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-retrival 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, phylogentic analysis, predictive methods using nucleic acid and protein sequences, submitting DNA sequences to the databases.

Unit III **10 Hrs**

Innovation: Idea to enter into business, Designing and development of new products as per market demands and their future prospective. Needs of customer, branding, distribution, promotion and advertising.

Types of bio-industries and IPR: biopharma, bioagri and bioservices. IP protection & commercialization strategies- freedom to operate.

Accounting and Finance : Business plan preparation, contracts, partnerships, business feasibility analysis by SWOT, socio-economic costs benefit analysis; funds/support from Government agencies like MSME/banks and private agencies like venture capitalists:/angel investors for bio entrepreneurship; business plan proposal for virtual start up company. statutory and legal requirements for starting a company/venture; basics in accounting practices: concepts of balance sheet, profit and loss statement, Valuation, Cash flow, double entry. Information technology for business administration and expansion. Technology transfer.

Incubation centres: Govt. (C-CAMP, KBITS, CFTRI) and Private incubation centres for start-ups.

Unit IV **8 Hrs**

Marketing : Market conditions, segments, prediction of market changes; identifying needs of customers; Market linkages, branding issues; developing distribution channels - franchising; policies, promotion, advertising; branding and market linkages for virtual start-up company.

Business Strategy & HR: Entry and exit strategy; pricing strategy; negotiations with financiers, bankers, government and law enforcement authorities; dispute resolution skills; external environment/ changes; avoiding/managing crisis; broader vision–global thinking; mergers & acquisitions.

Regulatory understanding:- GLP, GMP, GCP, PCB, IBSC, ISO

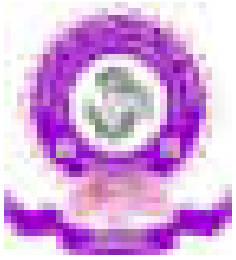
Bioentrepreneurship and case study: Importance of entrepreneurship; advantages of being entrepreneur - freedom to operate; introduction to bioentrepreneurship – biotechnology in a global scale; Scope in bioentrepreneurship; innovation – types, out of box thinking; skills for successful entrepreneur – creativity, leadership, managerial, team building, decision making, Risk assessment, opportunities for bioentrepreneurship- development programs of public and private agencies (MSME, DBT, BIRAC, Start-up & Make in India).

References:

1. Singh Narendra, Project management and control, (Himalaya publishing house)
2. Prasanna Chandra, Projects: Planning, Analysis, selection, implementation& review (Tata McGrow Hill)
3. P. GopalaKrishna& V.E. Rama Moorthy, Project management (Mac Millan India)
4. Chandra prasanna, proect preparation, Appraisal and Implementation (Tata Mcgrow Hill)
5. A. N. Desai, The dynamics of Entrepreneurial development and management (Himalaya publishing house)
6. Biostatistical Analysis. Zar J. H. Printice-Hall International.
7. Methods in Biostatistics. Mahajan, B. K. Smt. Hindu Mahajan

8. Bioinformatics. David W. Mount.
9. Bioinformatics A Practical Guide to the Analysis of Genes and Proteins Andreas D. Baxevanis and B. F. Francis Ouellette. A John Wiley & Sons, Inc., Publication.
10. Biostatistics. Daniel.
11. Handbook of Biostatistics A Review and Text. Christopher and Carvounis.

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
I Semester						
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
II Semester						
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
III Semester						
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

Paper Code	Paper	HC/SC/ EL/OE	Credits			
			L	T	P	Total
IV Semester						
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					04
						18

Semester	HC	SC	OE	Total
I Semester	14	4		18
II Semester	14	4		18
III Semester	13	5	04	22
IV Semester	04	14		18
Total	45	27	04	76

