johri, B.M.	Morphology of Angiosperms	MC Graw Hill, New York.
Eames A. J.	Plant cell and Tissue culture.	Narosa publishing House New Delhi.
Reinert . J and Yeoman M.M	Plant Anatomy	
Vashishta	Taxonomy of Vascular plants	
George H.M. Lawarance.	A Text book of systematic Botany	Harper C Row, New York.
R.N. sutaria	Botany for Degree Students.	
A. C. Dutta	Morphology of plants and Fungi	Mc Graw Hill, New York.
<b>PTERIDOPHYTA</b>	Morphology of vascular plants (lower groups ).	Central book depot. Allahabad.
Bold , H.C., Alexopoulos, C.J	The Biology and Morphology of Pteridophytes.	Vikas publishing House, New Delhi.
& Delevoryas, T.	Text book of Botany, Vol. II	Vani educational books, New Delhi.
Eames, Arthur, J.	An introduction to Pteridophyta.	Hutchinson university library, London.
Parihar, N.S. 1977	The Morphology of Pteridophytes	S. Chand and Co., New Delhi.
Pandey, S.N.& Others	Pteridophyta	Asia publishing house, New Delhi.
Rashid,A.1986	An Introduction to Gymnosperms.	K. Nath and Co.
Sporne,K.R.1970	Gymnosperms.	Prasaranga, University of Mysore, Mysore.
Vashista,P.C. 1987	Anavrutha beeja sasyagalu (Gymnosperms)	Ratna Prakashana Mandir, Agra
<b>GYMNOSPERMS</b>	Text book of Botany Vol. II.	Hutchinson university library, London.
Datta, S.C.	The Morphology of Gymnosperms.	Shashidhar Malaviya Prakashan.
Pandey, B.P.	An Introduction to Gymnosperms.	S.Chand & Co. New Delhi.
Ramaswamy, S.N. 1984	Gymnosperms.	Wiley, New York.
Saxena and Sarabhai 1993	Studies in palaeobotany.	Narosa, New Delhi.
Sporne, K.R.1969	The Gymnosperms.	Wiley-Estern, New Delhi.
Trivedi, B.S.& Singh, D.K	Out line of Biochemistry	Centar book Depot, Allahabad.
Vashista, B.R.	Plant physiology	Affiliated East West, New Delhi.
Andrews, H.N. 1961		Affiliated East West, New Delhi.
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		



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		McGraw Hill.
BentonAllen.H & Warner, WE	Environmental Pollution and Control	John Wiley and Sons, New York.
Colinvaux paul, A. 1973		Tata-McGraw Hill publishing Co. New Delhi.
Dash,M.C.	Field Biology an Ecology	S.Chand & Co, New Delhi.
	Introduction to Ecology	Prentice Hall of india New Delhi.
Dara, S.S. 1993	Fundamentals of Ecology	Ratna Prakashan mandir, Agra.
		Vishal Publications, Jalandar.
Kormondy Edward, J. 1986	A Text book of Environmental Chemistry and Pollution Control.	Vikas, New Delhi.
Kochhar, P.L. 1990	Concept of Ecology	Macmillan Education Ltd. London.
Kotpal, R.L. 7 Bali, N.P. 1987	Plant Ecology	Longman Inc., newe York.
Kumar,H.D. 1990	Concept of Ecology	Oxford and IBH, New Delhi.
Lloyd, J.R.1980		Saunders, W.B. Philadelphia
Mason, C.E.1981	Concept of Ecology	Wiley, New York.
Misra.K.C. 1989	Man and the ecosystem.	
Odum,E.P. 1971	Biology of fresh water Pollution	
Odum,E.P. 1983	Manual of plant Ecology	Divyajyoti prakashan Jodhpur.
	Fundamentals of Ecology	
Pratap Mowli, P & Venkata Subbaya, N. 1989.	Basic Ecology	Rastogi Publications, Meerut
Sharma, P.D.		I Edn. Rastogi Publications,Meerut.
Sharma, P.D.	Air Pollution and Control	Anmol Publications, New Delhi.
Trivedi, R.N. 1993	Ecology and Environment	
	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	
Nair, P.G.K. Prabhakar Achar, K.	A Text book of Genetics & Evolution	Konark Publishers pvt.Ltd. A. 149, Main Vikar Marg, New Delhi
Fairbanks, D.J. and Anderson, W.R. 1999	Genetics – the community of life	Brooks-Cole, California.
Pawar, C.B. 1983	Essentials of Cytology	
Savage, J.M. 1969	Evolution	Himalayan publishing house, Bombay.
Stansfields, W.D. 1977	The Science of Evolution	Oxford and IBH, New Delhi
Sinnot, E.W., Dunn, L.C.,	Principles of Genetics	Calif polytechnic state university and Macmillan, New York.

& 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
Strichberger 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
Ahmedullh, 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.

## **Course 1: Practicals: DSC-2P, 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

FSB480

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
4	56	2	56
Content of Theory Course 2			56Hrs
Unit –1			15
<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.			5
<b>Chapter No. 2</b> Morphology and reproduction and life-cycles of Nostoc, <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.			5
<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.			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
	15
	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

**FSB483**

**I B.Sc., II-Semester**

**DSC-2 Diversity of Non- Flowering Plants**

*PRACTICALS*

**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)

**FSD480**

**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
04	56	02	56

### Contents of Theory Course

Unit	Topics	Teaching Hours
I	<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
II	<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,</p>	15 hrs

	<p>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>	
III	<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.</p> <p>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).</p> <p>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>	11hrs
IV	<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>	15 hrs
7		

Concept of Biodiversity Hotspots, Biodiversity hot spots of India.

Concept of endemism and endemic species.

ICUN plant categories with special reference to Karnataka/ Western Ghats.

Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002).

Conservation methods – *In-situ* and *ex-situ* methods

*In-situ* methods – Biosphere reserves, National parks, Sanctuaries, Sacred grooves.

*Ex-situ* methods- Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.

### 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.

**FSC940**

**B.Sc. BOTANY – III Semester**

**Open Elective Course (OEC – 3.3)**

## **Landscaping and Gardening**

### **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)

*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)



FSC480

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
04	56 hours	02	56 hours
Unit	PLANT ANATOMY		Teaching hours
I	ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES		14
	<p>Introduction, objective and scope of Plant Anatomy, Plant cell structure- nature of plant cell wall.</p> <p><b>Tissue and tissue systems</b> - meristematic tissue, permanent tissue and secretory cells.</p> <p><b>Classification of meristem:</b> (apical, intercalary and lateral), primary and secondary meristem.</p> <p><b>Apical meristem:</b> 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>		
II	ANGIOSPERM ANATOMY		14

	<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 (<i>Helianthus annuus</i>), Structure of Monocot stem (<i>Zea mays</i>).</p> <p><b>Structure of Dicot leaf:</b> Primary structure (<i>Helianthus annuus</i>), primary structure of Monocot leaf (<i>Zea mays</i>), Stomatal types.</p> <p><b>Anomalous secondary growth:</b> <i>Boerhaavia</i> (dicot stem) <i>Dracaena</i> (monocot stem) Applications in Systematics, and Pharmacognosy. Forensicbotany.</p>	
IV	<p style="text-align: center;"><b>REPRODUCTIVE BIOLOGY</b></p> <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 embryosac (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>	20

## 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
3	39	0	00
<b>Unit I :Nursery and Vegetative propagation</b>			13
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.			
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.			
<b>Unit II :Gardening</b>			13
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.			
<b>Unit III: Seed, Sowing/raising of seeds and seedlings</b>			13
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.			
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.			

FSD483

II B.Sc. IV-Semester

## Ecology and Conservation Biology

### PRACTICALS

Practical No.	LIST OF EXPERIMENTS TO BE CONDUCTED
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.

**FSA480**

**I B.Sc., I- Semester DSC-1**

**Microbial Diversity and Technology**

<b>Number of Theory Credits</b>	<b>Number of lecture hours/semester</b>	<b>Number of practical Credits</b>	<b>Number of practical hours / semester</b>
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4	56	2	56
<b>Content of Theory Course 1</b>			<b>56 Hrs</b>
<b>Unit –1</b>			<b>15</b>
<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>			<b>5</b>
<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>			<b>5</b>
<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>			<b>5</b>

<b>Unit – 2</b>	<b>15</b>
<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.	<b>5</b>
<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.	<b>5</b>
<b>Chapter No. 6. Microbial Growth</b> -Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.	<b>5</b>
<b>Unit – 3</b>	<b>11</b>
<b>Chapter No. 7 Microbial cultures and preservation</b> -Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods-overlapping cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.	<b>5</b>
<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.	<b>4</b>
<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.	<b>2</b>

<b>Unit – 4</b>	<b>15</b>
<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>	<b>5</b>
<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>	<b>6</b>
<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>	<b>4</b>



## **Course 1: Practicals: DSC-2P, 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

FSB480

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
4	56	2	56
Content of Theory Course 2			56Hrs
Unit –1			15
Chapter No. 1 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.			5
Chapter No. 2 Morphology and reproduction and life-cycles of Nostoc, <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.			5
Chapter No. 3 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.			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
	15
	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

**FSB483**

**I B.Sc., II-Semester**

**DSC-2 Diversity of Non- Flowering Plants**

*PRACTICALS*

**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)

**FSD480**

**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
04	56	02	56

### Contents of Theory Course

Unit	Topics	Teaching Hours
I	<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
II	<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,</p>	15 hrs

	<p>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>	
III	<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.</p> <p>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).</p> <p>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>	11hrs
IV	<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>	15 hrs

Concept of Biodiversity Hotspots, Biodiversity hot spots of India.

Concept of endemism and endemic species.

ICUN plant categories with special reference to Karnataka/ Western Ghats.

Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002).

Conservation methods – *In-situ* and *ex-situ* methods

*In-situ* methods – Biosphere reserves, National parks, Sanctuaries, Sacred grooves.

*Ex-situ* methods- Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.

### 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.



**FSC940**

**B.Sc. BOTANY – III Semester**

**Open Elective Course (OEC – 3.3)**

## **Landscaping and Gardening**

### **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)

*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)

FSC480

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
04	56 hours	02	56 hours
Unit	PLANT ANATOMY		Teaching hours
I	ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES		14
	<p>Introduction, objective and scope of Plant Anatomy, Plant cell structure- nature of plant cell wall.</p> <p><b>Tissue and tissue systems</b> - meristematic tissue, permanent tissue and secretory cells.</p> <p><b>Classification of meristem:</b> (apical, intercalary and lateral), primary and secondary meristem.</p> <p><b>Apical meristem:</b> 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>		
II	ANGIOSPERM ANATOMY		14

	<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 (<i>Helianthus annuus</i>), Structure of Monocot stem (<i>Zea mays</i>).</p> <p><b>Structure of Dicot leaf:</b> Primary structure (<i>Helianthus annuus</i>), primary structure of Monocot leaf (<i>Zea mays</i>), Stomatal types.</p> <p><b>Anomalous secondary growth:</b> <i>Boerhaavia</i> (dicot stem) <i>Dracaena</i> (monocot stem) Applications in Systematics, and Pharmacognosy. Forensicbotany.</p>	
IV	<p style="text-align: center;"><b>REPRODUCTIVE BIOLOGY</b></p> <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 embryosac (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>	20

## 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
3	39	0	00
<b>Unit I :Nursery and Vegetative propagation</b>			13
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.			
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.			
<b>Unit II :Gardening</b>			13
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.			
<b>Unit III: Seed, Sowing/raising of seeds and seedlings</b>			13
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.			
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.			