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 Orthogonalit **(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_v (x), Bessel differential equation, generating function for J_v (x), Integrals for J_o (x) and J_v (x), recurrence formulae for J_v (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. Chattopadhay 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 theorm **(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 η_{ij} = 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 monoatmic 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 $\mathbf{L}^2$ and L_z**.** Particle on a sphere and the rigid rotator. General angular momentum. The spectrum of $\mathbf{J}^2$ 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. Spectroscpic 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)** $^2D_{3/2} - {}^2P_{1/2}$ **2)** $^2D_{5/2} - {}^2P_{3/2}$ **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 Ediition, 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 X 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 × 4 hours × 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 × 4 hours × 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 × 4 hours × 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, α-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 crystl growth. Czochralski, Kyropoulus, 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. Phenomenalogical 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 μ 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 triflouride 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. Nordhiem'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 SpectralLines, 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. Papapetrov 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 γ-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 Pyrheliometer. **[16 hours]**

Materials and solar cell technology : Single, poly and amorphous silicon, GaAs, CdS, fabrication of single and polycrystalline silicon solar cells, amorphous silicon solar cells, photovoltaic systems and technical problems. Wind Energy Origin and classification of winds, Aerodynamics of windmill: Maximum power and Forces on the Blades and thrust on turbines; Wind data collection and field estimation of wind energy, Site selection, Basic components of wind mill, Types of wind mill, Wind energy farm, Hybrid wind energy systems: The present Indian Scenario. **[16 hours]**

Biomass energy and biogas technology: Nature of Biomass as a fuel, Biomass energy conversion processes, Direct combustion: heat of combustion, combustion with improved Chulha and cyclone furnace; Dry chemical conversion processes: pyrolysis, gasification, types of gasification. Importance of biogas technology, anaerobic decomposition of biodegradable materials, Factors affecting Bio-digestion, Types of biogas plants, Applications of biogas. **[16 hours]**

Tutorial **[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-Dushmann 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 × 4 hours × 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 × 4 hours × 16 weeks =**128 hours**

Reference: 1. Varier K. M., Antony Joseph and Pradyumman 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 × 4 hours × 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. Randomocity 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 × 4 hours × 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 × 4 hours × 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 depositon, chemical vapor depostion. Top- Down Approach; Ball milling, Microfabrification, 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 (ρ), general properties, multipole parameters, combined systems, Diagonalization of ρ. 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 ½ 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_A-N transition.
[De Gennes and Prost] **[16 hours]**

Dynamical properties of nematics: Experiments measuring the Leslie coefficients-Laminar flow under a strong orienting field, Attenuation of ultrasonic shear waves, Laminar flow in the absence of external fields. Convective instabilities under electric fieldsb - 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. Chandrashekhar 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), Leanard 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, Kisalaya Publications, 2000.
4. Lutgens F.K. and Tarbuk E.K., The atmosphere: An introduction to meteorology, Prentice Hall USA, 1986.
5. Holton, J.R., Dynamic meteorology, 3rd edition, Academic Press, USA, 1992.
6. Keshvamurthy R.N. and Shankar Rao M., The physics of monsoons, Allied Publishers, 1992.
7. Iqbal M., An introduction to solar radiation, Academic Press, USA, 1983.
8. Wilkening M., Radon in the environment, Elsevier Science Publishers, The Netherlands, 1990.
9. Israel H., Atmospheric electricity-Vol II, Israel Program for Scientific Translations, Jerusalem. 1973.

PHY-410: Numerical Methods

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. ChuW.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. Hautojarvi 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, Poincar´e 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 Poincar´e 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, 3rd 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(TI) 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-Dushmann 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 × 4 hours × 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 × 4 hours × 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 × 4 hours × 16 weeks = **64 hours**

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 2020-21

Name of the Course	**Course Code**	**Employability/ Skill development**	**Highlighted Syllabus**
Analytical Chemistry Practicals	CHA050 & CHB050	Skill development	1. Determination of total acidity of vinegar and wines. 2. Determination of purity of a commercial boric acid sample, and Na_2CO_3 content of washing soda. 3. Determination of the *p*H of hair shampoos. 4. Analysis of water/ waste water for acidity by visual, *p*H metric and conductometric titrations. 5. Determination of ammonia in house-hold cleaners by visual and conductometric titration. 6. Spectrophotometric determination of creatinine and phosphorus in urine. 7. Flame emission spectrometric determination of sodium, potassium and calcium in river/ lake water. 8. Mercurimetric determination of chloride in blood or urine. 9. Determination of total hardness, calcium and magnesium hardness and carbonate and bicarbonate hardness of water. 10. Determination of calcium in calcium gluconate/ calcium carbonate tablets/ injections and of calcium in milk powder.
Inorganic Chemistry Practicals	CHA060 & CHB060	Skill development	1. Determination of iron in haematite ore. 2. Estimation of calcium and magnesium carbonates in dolomite ore. 3. Determination of manganese dioxide in pyrolusite ore. 4. analysis of copper-nickel in alloy/mixture. 5. Gravimetric analysis of molybdenum with 8-hydroxyquinoline. 6. Spectrophotometric determinations of complexes. 7. Semimicro qualitative analysis of inorganic mixtures.
Organic Chemistry Practicals	CHA070 & CHB070	Skill development	1. Preparation *p*-bromoaniline from acetanilide**.** 2. Preparation of *n*-butyl bromide from *n*-butyl alcohol. 3. Oxidation of cyclohexanol to adipic acid. 4. Esterification: Preparation of benzoccaine from

			p-nitrotoluene. 5. Diazotization (Sandmeyer's reaction). 6. Preparation benzilic acid from benzoin. 7. Preparation of *o*-hydroxy benzophenone from phenyl benzoate *via* Fries rearrangement. 8. Preparation of benzanilide from benzophenone oxime *via* Beckmann rearrangement. 9. Preparation of benzoic acid from benzaldehyde (Cannizzaro Reaction). 10. Preparation of chalcone. 11. Separation of binary mixtures, identification of functional groups and preparation of suitable solid derivatives.
Physical Chemistry Practicals	CHA080 & CHB080	Skill development	1. Study of kinetics of hydrolysis of methyl acetate in presence of two different concentrations of HCl/H_2SO_4 and report the relative catalytic strength. 2. Determination of partial molar volumeof salt-water system. 3. Determination of heat of solution of organic acid (benzoic acid/salicylic acid) by variable temperature method. 4. Analysis of a binary mixture (Gylcerol & Water) by measurement of refractive index. 5. Determination of the molecular weight of a polymer material by viscosity measurements. 6. Conductometric titration of a mixture of HCl and CH_3COOH against NaOH. 7. Potentiometric titration of KI *vs* $KMnO_4$ solution.
Analytical Chemistry Practicals	CHC210 & CHD210	Skill development	1. Determination of calcium in limestone. 2. Determination of vitamin C in orange juice. 3. Determination of saccharin in tablets. 4. Determination of iron in mustard seeds and phosphorus in peas by spectrophotometry. 5. Determination of ethanol in wine. 6. Analyses of waste waters for DO and COD by titrimetry. 7. Analysis of a ground water sample for sulphate by titrimetry (EDTA) and turbidimetry. 8. Determination of aspirin, phenacetin and caffeine in mixture and APC tablets. 9. Ascorbic acid determination in natural orange juice by coulometry. 10. Determination of fluoride in drinking water/ground water by spectrophotometry. 11. Analysis of a soil Urine, Blood samples.
Inorganic Chemistry Practicals	CHC220 & CHD220	Skill development	1. Determination of bismuth, cadmium and lead in a mixture. 2. Spectrophotometric determination of chromium and manganese in a steel solution.

			3. Flame photometric determination of the metal ions. 4. Determination of iron as the 8-hydroxyquinolate by solvent extraction method. 5. Preparation and characterization of metal complexes. 6. Determination of the composition of iron-phenanthroline complexes.
Organic Chemistry Practicals	CHC230 & CHD230	Skill development	1. Fractional crystallization: separation of mixture of naphthalene and biphenyl. 2. Thin layer chromatography: Separation of plant pigments. 3. Column chromatography: Separation of *o*- and *p*-nitro aniline 4. Isolation of piperine from pepper. 5. Isolation of caffeine from tea. 6. Isolation of azelaic acid from castor oil. 7. Isolation of carotene from carrot. 8. Isolation of lycopene from tomato. 9. Isolation of cincole from eucalyptus leaves. 10. Estimation of ketones by haloform reaction. 11. Estimation of sugars by Bertrand's method. 12. Estimation of nitro groups, Estimation of amino group. 13. Determination of enol content by Meyer's method. 14. Determination of iodine value of an oil or fat. 15. Determination of saponification value of oil. 16. Determination of equivalent weight of carboxylic acid by silver salt method.
Physical Chemistry Practicals	CHC240 & CHD240	Skill development	1. Study of kinetics of autocatalytic reaction. 2. Kinetics of saponification of ethyl acetate. 3. Spectrophotometric kinetics of oxidation. 4. Study the phase diagram of three component system. 5. Conductometric titrations. 6. Potentiometric titrations. 7. Spectrophotometric analysis
Inorganic Chemistry-I	CHA100	Employability	Molecular symmetry and group theory The Point Groups Used with Molecules Representation of groups Applications of group theory Symmetry in Chemical bonding
Spectroscopy	CHC 020	Employability	NMR Spectroscopy Multiple resonance spectroscopy Electron Spin Resonance Spectroscopy NQR Spectroscopy Mössbauer spectroscopy Photoelectron Spectroscopy IR spectroscopy Mass Spectrometry