FSD483

II B.Sc. IV-Semester

## Ecology and Conservation Biology

### PRACTICALS

Practical No.	LIST OF EXPERIMENTS TO BE CONDUCTED
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.

**FSA480**

**I B.Sc., I- Semester DSC-1**

**Microbial Diversity and Technology**

<b>Number of Theory Credits</b>	<b>Number of lecture hours/semester</b>	<b>Number of practical Credits</b>	<b>Number of practical hours / semester</b>
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4	56	2	56
<b>Content of Theory Course 1</b>			<b>56 Hrs</b>
<b>Unit –1</b>			<b>15</b>
<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>			<b>5</b>
<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>			<b>5</b>
<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>			<b>5</b>

<b>Unit – 2</b>	<b>15</b>
<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.	<b>5</b>
<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.	<b>5</b>
<b>Chapter No. 6. Microbial Growth</b> -Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.	<b>5</b>
<b>Unit – 3</b>	<b>11</b>
<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.	<b>5</b>
<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.	<b>4</b>
<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.	<b>2</b>

<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

I Sem Practicals: CHEMISTRY-DSE 1 LAB

**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).

DEPARTMENT OF CHEMISTRY  
CHEMISTRY DSE2 LAB

**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  $H_2O_2$  catalyzed by  $FeCl_3$
6. Determination of percentage composition of NaCl solution by determining miscibility temperature of phenol-water system.

**PART-B Analytical Chemistry**

1. Determination of alkali present in soaps/detergents using standard 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 HCl solution.
6. Determination of chlorine in bleaching powder by iodometry (standard solution to be given)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

**III Semester : Practical 3**

**3 hours per week**

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Systematic semi micro qualitative analysis of a mixture of two simple salts ( with no interfering radicals).

The constituent ions in the mixture to be restricted to the following

Anions :  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{SO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$

Cations :  $\text{Pb}^{2+}$ ,  $\text{Bi}^{3+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ,  $\text{NH}_4^+$

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU**

**DEPARTMENT OF CHEMISTRY**

**IV Semester : Practical 4**

**3 hours per week**

**Part 1 :**

1. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer
2. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
3. Determination of molecular mass of a non-volatile solute by walker-Lumsden method.
4. Determination of rate constant of the decomposition of hydrogen peroxide catalysed by  $\text{FeCl}_3$ .
5. Determination of transition temperature of the salt hydrates .
6. Determination of rate constant of saponification of ethylacetate titrimetrically.
7. Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol-water system.
8. Determination of the mass present in the given solution of a strong acid using strong base by thermometric titration method
9. Determination of molecular weight of a polymer material by viscosity measurements (cellulose acetate/ Methyl acrylate)
10. Study of kinetics of reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI, second order, determination of rate constant.



I Sem Practicals: CHEMISTRY-DSE 1 LAB

**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
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1. Preparation of acetanilide from aniline using  $\text{Zn}/\text{acetic acid}$  (Green method).
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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).

DEPARTMENT OF CHEMISTRY  
CHEMISTRY DSE2 LAB

**PART-A Physical Chemistry**

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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  $H_2O_2$  catalyzed by  $FeCl_3$
6. Determination of percentage composition of NaCl solution by determining miscibility temperature of phenol-water system.

**PART-B Analytical Chemistry**

1. Determination of alkali present in soaps/detergents using standard 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 HCl solution.
6. Determination of chlorine in bleaching powder by iodometry (standard solution to be given)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

**III Semester : Practical 3**

**3 hours per week**

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Systematic semi micro qualitative analysis of a mixture of two simple salts ( with no interfering radicals).

The constituent ions in the mixture to be restricted to the following

Anions :  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{SO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$

Cations :  $\text{Pb}^{2+}$ ,  $\text{Bi}^{3+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ,  $\text{NH}_4^+$

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU**

**DEPARTMENT OF CHEMISTRY**

**IV Semester : Practical 4**

**3 hours per week**

**Part 1 :**

1. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer
2. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
3. Determination of molecular mass of a non-volatile solute by walker-Lumsden method.
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I Sem Practicals: CHEMISTRY-DSE 1 LAB

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DEPARTMENT OF CHEMISTRY  
CHEMISTRY DSE2 LAB

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JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

**III Semester : Practical 3**

**3 hours per week**

---

Systematic semi micro qualitative analysis of a mixture of two simple salts ( with no interfering radicals).

The constituent ions in the mixture to be restricted to the following

Anions :  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{SO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$

Cations :  $\text{Pb}^{2+}$ ,  $\text{Bi}^{3+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ,  $\text{NH}_4^+$

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU**

**DEPARTMENT OF CHEMISTRY**

**IV Semester : Practical 4**

**3 hours per week**

**Part 1 :**

1. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer
2. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
3. Determination of molecular mass of a non-volatile solute by walker-Lumsden method.
4. Determination of rate constant of the decomposition of hydrogen peroxide catalysed by  $\text{FeCl}_3$ .
5. Determination of transition temperature of the salt hydrates .
6. Determination of rate constant of saponification of ethylacetate titrimetrically.
7. Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol-water system.
8. Determination of the mass present in the given solution of a strong acid using strong base by thermometric titration method
9. Determination of molecular weight of a polymer material by viscosity measurements (cellulose acetate/ Methyl acrylate)
10. Study of kinetics of reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI, second order, determination of rate constant.



I Sem Practicals: CHEMISTRY-DSE 1 LAB

**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).

DEPARTMENT OF CHEMISTRY  
CHEMISTRY DSE2 LAB

**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  $H_2O_2$  catalyzed by  $FeCl_3$
6. Determination of percentage composition of NaCl solution by determining miscibility temperature of phenol-water system.

**PART-B Analytical Chemistry**

1. Determination of alkali present in soaps/detergents using standard 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 HCl solution.
6. Determination of chlorine in bleaching powder by iodometry (standard solution to be given)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

**III Semester : Practical 3**

**3 hours per week**

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Systematic semi micro qualitative analysis of a mixture of two simple salts ( with no interfering radicals).

The constituent ions in the mixture to be restricted to the following

Anions :  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{SO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$

Cations :  $\text{Pb}^{2+}$ ,  $\text{Bi}^{3+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ,  $\text{NH}_4^+$

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU**

**DEPARTMENT OF CHEMISTRY**

**IV Semester : Practical 4**

**3 hours per week**

**Part 1 :**

1. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald's viscometer
2. Determination of the density using specific gravity bottle and surface tension of a liquid using stalagmometer.
3. Determination of molecular mass of a non-volatile solute by walker-Lumsden method.
4. Determination of rate constant of the decomposition of hydrogen peroxide catalysed by  $\text{FeCl}_3$ .
5. Determination of transition temperature of the salt hydrates .
6. Determination of rate constant of saponification of ethylacetate titrimetrically.
7. Determination of percentage composition of sodium chloride solution by determining the miscibility temperature of phenol-water system.
8. Determination of the mass present in the given solution of a strong acid using strong base by thermometric titration method
9. Determination of molecular weight of a polymer material by viscosity measurements (cellulose acetate/ Methyl acrylate)
10. Study of kinetics of reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI, second order, determination of rate constant.

V Semester Practical 5A

**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.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

**V Semester: Practical 5B**

**3 hours per week**

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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.

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU**

**DEPARTMENT OF CHEMISTRY**

**VI SEMESTER, PRACTICAL 6A**

**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 refractometer.
3. Determination of concentration of an acid/ base by conductometric method.
4. Potentiometric titration of Ferrous ammonium sulphate and  $K_2Cr_2O_7$ .
5. Determination of PKa of weak acid by potentiometric method
6. PH titration of strong acid and strong base.
7. Calorimetric estimation of  $Fe^{3+}$  ion using Ammonium thiocyanate
8. Calorimetric estimation of  $Cu^{2+}$  ion using  $NH_4OH$
9. Calorimetric estimation of Aspirin using  $FeCl_3$

**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.

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 ( $\text{J molecule}^{-1}$ ,  $\text{kJ mol}^{-1}$ ,  $\text{cm}^{-1}$ ,  $\text{eV}$ ).
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



V Semester Practical 5A

**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.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

**V Semester: Practical 5B**

**3 hours per week**

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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.

**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU**

**DEPARTMENT OF CHEMISTRY**

**VI SEMESTER, PRACTICAL 6A**

**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 refractometer.
3. Determination of concentration of an acid/ base by conductometric method.
4. Potentiometric titration of Ferrous ammonium sulphate and  $K_2Cr_2O_7$ .
5. Determination of PKa of weak acid by potentiometric method
6. PH titration of strong acid and strong base.
7. Calorimetric estimation of  $Fe^{3+}$  ion using Ammonium thiocyanate
8. Calorimetric estimation of  $Cu^{2+}$  ion using  $NH_4OH$
9. Calorimetric estimation of Aspirin using  $FeCl_3$

**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.

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DEPARTMENT OF CHEMISTRY

VI Semester : Practical 6B

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 ( $\text{J molecule}^{-1}$ ,  $\text{kJ mol}^{-1}$ ,  $\text{cm}^{-1}$ ,  $\text{eV}$ ).
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.
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V Semester Practical 5A

**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
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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.

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DEPARTMENT OF CHEMISTRY

**V Semester: Practical 5B**

**3 hours per week**

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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.
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**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU**

**DEPARTMENT OF CHEMISTRY**

**VI SEMESTER, PRACTICAL 6A**

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3. Isolation of Nicotine from Tobacco leaves.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU

DEPARTMENT OF CHEMISTRY

VI Semester : Practical 6B

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 ( $\text{J molecule}^{-1}$ ,  $\text{kJ mol}^{-1}$ ,  $\text{cm}^{-1}$ ,  $\text{eV}$ ).
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.
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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  $\text{HCl}(\text{g})$

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UG\_B.COM\_ Adverting Skills 2022-23

<b>ModuleNo.1:Introduction</b>	<b>10</b>
CommunicationProcess;Advertisingasa toolofcommunication;Meaning,natureand importance of advertising;Typesof advertising;Advertisingobjectives.Audience analysis;Setting of advertising budget: Determinants and major methods.	
<b>ModuleNo.2:MediaDecisions</b>	<b>07</b>
Major media types - their characteristics, internet as an advertising media, merits and demerits;Factorsinfluencingmediachoice;mediaselection,mediascheduling,Advertising through the Internet-media devices.	
<b>ModuleNo.3:MessageDevelopment</b>	<b>08</b>
Advertisingappeals,Advertisingcopyandelements,Preparingadsfordifferentmedia	
<b>ModuleNo.4:Measuring Advertising Effectiveness</b>	<b>10</b>
Evaluatingcommunicationandsaleseffects;Pre-andPost-testingtechniques	
<b>ModuleNo.5:AdvertisingAgency</b>	<b>07</b>
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## **UG\_B.COM\_ BUSINESS RESEARCH METHODS 2022-23**

### **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.

## UG\_B.COM\_ CORPORATE TAX PLANNING 2022-23

### **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]

**ENF30001**

**UG\_B.COM\_ GOODS AND SERVICES TAX AND CUSTOM DUTY2022-23**

**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.

UG\_B.COM\_ Management principles and Applications 2022-23

<b>Module No. 1: Introduction to Management</b>	<b>12</b>
Introduction-Meaning and importance of Management-Managerial Functions- Essence of Management-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.	

## UG\_B.COM\_AUDITING AND CORPORATE GOVERNANCE 2022-23

### **Unit 1: Introduction**

**Auditing:** Introduction, Meaning, Objectives, Basic Principles And Techniques; Classification Of Audit, Audit Planning, Internal Control – Internal Check And Internal Audit; Audit Procedure – Vouching And Verification Of Assets & Liabilities.

### **Unit 2: Auditor's Responsibility**

Auditor's Responsibility To Consider Frauds And Errors In Financial Statements. Recognizing Errors And Frauds- Responsibility-Prevention Of Frauds And Errors. Professional Code And Ethics (In Brief). Computer Based Audit Procedures.

### **Unit 3: Special Areas Of Audit**

**Special Areas Of Audit:** Special Features Of Cost Audit, Tax Audit, And Management Audit; **Recent Trends In Auditing:** Basic Considerations Of Audit In Edp Environment; Auditing Standards; **Relevant Case Studies/Problems;**

### **Unit 4: Corporate Governance**

Conceptual Framework Of Corporate Governance: Theories & Models, Broad Committees; **Corporate Governance Reforms.** **Major Corporate Scandals In India And Abroad;** Common Governance Problems Noticed In Various Corporate Failures. Codes & Standards On Corporate Governance

### **Unit 5: Business Ethics**

**Morality And Ethics, Business Values And Ethics,** Approaches And Practices Of Business Ethics, Corporate Ethics, Ethics Program, Codes Of Ethics, Ethics Committee; Ethical Behaviour: Concepts And Advantages; Rating Agencies; **Green Governance;** Clause 49 And Listing Agreement.

UG\_B.COM\_Entrepreneurship skills 2022-23

<b>ModuleNo.1: Introduction</b>	<b>10</b>
Need of becoming entrepreneur- ways to become a good entrepreneur-Enabling environmentavailabletobecomeanentrepreneur. Self-discovery,IdeaGeneration-Idea Evaluation-Feasibilityanalysis- Finding team-Preparation of business model.	
<b>ModuleNo.2:Promoting Entrepreneur</b>	<b>08</b>
Introduction-DifferentGovernment institutions/schemespromotingentrepreneurs: Graminbanks,PMMY-MUDRALoan,DIC,SIDA,SISI,NSIC,andSIDO,etc.,	
<b>ModuleNo.3:EnterpriseSet-up</b>	<b>08</b>
Introduction–Waystosetupanenterpriseanddifferentaspectsinvolved:legal compliances,marketingaspect,budgetingetc.,	
<b>ModuleNo.4:MonitoringandMaintaininganEnterprise</b>	<b>10</b>
Introduction–Daytodaymonitoringmechanismformanaginganenterprise-Different GovernmentSchemessupportingentrepreneurship.	
<b>ModuleNo.5:CaseletsDiscussion</b>	<b>0</b>
Examplesofsuccessful andunsuccessfulentrepreneurshipofMUDRA Loan,Gramin banks, SISI and NSIC etc.,	

UG\_B.COM\_Laws and practice of Banking 2022-23

<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.	



## UG\_B.Com\_Principles of Marketing 2022-23

<b>Module No. 1: Introduction to Marketing</b>	<b>12</b>
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.	
<b>Module No. 2: Consumer Behaviour &amp; Market segmentation</b>	<b>12</b>
<b>Consumer Behaviour:</b> Nature and Importance-Consumer buying decision process; Factors influencing consumer buying behaviour; <b>Market segmentation:</b> Concept, importance and bases; Target market selection-Positioning concept-Importance and bases; Product	
differentiation vs. market segmentation. <b>Marketing Mix:</b> Product-Price-Place & Promotion.	
<b>Module No. 3: Product and Pricing</b>	<b>12</b>
<b>Product:</b> 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. <b>Pricing:</b> Significance. Factors	
affecting price of a product. Pricing policies and strategies.	
<b>Module No. 4: Promotion and Distribution</b>	<b>12</b>
<b>Promotion:</b> 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. <b>Distribution Channels and Physical Distribution:</b> 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.	
<b>Module No. 5: Recent Developments in Marketing</b>	<b>08</b>
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.	

## UG\_B.COM\_FINANCIAL ACCOUNTING 2022-23

<b>Module No. 1: Theoretical Framework of Accounting</b>	<b>10</b>
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).	
<b>Module No. 2: Financial Statements of Sole Proprietors</b>	<b>12</b>
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.	
<b>Module No. 3: Consignment Accounts</b>	<b>12</b>
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.	
<b>Module No. 4: Royalty Accounts</b>	<b>14</b>
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.	
<b>Module No. 5: Emerging Trends in Accounting</b>	<b>08</b>
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).	



**JSS COLLEGE OF ARTS, COMMERCE AND  
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**OOTY ROAD, MYSURU- 570 025**

**DEPARTMENT OF ELECTRONICS**

**Syllabus on Skill Development**

**2022-23**

**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.

**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

**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.

**DME26404**

**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>



**DME26604**

## **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





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**Syllabus on Skill Development**

**2022-23**

## 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.

## **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

## Semester – III Programming in C and Digital Design using Verilog-Practicals

ProgramName	BScin Electronics	Semester	Third Semester
CourseTitle	Programming in C and Digital Design using Verilog (Practical)		
CourseCode:	FSC443	No. of Credits	2
Formative Assessment Marks	25	Summative Assessment Marks	25
<b>Note: Minimum of 5 programmes to be written and executed in each section</b>			

### Section –A:Digital Design 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

## Semester – IV Electronic Communication-I – Practical

Program Name	BSc in Electronics	Semester	Fourth Semester
Course Title	Electronic Communication-I (Practical)		
Course Code:	FSD 443	No. of Credits	2
Formative Assessment Marks	25	Summative Assessment Marks	25

**Note: Minimum of 10 Experiments are to be performed using hardware and simulation.**

### 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.





## V SEMESTER

### Practical Paper – V

#### FUNDAMENTALS OF G.I.S

Unit	Topic	Total teaching hours: 60
<b>Unit 1</b>	a) Meaning, definitions, components and importance of GIS	20
	b) Spatial entities – Point, line and polygon Sources of spatial data- Census, Topographical Maps, Aerial Photographs and Satellite Imageries	
<b>Unit 2</b>	a) Spatial Data Structure - Raster and vector data Structures Linking spatial and non spatial data	20
	b) Introduction to MapInfo software	
<b>Unit 3</b>	a) Geo – referencing , Choice of map projection b) Digitization c) Attaching attribute data (Creating data base) d) Editing e) Map layout f) 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

## VI SEMESTER

### Practical Paper – VI

#### COMPUTER MAPPING AND GPS SURVEYING

Unit	Topic	Total teaching hours: 60
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1.	Introduction to Computer : Generation of Computers, Hardware and Software Components	20
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2.	Computer graphics : Creating Data base in computer, creation of Line, Bar and Pie diagrams.	20
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Thematic Maps - Choro chromatic and schematic Maps

3.	GPS Surveying: Concepts, Segments and applications, plotting way points by using map source software .	20
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4.	Tour report / Factory visit	
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#### 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.

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### Practical Paper – V

#### FUNDAMENTALS OF G.I.S

Unit	Topic	Total teaching hours: 60
<b>Unit 1</b>	a) Meaning, definitions, components and importance of GIS	20
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## VI SEMESTER

### Practical Paper – VI

#### COMPUTER MAPPING AND GPS SURVEYING

Unit	Topic	Total teaching hours: 60
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1.	Introduction to Computer : Generation of Computers, Hardware and Software Components	20
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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.



# **JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

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**OOTY ROAD, MYSURU- 570 025**

NATIONAL EDUCATION POLICY 2020 INITIATIVES

B.Sc. (Hons) Mathematics,

B.Sc. with Mathematics as a Major/Minor Subject

## **Syllabus for B.Sc (Hons) programmes**

- Physics and Mathematics**
- Computer Science and Mathematics**

**W.E.F. THE ACADEMIC YEAR 2021-22**

**DEPARTMENT OF MATHEMATICS**

## 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/Hons.) 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 / Maxima/ 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.

**Syllabus for B.Sc. with Mathematics as Major Subject & B.Sc. (Hons)  
Mathematics**

**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**

**UG Mathematics - CBCS**  
**Unit IV: Successive Differentiation and Integral Calculus-I: nth Derivatives**

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 Hour**

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

UG

<b>Theory based Practical's on Algebra - I and Calculus-I</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>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:** Maxima/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 Course

(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	

**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- center 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.
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.

## Open Elective

UG-Mathematics- CBCS

(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 upto 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.

**Open Elective**

4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi.

## Open Elective

### UG-Mathematics- CBCS

(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. 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, Pratogitaprasakan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

**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.



**Unit-IV: Integral Calculus-II:** *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 using double integrals. *Triple integral:* Definition of triple integrals and evaluation- change of variables, volume as triple integral. **14 Hours**

Reference Books:

1. Differential Calculus, Shantinayakan, 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, Shantinayakan 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, 6<sup>th</sup> edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991

<b>Theory based practical's On Algebra – II (Number Theory) and Calculus – II</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:** Maxima/Scilab /Phython/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 Science stream who have not chosen Mathematics as one of the Core subjects)

Optional Mathematics – II	
Teaching Hours : 3 Hours/Week	Credits:3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.- 60 + I.A. – 40)

**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.
- 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, 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. David M Burton, Elementary Number Theory, 6<sup>th</sup> edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

**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 Installments (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.

**UG-Mathematics-CECS** 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

(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</b> <b>(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. 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, Pratogitaprakasan, Kic X, Kiran Prakashan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.







# **JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**

**(Autonomous)**

**OOTY ROAD, MYSURU- 570 025**

NATIONAL EDUCATION POLICY 2020 INITIATIVES

**B.Sc. (Hons) Mathematics,**

**B.Sc. with Mathematics as a Major/Minor Subject**

## **Syllabus for B.Sc (Hons) programmes**

- Physics and Mathematics**
- Computer Science and Mathematics**

**W.E.F. THE ACADEMIC YEAR 2021-22**

**DEPARTMENT OF MATHEMATICS**

## 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/Hons.) 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 / Maxima/ 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.

**Syllabus for B.Sc. with Mathematics as Major Subject & B.Sc. (Hons)  
Mathematics**

**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**

**UG Mathematics - CBCS**  
**Unit IV: Successive Differentiation and Integral Calculus-I: nth Derivatives**

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 Hour**

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

UG

<b>Theory based Practical's on Algebra - I and Calculus-I</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>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:** Maxima/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 Course

(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	

**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- center 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.
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.

## Open Elective

UG-Mathematics- CBCS

(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 upto 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.

**Open Elective**

4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi.

## Open Elective

### UG-Mathematics- CBCS

(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. 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, Pratogitaprasakan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

**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.

**Unit-IV: Integral Calculus-II:** *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 using double integrals. *Triple integral:* Definition of triple integrals and evaluation- change of variables, volume as triple integral. **14 Hours**

Reference Books:

1. Differential Calculus, Shantinayakan, 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, Shantinayakan 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, 6<sup>th</sup> edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991

<b>Theory based practical's On Algebra – II (Number Theory) and Calculus – II</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:** Maxima/Scilab /Phython/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 Science stream who have not chosen Mathematics as one of the Core subjects)

Optional Mathematics – II	
Teaching Hours : 3 Hours/Week	Credits:3
Total Teaching Hours: 42 Hours	Max. Marks: 100 (S.A.- 60 + I.A. – 40)

**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.
- 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, 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. David M Burton, Elementary Number Theory, 6<sup>th</sup> edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

**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 Installments (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.

**UG-Mathematics-OBCS** 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

(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</b> <b>(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. 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, Pratogitaprakasan, Kic X, Kiran Prakashan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.



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)**

## 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**

<b>Course 1 : DSC-1T General Microbiology</b>		<b>Course 2 : OE 1T Microbial Technology for Human Welfare</b>		<b>Course 3 : SEC 1T Microbiological Methods and Analytical Techniques</b>	
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, Eleri Metchnikoff. Contributions of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Microscopy- 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 stains, 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.  <b>Culture media</b> – Types, Cultivation of aerobic and anaerobic bacteria. Pure culture techniques and Cultural characteristics.  <b>Preservation of microorganisms:</b> 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, pilli, 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>	



**Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms****14Hrs**

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.

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

**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>	
<b>Number of Theory Credits</b>	<b>Number of lecture hours/semester</b>	<b>Number of Theory Credits</b>	<b>Number of lecture hours/semester</b>
<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>

Bioenergetics: Free energy, Enthalpy, Entropy, Classification of high energy compounds, Oxidation reduction reactions, equilibrium constant, Redox potential, Law of thermodynamics.  
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)  
Microbial Photosynthesis: Light reaction: Light harvesting pigments Photophosphorylation, CO<sub>2</sub> fixation pathways: Calvin cycle, CODH pathway, Reductive TCA pathway.

## **FSB501P 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





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)**



## 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**

<b>Course 1 : DSC-1T General Microbiology</b>		<b>Course 2 : OE 1T Microbial Technology for Human Welfare</b>		<b>Course 3 : SEC 1T Microbiological Methods and Analytical Techniques</b>	
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, Eleri Metchnikoff. Contributions of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Microscopy- 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 stains, 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.  <b>Culture media</b> – Types, Cultivation of aerobic and anaerobic bacteria. Pure culture techniques and Cultural characteristics.  <b>Preservation of microorganisms:</b> 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, pilli, 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>	

**Unit – 4: Types, structure, organisation and reproduction of eukaryotic microorganisms****14Hrs**

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.

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

**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>	
<b>Number of Theory Credits</b>	<b>Number of lecture hours/semester</b>	<b>Number of Theory Credits</b>	<b>Number of lecture hours/semester</b>
<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>

Bioenergetics: Free energy, Enthalpy, Entropy, Classification of high energy compounds, Oxidation reduction reactions, equilibrium constant, Redox potential, Law of thermodynamics.  
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)  
Microbial Photosynthesis: Light reaction: Light harvesting pigments Photophosphorylation, CO<sub>2</sub> fixation pathways: Calvin cycle, CODH pathway, Reductive TCA pathway.

## **FSB501P 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









**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
**(Autonomous)**  
**OOTY ROAD, MYSURU- 570 025**

**DEPARTMENT OF PHYSICS**

**Syllabus under**  
**National Educational Policy**

**For B.Sc programmes**

- ✓ **Physics, Chemistry**
- ✓ **Physics, Mathematics**
- ✓ **Physics, Computer Science**
- ✓ **Physics, Electronics**

**Wef**

**2021-22**

## Curriculum Structure-Physics

### (Core and Electives)

#### Semesters- I to X

SEM	DSC	Core Papers
Sem-1 :	A1	Mechanics & Properties of Matter
Sem -2 :	A2	Electricity and Magnetism
Sem-3 :	A3	Wave motion and optics
Sem-4:	A4	Thermal Physics & Electronics

## 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

**Detailed Syllabus for Semesters I & II  
B.Sc., Physics**

**Detailed Syllabus for Semesters I & II**

Semester I & II	SEMESTER I		SEMESTER II	
	2021-2022	2022-2023	2022-2023	2023-2024
Course Code	PH101	PH102	PH201	PH202
Course Name	Physics I	Physics II	Physics III	Physics IV
Prerequisites				
Course Objectives	<ol style="list-style-type: none"> <li>1. Understand the basic concepts of mechanics.</li> <li>2. Calculate the motion of particles and rigid bodies.</li> <li>3. Apply the conservation laws of energy, momentum, and angular momentum.</li> <li>4. Understand the concept of simple harmonic motion.</li> <li>5. Calculate the motion of a particle in a central force field.</li> <li>6. Understand the concept of relativity.</li> <li>7. Calculate the motion of a particle in a relativistic field.</li> <li>8. Understand the concept of quantum mechanics.</li> </ol>	<ol style="list-style-type: none"> <li>1. Understand the basic concepts of electromagnetism.</li> <li>2. Calculate the electric and magnetic fields of a charge distribution.</li> <li>3. Apply the conservation laws of energy, momentum, and angular momentum.</li> <li>4. Understand the concept of wave motion.</li> <li>5. Calculate the motion of a particle in a wave field.</li> <li>6. Understand the concept of quantum mechanics.</li> <li>7. Calculate the motion of a particle in a quantum field.</li> <li>8. Understand the concept of relativity.</li> </ol>	<ol style="list-style-type: none"> <li>1. Understand the basic concepts of quantum mechanics.</li> <li>2. Calculate the wave function of a particle in a potential well.</li> <li>3. Apply the conservation laws of energy, momentum, and angular momentum.</li> <li>4. Understand the concept of wave motion.</li> <li>5. Calculate the motion of a particle in a wave field.</li> <li>6. Understand the concept of quantum mechanics.</li> <li>7. Calculate the motion of a particle in a quantum field.</li> <li>8. Understand the concept of relativity.</li> </ol>	<ol style="list-style-type: none"> <li>1. Understand the basic concepts of quantum mechanics.</li> <li>2. Calculate the wave function of a particle in a potential well.</li> <li>3. Apply the conservation laws of energy, momentum, and angular momentum.</li> <li>4. Understand the concept of wave motion.</li> <li>5. Calculate the motion of a particle in a wave field.</li> <li>6. Understand the concept of quantum mechanics.</li> <li>7. Calculate the motion of a particle in a quantum field.</li> <li>8. Understand the concept of relativity.</li> </ol>

# 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 to be covered/taught/learnt:</b> <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>	<ol style="list-style-type: none"> <li>1. i). Students can measure diameters of small balls of different size and estimate their volumes.</li> <li>2. ii). Students can measure lengths of nails of different size.</li> <li>iii). Students can measure volume of a liquid</li> <li>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.</li> <li>v). students can estimate standard deviations wherever possible.</li> </ol>	
<b>Activity No. 2</b>	<p>Students can try and understand conservation of energy in every day examples. For example:</p> <ol style="list-style-type: none"> <li>i) What happens in solar conservation panels</li> <li>ii) Pushing an object on the table it moves</li> <li>iii) Moving car hits a parked car causes parked car to move.</li> </ol> <p>In these cases, energy is conserved. How? Understand and verify if possible.</p>	
<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>	

<b>Unit - 3</b>		
<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 Kirchoff'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>		Hrs
<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>	1. Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. 2. A small project report on production of electricity as a source of energy: Different methods	
<b>Activity No. 2</b>	1. Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. 2. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	
<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>1. Learn about electrical appliances which work with AC and DC electricity</li> <li>2. 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>1. Learn about power transmission: 3-phase electricity, voltage and phase</li> <li>2. 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>3. Prepare a small project report on street lighting and types of electrical bulbs.</li> </ol>	

## Unit – 3

<b>Chapter No.6</b>	<p><b>Topics to be covered</b></p> <p><b>Magnetism</b>            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.</p>	7
<b>Chapter No. 7</b>	<p><b>Topics to be covered</b></p> <p>Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.</p>	6
<b>Topics for self study( If any)</b>	Hall Effect	
<b>Suggested Activities</b>		
<b>Activity No. 5</b>	<p><b>Activity:</b></p> <ol style="list-style-type: none"> <li>1. Prepare a small project report on street lighting and types of electrical bulbs.</li> <li>2. Learn the measurement of electric current using tangent galvanometer.</li> </ol>	
<b>Activity No.6</b>	<p><b>Activity:</b></p> <p>Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.</p>	
<b>Unit - 4</b>		
<b>Chapter No. 8</b>	<p><b>Electromagnetic waves:</b>            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.</p>	8
<b>Chapter No. 9</b>	<p><b>Topics to be covered:</b></p> <p>Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.</p>	5
<b>Topics for self study( If any)</b>	<p><i>B-H curves and its characteristics</i>  <i>Ferrites</i></p>	

	<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.

<b>Suggested Activities (2 Hours)</b>	
<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. 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 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. 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 two marble 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>
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## 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's	BL	CO	PO
i.	Explain using Michelson interferometer how to determine the wavelength of light.	L2	7	1-6, 11-12
ii.	Give an account of the different possible shapes that are obtained in Michelson interferometer experiment and their relevance.	L2	7	1-6, 11-12
iii.	Discuss the wave model and the Corpuscular model of light.	L2	7	1-6, 11-12
iv.	Explain Maxwells electromagnetic waves.	L2	7	1-6, 11-12
v.	Give an account of the phenomenon of wave-particle duality.	L1	7	1-6, 11-12
vi.	Give the Huygen theory of wave-front.	L1	7	1-6, 11-12

<b>vii.</b>	Define Interference. Give some examples of Interference.	<b>L1</b>	<b>7</b>	<b>1-6, 11-12</b>
<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)	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<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.	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>x.</b>	Give the theory of interference due to division of amplitude by parallel and non-parallel plates.	<b>L1</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>xi.</b>	Explain how Newton's rings are obtained and discuss how the wavelength of light is determined using this experiment.	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>xii.</b>	Higher order problems.	<b>L3</b>	<b>7</b>	<b>1-6, 11-12</b>

### **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>
<b>Wave Motion and Optics</b>	
<b>Unit – 4 - Diffraction and Polarisation</b>	
<b>The Portion to be Covered</b>	

**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.nnin.org/sites/default/files/files/Karen_Rama_USING_CDs_AND_DVDs_AS_DIFFRACTION GRATINGS_0.pdf">https://www.nnin.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	<i>Eugene 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
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<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>

## List of Experiments to be performed in the Laboratory

(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.

## Reference Book for Laboratory Experiments

SI 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





## 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</b>	
<b>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 liquidaation of gases?	L2	2	1-6, 11-12
ix.	State Maxwell-Boltzmann Law of Distribution of Velocities in Ideal gases.	L1	2	1-6, 11-12
x.	Explain the mean RMS and most probable speeds in ideal gases.	L1	2	1-6, 11-12
xi.	Explain degrees of freedom associated with particles in an ideal gas?	L2	2	1-6, 11-12

<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>

### **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)**

#### **Activity No. 4**

**(i) Measuring the Solar Constant**

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.

**(ii) Thermo emf**

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.

**(iii) Inverse square law of radiation**

Materials: A cardboard with a grid, cardboard with a hole, supporting clips, a ruler, candle.

**(iv) Activity:** 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.

Ref: Activity Based Physics Thinking Problems in Thermodynamics: Kinetic Theory

<http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm>



<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> <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 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> <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> 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>

**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> <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> 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</p>
<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> <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> <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>
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## Thermal Physics and Electronics

### Unit – 4

#### The Portion to be Covered

**Electronics:** Integrated Circuits (Analog and Digital), Operational Amplifier, Ideal characteristics of Op-Amp, Inverting and Non-Inverting Configurations. Applications- Voltage Follower, Addition and Subtraction. **(4 hours)**

**Digital:** 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. **(3 hours)**

**Boolean Algebra Theorems:** 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. **(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 op-amps and give the characteristics of an ideal op-amp.	L 1	4	1-6, 11-12
ii.	Explains an inverting and non-inverting configuration of typical op-amps, with a schematic diagram.	L 2	4	1-6, 11-12

iii.	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
iv.	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
v.	Give different digital wave forms and explain how one can visualize the switching and logic levels.	L 1	5	1-6, 11-12
vi.	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
vii.	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
viii.	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
ix.	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
x.	Why are X-NOR gates called Universal Gates?	L 2	5	1-6, 11-12
xi.	High Order Problems.	L 3	4, 5	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. 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>	<b>Operational Amplifiers</b>  <b>(i)</b> Understand the concept of virtual ground of an OP-AMP. <b>(ii)</b> Learn the different types of op-amps used for different applications. <b>(iii)</b> What is a buffer? Prepare a report on buffers and its application in instrumentation electronics.
<b>Activity No. 12</b>	<b>(i)</b> 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.  <b>(ii)</b> A locker has been rented in the bank. Express the process of opening the locker in terms of digital operation.  <b>(iii)</b> 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.

### 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>Mark s</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**







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- ✓ **Physics, Chemistry**
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**2021-22**

## Curriculum Structure-Physics

### (Core and Electives)

#### Semesters- I to X

SEM	DSC	Core Papers
Sem-1 :	A1	Mechanics & Properties of Matter
Sem -2 :	A2	Electricity and Magnetism
Sem-3 :	A3	Wave motion and optics
Sem-4:	A4	Thermal Physics & Electronics

## 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

**Detailed Syllabus for Semesters I & II  
B.Sc., Physics**

**Detailed Syllabus for Semesters I & II**

Semester I & II	SEMESTER I		SEMESTER II	
	2021-2022	2022-2023	2022-2023	2023-2024
Course Code	PH101	PH102	PH201	PH202
Course Name	Physics I	Physics II	Physics III	Physics IV
Prerequisites				
Credits	3	3	3	3
Assessment	Internal: 30% External: 70%	Internal: 30% External: 70%	Internal: 30% External: 70%	Internal: 30% External: 70%
Course Objectives	<p><b>General Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Gain a solid foundation in classical mechanics.</li> <li>2. Develop problem-solving skills in physics.</li> <li>3. Understand the relationship between theory and experiment.</li> <li>4. Apply mathematical techniques to physical problems.</li> <li>5. Develop laboratory skills and report writing.</li> </ol>	<p><b>Technical Skills (Optional):</b></p> <ol style="list-style-type: none"> <li>1. Use of instruments.</li> <li>2. Error analysis.</li> <li>3. Graphical representation.</li> <li>4. Data reduction.</li> <li>5. Report writing.</li> </ol>	<p><b>General Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Understand the laws of thermodynamics and the concept of entropy.</li> <li>2. Apply the laws of thermodynamics to various systems.</li> <li>3. Understand the concept of heat engines and refrigerators.</li> <li>4. Apply the laws of thermodynamics to real-world situations.</li> <li>5. Develop laboratory skills and report writing.</li> </ol>	<p><b>General Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Understand the laws of electromagnetism and the concept of electromagnetic waves.</li> <li>2. Apply the laws of electromagnetism to various systems.</li> <li>3. Understand the concept of AC circuits and resonance.</li> <li>4. Apply the laws of electromagnetism to real-world situations.</li> <li>5. Develop laboratory skills and report writing.</li> </ol>

# 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 to be covered/taught/learnt:</b> <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>	<ol style="list-style-type: none"> <li>1. i). Students can measure diameters of small balls of different size and estimate their volumes.</li> <li>2. ii). Students can measure lengths of nails of different size.</li> <li>iii). Students can measure volume of a liquid</li> <li>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.</li> <li>v). students can estimate standard deviations wherever possible.</li> </ol>	
<b>Activity No. 2</b>	<p>Students can try and understand conservation of energy in every day examples. For example:</p> <ol style="list-style-type: none"> <li>i) What happens in solar conservation panels</li> <li>ii) Pushing an object on the table it moves</li> <li>iii) Moving car hits a parked car causes parked car to move.</li> </ol> <p>In these cases, energy is conserved. How? Understand and verify if possible.</p>	
<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>	

<b>Unit - 3</b>		
<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>		Hrs
<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>	1. Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. 2. A small project report on production of electricity as a source of energy: Different methods	
<b>Activity No. 2</b>	1. Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. 2. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	
<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>1. Learn about electrical appliances which work with AC and DC electricity</li> <li>2. 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>1. Learn about power transmission: 3-phase electricity, voltage and phase</li> <li>2. 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>3. Prepare a small project report on street lighting and types of electrical bulbs.</li> </ol>	

## Unit – 3

<b>Chapter No.6</b>	<p><b>Topics to be covered</b></p> <p><b>Magnetism</b>            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.</p>	7
<b>Chapter No. 7</b>	<p><b>Topics to be covered</b></p> <p>Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.</p>	6
<b>Topics for self study( If any)</b>	Hall Effect	
<b>Suggested Activities</b>		
<b>Activity No. 5</b>	<p><b>Activity:</b></p> <ol style="list-style-type: none"> <li>1. Prepare a small project report on street lighting and types of electrical bulbs.</li> <li>2. Learn the measurement of electric current using tangent galvanometer.</li> </ol>	
<b>Activity No.6</b>	<p><b>Activity:</b></p> <p>Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.</p>	
<b>Unit - 4</b>		
<b>Chapter No. 8</b>	<p><b>Electromagnetic waves:</b>            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.</p>	8
<b>Chapter No. 9</b>	<p><b>Topics to be covered:</b></p> <p>Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.</p>	5
<b>Topics for self study( If any)</b>	<p><i>B-H curves and its characteristics</i>  <i>Ferrites</i></p>	

	<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.

<b>Suggested Activities (2 Hours)</b>	
<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. 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 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. 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 two marble 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>
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## 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's	BL	CO	PO
i.	Explain using Michelson interferometer how to determine the wavelength of light.	L2	7	1-6, 11-12
ii.	Give an account of the different possible shapes that are obtained in Michelson interferometer experiment and their relevance.	L2	7	1-6, 11-12
iii.	Discuss the wave model and the Corpuscular model of light.	L2	7	1-6, 11-12
iv.	Explain Maxwells electromagnetic waves.	L2	7	1-6, 11-12
v.	Give an account of the phenomenon of wave-particle duality.	L1	7	1-6, 11-12
vi.	Give the Huygen theory of wave-front.	L1	7	1-6, 11-12

<b>vii.</b>	Define Interference. Give some examples of Interference.	<b>L1</b>	<b>7</b>	<b>1-6, 11-12</b>
<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)	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<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.	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>x.</b>	Give the theory of interference due to division of amplitude by parallel and non-parallel plates.	<b>L1</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>xi.</b>	Explain how Newton's rings are obtained and discuss how the wavelength of light is determined using this experiment.	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>xii.</b>	Higher order problems.	<b>L3</b>	<b>7</b>	<b>1-6, 11-12</b>

### **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>
<b>Wave Motion and Optics</b>	
<b>Unit – 4 - Diffraction and Polarisation</b>	
<b>The Portion to be Covered</b>	

**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.nnin.org/sites/default/files/files/Karen_Rama_USING_CDs_AND_DVDs_AS_DIFFRACTION GRATINGS_0.pdf">https://www.nnin.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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<b>Textbook</b>				
<b>S</b>				
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

<b>References Books</b>				
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	<i>Eugene 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
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<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>

## List of Experiments to be performed in the Laboratory

(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.

## Reference Book for Laboratory Experiments

SI 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



## 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</b>	
<b>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 liquidaation of gases?	L2	2	1-6, 11-12
ix.	State Maxwell-Boltzmann Law of Distribution of Velocities in Ideal gases.	L1	2	1-6, 11-12
x.	Explain the mean RMS and most probable speeds in ideal gases.	L1	2	1-6, 11-12
xi.	Explain degrees of freedom associated with particles in an ideal gas?	L2	2	1-6, 11-12

<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>

### **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)**

#### **Activity No. 4**

**(i) Measuring the Solar Constant**

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.

**(ii) Thermo emf**

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.

**(iii) Inverse square law of radiation**

Materials: A cardboard with a grid, cardboard with a hole, supporting clips, a ruler, candle.

**(iv) Activity:** 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.

Ref: Activity Based Physics Thinking Problems in Thermodynamics: Kinetic Theory

<http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm>

<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> <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 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> <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> 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>

**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> <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> 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</p>
<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> <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> <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>
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## Thermal Physics and Electronics

### Unit – 4

#### The Portion to be Covered

**Electronics:** Integrated Circuits (Analog and Digital), Operational Amplifier, Ideal characteristics of Op-Amp, Inverting and Non-Inverting Configurations. Applications- Voltage Follower, Addition and Subtraction. **(4 hours)**

**Digital:** 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. **(3 hours)**

**Boolean Algebra Theorems:** 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. **(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 op-amps and give the characteristics of an ideal op-amp.	L 1	4	1-6, 11-12
ii.	Explains an inverting and non-inverting configuration of typical op-amps, with a schematic diagram.	L 2	4	1-6, 11-12

iii.	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
iv.	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
v.	Give different digital wave forms and explain how one can visualize the switching and logic levels.	L 1	5	1-6, 11-12
vi.	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
vii.	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
viii.	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
ix.	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
x.	Why are X-NOR gates called Universal Gates?	L 2	5	1-6, 11-12
xi.	High Order Problems.	L 3	4, 5	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. 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>	<b>Operational Amplifiers</b> <ul style="list-style-type: none"> <li>(i) Understand the concept of virtual ground of an OP-AMP.</li> <li>(ii) Learn the different types of op-amps used for different applications.</li> <li>(iii) What is a buffer? Prepare a report on buffers and its application in instrumentation electronics.</li> </ul>
<b>Activity No. 12</b>	<ul style="list-style-type: none"> <li>(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.</li> <li>(ii) A locker has been rented in the bank. Express the process of opening the locker in terms of digital operation.</li> <li>(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.</li> </ul>

### Textbooks

SI 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

SI 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>Mark s</b>
Internal Assessment	10
Activity	10
REU based Group Activity (Conduction, Report, Presentation)	10
Science Communication (Seminar/Poster etc)	10
<b>Total</b>	40

<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**







**JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE**  
**(Autonomous)**  
**OOTY ROAD, MYSURU- 570 025**

**DEPARTMENT OF PHYSICS**

**Syllabus under**  
**National Educational Policy**

**For B.Sc programmes**

- ✓ **Physics, Chemistry**
- ✓ **Physics, Mathematics**
- ✓ **Physics, Computer Science**
- ✓ **Physics, Electronics**

**Wef**

**2021-22**

## Curriculum Structure-Physics

### (Core and Electives)

#### Semesters- I to X

SEM	DSC	Core Papers
Sem-1 :	A1	Mechanics & Properties of Matter
Sem -2 :	A2	Electricity and Magnetism
Sem-3 :	A3	Wave motion and optics
Sem-4:	A4	Thermal Physics & Electronics



## 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

**Detailed Syllabus for Semesters I & II  
B.Sc., Physics**

**Detailed Syllabus for Semesters I & II**

Semester I & II	SEMESTER I		SEMESTER II	
	2021-2022	2022-2023	2022-2023	2023-2024
Course Code	PH101	PH102	PH201	PH202
Course Name	Physics I	Physics II	Physics III	Physics IV
Prerequisites				
Credits	3	3	3	3
Assessment	Internal: 30% External: 70%	Internal: 30% External: 70%	Internal: 30% External: 70%	Internal: 30% External: 70%
Course Objectives	<p><b>General Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Gain a solid foundation in classical mechanics.</li> <li>2. Develop problem-solving skills in physics.</li> <li>3. Understand the relationship between theory and experiment.</li> <li>4. Apply mathematical techniques to physical problems.</li> <li>5. Develop laboratory skills and report writing.</li> </ol>	<p><b>Technical Skills (Optional):</b></p> <ol style="list-style-type: none"> <li>1. Use of instruments.</li> <li>2. Error analysis.</li> <li>3. Graphical representation.</li> <li>4. Data analysis.</li> <li>5. Report writing.</li> </ol>	<p><b>General Skills:</b></p> <ol style="list-style-type: none"> <li>1. Ability to work in groups.</li> <li>2. Communication skills.</li> <li>3. Critical thinking and problem-solving.</li> <li>4. Time management.</li> <li>5. Self-learning and independent study.</li> </ol>	

# 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 to be covered/taught/learnt:</b> <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>	<ol style="list-style-type: none"> <li>1. i). Students can measure diameters of small balls of different size and estimate their volumes.</li> <li>2. ii). Students can measure lengths of nails of different size.</li> <li>iii). Students can measure volume of a liquid</li> <li>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.</li> <li>v). students can estimate standard deviations wherever possible.</li> </ol>	
<b>Activity No. 2</b>	<p>Students can try and understand conservation of energy in every day examples. For example:</p> <ol style="list-style-type: none"> <li>i) What happens in solar conservation panels</li> <li>ii) Pushing an object on the table it moves</li> <li>iii) Moving car hits a parked car causes parked car to move.</li> </ol> <p>In these cases, energy is conserved. How? Understand and verify if possible.</p>	
<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>	

<b>Unit - 3</b>		
<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 Kirchoff'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>		Hrs
<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>	1. Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. 2. A small project report on production of electricity as a source of energy: Different methods	
<b>Activity No. 2</b>	1. Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. 2. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	
<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>1. Learn about electrical appliances which work with AC and DC electricity</li> <li>2. 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>1. Learn about power transmission: 3-phase electricity, voltage and phase</li> <li>2. 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>3. Prepare a small project report on street lighting and types of electrical bulbs.</li> </ol>	

## Unit – 3

<b>Chapter No.6</b>	<p><b>Topics to be covered</b></p> <p><b>Magnetism</b>            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.</p>	7
<b>Chapter No. 7</b>	<p><b>Topics to be covered</b></p> <p>Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.</p>	6
<b>Topics for self study( If any)</b>	Hall Effect	
<b>Suggested Activities</b>		
<b>Activity No. 5</b>	<p><b>Activity:</b></p> <ol style="list-style-type: none"> <li>1. Prepare a small project report on street lighting and types of electrical bulbs.</li> <li>2. Learn the measurement of electric current using tangent galvanometer.</li> </ol>	
<b>Activity No.6</b>	<p><b>Activity:</b></p> <p>Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.</p>	
<b>Unit - 4</b>		
<b>Chapter No. 8</b>	<p><b>Electromagnetic waves:</b>            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.</p>	8
<b>Chapter No. 9</b>	<p><b>Topics to be covered:</b></p> <p>Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.</p>	5
<b>Topics for self study( If any)</b>	<p><i>B-H curves and its characteristics</i>  <i>Ferrites</i></p>	

	<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.

<b>Suggested Activities (2 Hours)</b>	
<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. 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 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. 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 two marble 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>
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## 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's	BL	CO	PO
i.	Explain using Michelson interferometer how to determine the wavelength of light.	L2	7	1-6, 11-12
ii.	Give an account of the different possible shapes that are obtained in Michelson interferometer experiment and their relevance.	L2	7	1-6, 11-12
iii.	Discuss the wave model and the Corpuscular model of light.	L2	7	1-6, 11-12
iv.	Explain Maxwells electromagnetic waves.	L2	7	1-6, 11-12
v.	Give an account of the phenomenon of wave-particle duality.	L1	7	1-6, 11-12
vi.	Give the Huygen theory of wave-front.	L1	7	1-6, 11-12

<b>vii.</b>	Define Interference. Give some examples of Interference.	<b>L1</b>	<b>7</b>	<b>1-6, 11-12</b>
<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)	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<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.	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>x.</b>	Give the theory of interference due to division of amplitude by parallel and non-parallel plates.	<b>L1</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>xi.</b>	Explain how Newton's rings are obtained and discuss how the wavelength of light is determined using this experiment.	<b>L2</b>	<b>7</b>	<b>1-6, 11-12</b>
<b>xii.</b>	Higher order problems.	<b>L3</b>	<b>7</b>	<b>1-6, 11-12</b>

### **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>
<b>Wave Motion and Optics</b>	
<b>Unit – 4 - Diffraction and Polarisation</b>	
<b>The Portion to be Covered</b>	

**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.nnin.org/sites/default/files/files/Karen_Rama_USING_CDs_AND_DVDs_AS_DIFFRACTION GRATINGS_0.pdf">https://www.nnin.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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<b>Textbook</b>				
<b>S</b>				
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

<b>References Books</b>				
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	<i>Eugene 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
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<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>

## List of Experiments to be performed in the Laboratory

(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.

## Reference Book for Laboratory Experiments

SI 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



## 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 liquidaation of gases?	L2	2	1-6, 11-12
ix.	State Maxwell-Boltzmann Law of Distribution of Velocities in Ideal gases.	L1	2	1-6, 11-12
x.	Explain the mean RMS and most probable speeds in ideal gases.	L1	2	1-6, 11-12
xi.	Explain degrees of freedom associated with particles in an ideal gas?	L2	2	1-6, 11-12

<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>

### **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)**

#### **Activity No. 4**

#### **(i) Measuring the Solar Constant**

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.

#### **(ii) Thermo emf**

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.

#### **(iii) Inverse square law of radiation**

Materials: A cardboard with a grid, cardboard with a hole, supporting clips, a ruler, candle.

**(iv) Activity:** 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.

Ref: Activity Based Physics Thinking Problems in Thermodynamics: Kinetic Theory

<http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm>

<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> <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 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> <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> 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>

**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> <ol style="list-style-type: none"> <li>1. Step down transformer- 1 No. (5 V tapping, 100 – 500 mA current rating),</li> <li>BY 127 semiconductor diodes – 4 Nos,</li> <li>Inductor -1, Capacitor - 1, 3 pin 5V regulator-1</li> </ol> <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> <ol 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> </ol>
	<p><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</p>
<b>Activity No. 8</b>	<ol 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> </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. 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> <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>
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## Thermal Physics and Electronics

### Unit – 4

#### The Portion to be Covered

**Electronics:** Integrated Circuits (Analog and Digital), Operational Amplifier, Ideal characteristics of Op-Amp, Inverting and Non-Inverting Configurations. Applications- Voltage Follower, Addition and Subtraction. **(4 hours)**

**Digital:** 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. **(3 hours)**

**Boolean Algebra Theorems:** 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. **(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 op-amps and give the characteristics of an ideal op-amp.	L 1	4	1-6, 11-12
ii.	Explains an inverting and non-inverting configuration of typical op-amps, with a schematic diagram.	L 2	4	1-6, 11-12

iii.	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
iv.	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
v.	Give different digital wave forms and explain how one can visualize the switching and logic levels.	L 1	5	1-6, 11-12
vi.	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
vii.	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
viii.	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
ix.	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
x.	Why are X-NOR gates called Universal Gates?	L 2	5	1-6, 11-12
xi.	High Order Problems.	L 3	4, 5	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. 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>	<b>Operational Amplifiers</b>  <b>(i)</b> Understand the concept of virtual ground of an OP-AMP. <b>(ii)</b> Learn the different types of op-amps used for different applications. <b>(iii)</b> What is a buffer? Prepare a report on buffers and its application in instrumentation electronics.
<b>Activity No. 12</b>	<b>(i)</b> 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.  <b>(ii)</b> A locker has been rented in the bank. Express the process of opening the locker in terms of digital operation.  <b>(iii)</b> 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.

### 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>Mark s</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**







# 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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<b>2. Trainer Prerequisites</b>	<b><u>09</u></b>
<b>3. Annexure: Assessment Criteria</b>	<b><u>10</u></b>

# 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 “FIC/Q0109”, 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: “Supervisor-Fruits & Vegetables Processing” mapped to QP: “FIC/Q0109, 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: “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

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
<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

Total Marks: 600	Compulsory NOS				
Assessable outcomes	Assessment criteria for outcomes	Total Marks	Out Of	Theory	Skills Practical
	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**

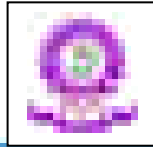
**SUB-SECTOR: FRUIT & VEGETABLE, FOOD GRAIN MILLING (INCLUDING OILSEEDS), DAIRY PRODUCTS, MEAT & POULTRY, FISH & SEAFOOD, BREAD & BAKERY, ALCOHOLIC BEVERAGES, AERATED WATER/ SOFT DRINKS, SOYA FOOD, PACKAGED FOOD**

**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 unitor food regulatory matters		
<b>Training Outcomes</b>	<b>After completing this programme, participants will be able to:</b> Designing, developing, implementing and changing food regulatory systems in the organisation. Act as a liaison between organisation and government regulatory agencies Ensure that the products produced and distributed comply with regulatory standards.		



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>	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
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>	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 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>	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 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 out 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>	





# **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**

**Programme: B. Voc. (Software Development)**

# Model Curriculum

## JUNIOR SOFTWARE DEVELOPER

### JUNIOR SOFTWARE DEVELOPER

SECTOR: IT-ITeS

SUB-SECTOR: IT Services

OCCUPATION: **Application Development**

REFERENCE ID: **SSC/Q0508, version 1.0** NSQF LEVEL: 4





Format: ModCur\_2015\_1\_0

Model Curriculum for Junior Software Developer

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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-requisites 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 DeveloperSSC/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</li> </ul>	SSC/N0506	Refer to Unique Equipment Required section

				social internet media.		
2	Problem Solving and Program Design	30:00	60:00	<p>Candidates will be able to:</p> <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	12:00	38:00	<p>Candidates will be able to:</p> <ul style="list-style-type: none"> <li>• Obtain guidance from</li> </ul>	SSC/N9002	Refer to Unique



	Communication			<p>appropriate people to agree the analysis to be performed on the data</p> <ul style="list-style-type: none"> <li>Obtain advice and guidance from appropriate people on issues with data analysis</li> </ul>		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
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				<p>safely, competently and within the limits of authority</p> <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	<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 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
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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> <p>• Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time</p>		

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>	<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>		
<b>Sr. No.</b>	<b>Module</b>	<b>Theory Duration (hh:mm)</b>	<b>Practical Duration (hh:mm)</b>	<b>Key Learning Outcomes</b>	<b>Corresponding NOS Code</b>	<b>Equipment Required</b>



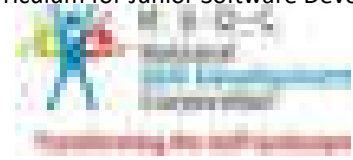


				<p>For Domain NOS, For NOS SSC/N0506 – HTML, C++ / Java, IDE</p> <p>General:</p> <ul style="list-style-type: none"> <li>• Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning</li> <li>• White Board, Markers and Eraser</li> <li>• Projector with screen</li> <li>• Flip chart 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:</li> <li>• Intranet</li> <li>• Email</li> <li>• IMs</li> <li>• Learning management system 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 -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> <li>• Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.</li> </ul>
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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 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. 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.

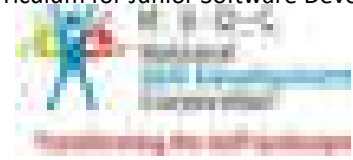


Annexure1: Assessment Criteria

<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 <b>customer</b> 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		2.5	0	2.5



	base for solutions to queries, where available
	PC7. resolve queries within your area of competence or authority in line with organizational guidelines and service level agreements (SLAs)
	PC8. obtain advice and guidance from appropriate people, where necessary
	PC9. obtain confirmation from customers that queries have been resolved to satisfaction

	15	0	15
	2.5	0	2.5
	10	0	10

of 13

	PC10. record the resolution of queries accurately using your organization's query management tool
	PC11. comply with relevant standards, policies, procedures and guidelines when dealing remotely with customer queries

	35	15	20
	7.5	0	7.5
	<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
	PC2. keep your immediate work area clean and tidy
	PC3. utilize your time effectively
	PC4. use resources correctly and efficiently
	PC5. treat confidential information correctly
	PC6. work in line with your organization's policies and procedures
	PC7. work within the limits of your job role
	PC8. obtain guidance from appropriate people, where necessary
	PC9. ensure your work meets the agreed requirements

	10	5	5
	5	0	5
	5	5	0
	5	2.5	2.5
	5	0	5
	2.5	0	2.5
	2.5	0	2.5
	2.5	0	2.5
	2.5	0	2.5
	2.5	0	2.5
	<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
	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority

	10	5	5
	5	0	5
	10	5	5

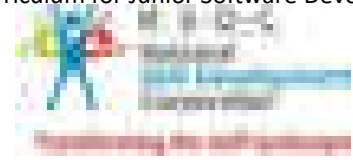


	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		5	0	5
	PC5. follow your organization’s emergency procedures promptly, calmly, and efficiently		5	0	5
	PC6. identify and recommend opportunities 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>

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Annexure2: Trainer Prerequisites for Job role: Junior Software Developer mapped to Qualification Pack: SSC/Q0508

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/Q0508.
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 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
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# Model Curriculum

## WEB DEVELOPER

### WEB DEVELOPER

SECTOR:	<b>IT-ITeS</b>
SUB-SECTOR:	<b>IT Services</b>
OCCUPATION:	<b>Application Development</b>
REFERENCE ID:	<b>SSC/Q0503, version 1.0</b>
NSQF LEVEL:	<b>5</b>





Format: ModCur\_2015\_1\_0

Model Curriculum for Web Developer SSC/Q0503

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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: -Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD	SSC/N0501	Refer to Unique Equipment Required Section



2	Analysis and Design of Web based Applications	20:00	30:00	Candidates will be able to: <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
				Requirements Specification (URS) with appropriate people <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
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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>• 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</li> </ul>		



				<p>base with their experiences of the media content and graphic designs developed</p> <ul style="list-style-type: none"> <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	<p>Candidates will be able to:</p> <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

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
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
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6	Managing and Health 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/ N 9003	
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</li> </ul>	SSC/N9005	Refer to Unique Equipment Required Section



				need for their job role • Identify accurately their current level of knowledge, skills and		
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				competence and any learning and development needs • Agree with appropriate people a plan of learning and development activities to address their learning needs • Undertake learning and development activities in line with their plan • Apply their new knowledge and skills in the workplace, under supervision • Obtain feedback from appropriate people on their knowledge and skills and how effectively they apply them • Review their knowledge, skills and competence regularly and take appropriate action		



	<p><b>Total Duration:</b> <u>109:00</u></p>	<p><u>291:00</u></p>	<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>For Domain NOSs:</p> <ul style="list-style-type: none"> <li>• NOS SSC/N0501: HTML5, Javascript, CSS, SQL, Web Builder, Word Press, Joomla and modelling tools such as 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>• White Board, Markers and Eraser</li> <li>• Projector with screen</li> <li>• Flip chart 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 ○Email ○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                             <ul style="list-style-type: none"> <li>✓ Handy Camera</li> </ul> </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 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>		

Grand Total Course Duration: **400 Hours 0 Minutes**

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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 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

<b>Assessment Criteria for Web Developer</b>	
<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
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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 Requirements Specification (BRS), Software	<b>100</b>	10	10	0

<b>content and graphic designs for software products and Applications)</b>	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
<b>3.SSC/N9001 (Manage their work to meet requirements)</b>	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
<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>	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	<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 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 who may be affected		10	0	10
	PC5. follow their organization's emergency		20	10	10





	procedures promptly, calmly, and efficiently				
	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	<b>100</b>	15	15	0
	PC2. obtain the data/information from reliable sources		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. carry out rule-based analysis of the data/information, if required		20	0	20
	PC6. insert the data/information into the agreed formats		10	0	10
	PC7. check the accuracy of their work, involving colleagues where required		10	0	10
	PC8. report any unresolved anomalies in the data/information to appropriate people		5	5	0
	PC9. provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time		5	0	5
		<b>Total</b>	100	30	70
<b>7.SSC/N9005 (Develop their knowledge, skills and competence)</b>	PC1. obtain advice and guidance from appropriate people to develop their knowledge, skills and competence	<b>100</b>	20	7	13
	PC2. identify accurately the knowledge and skills you need for their job role		14	7	7
	PC3. identify accurately their current level of knowledge, skills and competence and any 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. undertake learning and development activities in line with their plan		12	0	12



	PC6. apply their new knowledge and skills in the workplace, under supervision		12	0	12
	PC7. obtain feedback from appropriate people on their knowledge and skills and how effectively you apply them		7	0	7
	PC8. review their knowledge, skills and competence regularly and take appropriate action		14	7	7
		<b>Total</b>	100	21	79

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 Graduate 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

Republic of South Africa

REPUBLIC OF SOUTH AFRICA: NATIONAL

QUALIFICATION

### MODEL CURRICULUM

Implementation National Occupational Standards of  
National Qualification Framework: The Development of the Tourism/MSD/entry

Department of Education

Department of Basic Education

Department of Higher Education and Training

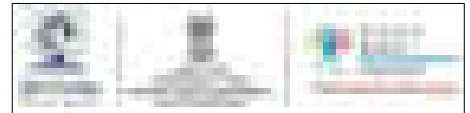
Department of Basic Education

Director-General

Department of Basic Education

www.education.gov.za

www.dbe.gov.za



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Fax: 91-11- 4151 9240

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# Model Curriculum

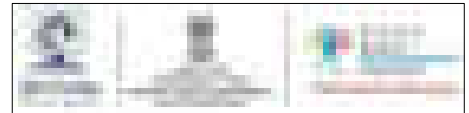
## Software Developer

SECTOR: IT-ITES

OCCUPATION: SUB-SECTOR: IT SERVICES DATA SCIENTISTS

REF. ID: SSC/Q0401, VERSION 1.0

NSQF LEVEL: 7





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# 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	<p><b>Application Development</b></p> <p><b>Theory Duration</b> (hh:mm) 20:00</p> <p><b>Practical Duration</b> (hh:mm) 80:00</p> <p><b>Corresponding NOS Code</b> SSC/N0502</p>	<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, 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
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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	<p><b>Self and work Management</b></p> <p><b>Theory Duration</b> (hh:mm) 12:00</p> <p><b>Practical Duration</b> (hh:mm) 38:00</p> <p><b>Corresponding NOS Code</b> SSC/N9001</p>	<p>Candidates will be able to:</p> <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>• 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>	Refer to Unique Equipment Required Section



5	<p><b>Team Work and Communication</b></p> <p><b>Theory Duration</b> (hh:mm) 12:00</p> <p><b>Practical Duration</b> (hh:mm) 38:00</p> <p><b>Corresponding NOS Code</b> SSC/N9002</p>	<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>	<p>Refer to Unique Equipment Required Section</p>
6	<p><b>Managing Health and Safety</b></p> <p><b>Theory Duration</b> (hh:mm) 05:00</p>	<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</li> </ul>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<p><b>Practical Duration</b> (hh:mm) 20:00</p> <p><b>Corresponding NOS Code</b> SSC/ N 9003</p>	<p>with safely, competently and within the limits of their authority</p> <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	<p><b>Data and Information Management</b></p> <p><b>Theory Duration</b> (hh:mm) 15:00</p> <p><b>Practical Duration</b> (hh:mm) 35:00</p> <p><b>Corresponding NOS Code</b> SSC/N9004</p>	<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> <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>	Refer to Unique Equipment Required Section
8	<p><b>Learning and Self Development</b></p> <p><b>Theory Duration</b> (hh:mm) 05:00</p> <p><b>Practical Duration</b> (hh:mm) 20:00</p> <p><b>Corresponding NOS Code</b> SSC/N9005</p>	<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 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
<b>Sr. No.</b>	<b>Module</b>	<b>Key Learning Outcomes</b>	<b>Equipment Required</b>
		<p>knowledge and skills and how effectively they apply them</p> <ul style="list-style-type: none"> <li>• Review their knowledge, skills and competence regularly and take appropriate action</li> </ul>	



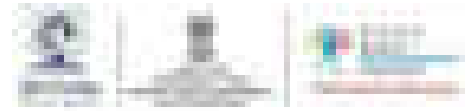
	<p><b>Total Duration</b></p> <p><b>Theory Duration</b> <b>109:00</b></p> <p><b>Practical Duration</b> <b>291:00</b></p>	<p><b>Unique Equipment Required:</b></p> <p>Training room should be fully furnished with the following equipment / tools / accessories. Additional / specific resources, wherever applicable (e.g. Hardware, software) are indicated in the main text corresponding to relevant learning outcome.</p> <p><b>For Domain NOSs:</b></p> <ul style="list-style-type: none"> <li>• For NOS SSC/N0501: C/C++, UML tools such as Rational suite •</li> <li>• For NOS SSC/N0502: JDK / Eclipse General:</li> <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>• Flip chart with markers</li> <li>• Faculty’s PC/Laptop with latest configuration and internet connection •</li> </ul> <p>Supporting software / applications for projecting audio, video, recording, • <b>Presentation Tools to support learning activities:</b></p> <ul style="list-style-type: none"> <li>o Intranet o Email o IMs</li> <li>o Learning management system 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 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>
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**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>

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> .



				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE 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. 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		30	0	30





	requirements defined in BRS/URS, SRS and HLD				
	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	0	15
	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	35	65
<b>2.SSC/N0502 (DEVELOP SOFTWARE CODE TO SPECIFICATION)</b>	PC1. 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	<b>100</b>	5	5	0
	PC2. access reusable components, code generation tools and unit testing tools from their organization's knowledge base		5	0	5
	PC3. convert technical specifications into code to meet the requirements, leveraging reusable components, where available		30	0	30
	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		5	0	5
	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
				5	5

		<b>MARKS ALLOCATION</b>			
<b>ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)</b>	<b>ASSESSMENT CRITERIA (PC)</b>	<b>TOTAL MARKS</b>	<b>OUT OF</b>	<b>THEORY</b>	<b>SKILLS PRACTICAL</b>
	PC10. submit tested 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 <b>resources</b> 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>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

				<b>MARKS ALLOCATION</b>	
<b>ASSESSMENT OUTCOME (NOS CODE AND</b>	<b>ASSESSMENT CRITERIA (PC)</b>	<b>TOTAL MARKS</b>	<b>OUT OF</b>	<b>THEORY</b>	<b>SKILLS PRACTICAL</b>



DESCRIPTION)					
<b>HEALTHY, SAFE AND SECURE WORKING ENVIRONMENT)</b>	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 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>		<b>100</b>	<b>30</b>
<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	<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 formats on time		6.25	0	6.25
	<b>Total</b>	<b>100</b>	<b>100</b>	<b>25</b>	<b>75</b>
<b>7.SSC/N9005 (DEVELOP THEIR KNOWLEDGE, SKILLS AND COMPETENCE)</b>	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

# Model Curriculum

## User Interface (UI) Developer

### User Interface (UI) Developer

SECTOR: IT-ITeS

SUB-SECTOR: IT Services

OCCUPATION: Application Development

REFERENCE ID: SSC/Q0502

NSQF LEVEL: 7



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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,</li> </ul>	SSC/N0501	Refer to Unique Equipment Required



				<p>SRS and HLD</p> <ul style="list-style-type: none"> <li>• review your designs with appropriate people</li> </ul>		
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Model Curriculum for **User Interface (UI) Developer**

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 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> <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/N0503	

Model Curriculum for **User Interface (UI) Developer**

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/N9001	
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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	<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 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/N9002	



6.	Maintain a healthy, safe and secure working environment	7:00	18:00	<p>Candidates will be able to:</p> <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/N9003	
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Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				~complete any health and safety records legibly and accurately		
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</li> </ul>	SSC/N9004	

Model Curriculum for **User Interface (UI) Developer**

				<p>data/information, if required</p> <ul style="list-style-type: none"> <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 upto-date data/information to the appropriate people in the required formats on time</li> </ul>	
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/N9005

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				~review your knowledge, skills and competence regularly and take appropriate action		



<p><b>Total Duration:</b></p>	<p><b><u>95:00</u></b></p>	<p><b><u>305:00</u></b></p>	<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</li> <li>• HTML 5, CSS, Java Script and SQL</li> <li>• IDEs such as Web Builder, Word Press, 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>• Flip chart 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 ○Email ○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                         <ul style="list-style-type: none"> <li>-Handy Camera</li> </ul> </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>
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Grand Total Course Duration: **400 Hours 0 Minutes**

Model Curriculum for **User Interface (UI) Developer**

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				↳Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.		

*(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.



**Annexure1: Assessment Criteria**

<b>Assessment Criteria for &lt;QP Name&gt;</b>	
<b>Job Role</b>	<b>User Interface (UI) Developer</b>
<b>Qualification Pack</b>	<b>SSC/Q0502</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> .

<b>Assessable Outcomes</b>	<b>Assessment criteria for the outcome</b>	<b>Total Mark</b>	<b>Out of</b>	<b>Theory</b>	<b>Skills Practical</b>
<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>	<b>100</b>	<b>35</b>

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<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	80
	<b>3. SSC/N0503 (Develop content graphical designs software for 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
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 actions 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		5	5	0	



	approval by appropriate people				
	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 requirements) meet</b>	PC1. establish and agree your <b>work requirements</b> with <b>appropriate people</b>	<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 <b>resources</b> 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 <b>appropriate people</b> , 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>100</b>	<b>25</b>	<b>75</b>
<b>5.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 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		10	0	10

Model Curriculum for **User Interface (UI) Developer**

	and procedures for working with colleagues				
		<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>	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 <b>emergency procedures</b> 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
<b>Assessable Outcomes</b>	<b>Assessment criteria for the outcome</b>	<b>Total Mark</b>	<b>Out of</b>	<b>Theory</b>	<b>Skills Practical</b>
<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>

**Annexure2: 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>	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.  The individual should be result oriented. The individual should also be able to demonstrate skills for communication, creative and logical thinking.
3	<b>Minimum Educational Qualifications</b>	Bachelor's Degree in Science/Technology/Computers or any graduate course
4a	<b>Domain Certification</b>	Minimum accepted score in SSC Assessment is 90% per NOS being taught in SSC/Q0502.

Model Curriculum for **User Interface (UI) Developer**

		Additional certification in computers/technology/ animation/graphics
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





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## 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	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>

\*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
<b>BCC060</b>	<b>HC</b>	<b>Experiments in Clinical Biochemistry and Molecular Biology** and Research Paper Presentation</b>	<b>0:0:4</b>	<b>4</b>
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
<b>BCD060</b>	<b>HC</b>	<b>Project Work OR Dissertation***</b>	<b>0:4:4</b>	<b>8*</b>
<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	<b>10</b>
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>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	<b>14</b>
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, alcaptonuria, methyl malonic Acidemia)	



<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>	<p>Extraction, Isolation, Purification and enzyme characterization. Determination of specific activity, optimum pH, temperature, time and energy of activation. Determination of <math>K_m</math> and <math>V_{max}</math>  Enzyme inhibition studies</p>	

## 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)
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- [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>
<b>BCA230</b>	<b>ENZYMOLGY</b>	<b>4</b>

**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

		<b>No. of Lectures</b>
<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.

Course Code	Title of the Course	Credits
BCA250	MICROBIAL BIOCHEMISTRY	4

**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

		No. of Lectures
<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	EXPERIMENTS IN IMMUNOLOGY AND BIOCHEMICAL ESTIMATIONS	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>	<p>Preparation of antigen adjuvant mixture, injection and raising antibodies in rat.  Purification of antibodies  Antibody titer and ELISA</p>	



## 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.
- [7] Immunology at a Glance: J.H.L. Playfare [ed.] Blackwell Science, (1987).
- [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, Cooper, Geoffrey, M., Oxford University Press, (2001)
- [2] Text Book of 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).
- [5] Human Biochemistry, Orten and Neuhans , 10th Edn. Mosbey International, (1983).
- [6] Human Physiology: The mechanisms of Body functions. A.J. Vander, et. Al.,(1985) McGraw-Hill.
- [7] Molecular Cell Biology, Baltimore et. al. (1995) Scientific American Publication.
- [8] Harper's Review of Biochemistry, Murray et. al., (1997) 24th Edn., Lange
- [9] Molecular Biology of Cell; Albertis *et. al.* (2002) Garland Science.
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- [11] Mammalian Biochemistry; White, Handler and Smith, McGraw-Hill, (1986).
- [12] Textbook of human Physiology by Guyton, 11th ed.Elesvier.
- [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

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- [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.
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- [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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- [5] Introduction to Pharmacopoeia CBS Publishers and Distributors 1991 edition
- [6] Essential of Clinical Research –Dr. Ravindra B. Ghooi and Sachin C. Itkar Nirali Prakashan 2010 edition
- [7] Basic Principle of Clinical Research and Methodology, Jaypee Brothers Medical Publishers (P) Ltd. 2009 ed.
- [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
- [10] Principles of Fermentation technology, Stanburry. P. Whitaker and S.J. Hall, 1995
- [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+ K+ 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**

- [1] The World of the cell by Becker, Kleinsmith and Harden Academic Internet Publishers; 5th edition (2006)
- [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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- [4] Medical Biochemistry (Paperback) by John W. Baynes and Marek Dominiczak. Publisher: Mosby.
- [5] Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Ed By Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James Shepherd. Publisher: Churchill Livingstone.
- [6] Review of Medical Physiology (Lange Basic Science) (Paperback) By William F. Ganong. Publisher: McGraw-Hill Medical
- [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
<b>BCC060</b>	<b>EXPERIMENTS IN CLINICAL BIOCHEMISTRY AND MOLECULAR BIOLOGY</b>	<b>4</b>

**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).
- [4] Hawk's Physiological Chemistry, ed. Oser, 14th Edn.(1976), Tata-McGrawHill.
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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

- [1] Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2nd Edition. Wiley 2006
- [2] Brown TA, Genomes, 3rd Edition. Garland Science 2006
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- [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).
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- [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.
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- [4] Daubenmier, R.F. (1970), Plant Communities, Wiley Eastern Private Limited
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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.

Course Code	Title of the Course	Credits
<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.