MASTER OF SOCIAL WORK

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 2020-21 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

Sl. No.	Course Type	Credits
1	HARD CORE (HC)	52
2	SOFT CORE (SC)	20
3	OPEN ELECTIVE (OE)	04
	TOTAL	76

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
		Total		**18**

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 /	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
			Total	**18**

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	Gerentological Social Work / Social Work Practice with Children/Society and Social Work	4:0:0	4
			Total	**19**

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
			Total	**21**

Note: In a Semester for only one Soft Core Course, there can be two choices.

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.

REFERENCES

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15. PRIA b — Training of Trainers: A Manual for Participatory Training Methodology in Development, New Delhi: Society for Participatory Research in Asia.

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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 col1ecting 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.

REFERENCES

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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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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; polices, 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.

REFERENCES

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12. Pareek, Udai and Rao, T. V. 1982	Designing and Managing Human Resources, New Delhi, Oxford & IBH.
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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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 industria1ization 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. Previsions) 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 settingunder collective bargaining, conflict-choice model of negotiation, Behavioral Theory of Labor Negotiation, Collective Bargaining in India, Collective bargaining in practice, levels of bargaining, coverage and duration of agreements,administration of agreements, negotiating a contract, the negotiation process, effective negotiation, negotiation and collective bargaining, post negotiation – Administration of the agreement.

Employee relations in knowledge based industry - Concepts of self-managed teams (SMT) - Changing employee/ employer and trade union relationship. Current rules of Taxation of Salaries.

Labor Welfare Officer - Duties and functions; Social Work in Industry.

REFERENCES

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2. Arora, M, 2005 — Industrial Relations, New Delhi, Excell Books.

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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.

REFERENCES:

1. Bajpai, P. K. (Ed.) 1998 — Social Work Perspectives on Health, Jaipur, Rawat Publications.

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.

3. Butrym, Zofia and Horder, John. 1983 — Health, Doctors and Social Workers, London: Routledge and Kegan Paul.

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Medicine, New Delhi, Oxford and LB.H. Publishing Company,

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18. UNICEF — Health and Basic Services, New Delhi, UNICEF South Central Asia Regional Office.

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.

REFERENCES

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26. National Mental Health Programme for India

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 femilar 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.

REFERENCES

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6. Jayagopal, R. 1990 — Human Resource Development: Conceptual Analysis and Strategies, New Delhi: Sterling Publishers Pvt. Ltd.

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11. Rao, T. V. 1990 — HRD Missionary, New Delhi. Oxford & IBH.

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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

1st and 3rd semester Changes made at BOS meeting held on 13.01.2022 (in %)
HC 1.3 Systematics of Angiosperms (5.17%)
HC 3.3 Plant Biotechnology (40.22%)
SC 3.3 Plant Propagation and Plant Breeding (1.7%)
OE 3.1 Plant Propagation Techniques (1.35%)
(CHANGES MADE ARE HIGHLIGHTED IN THE TEXT)

FIRST SEMESTER				**Credits: 22**
No.	**Course/Paper Code**	**Title of the Course/ Paper**	**Hrs/Week L:T:P**	**Credits**
1	**HARD CORE 1.1**	**Virology, Bacteriology, Mycology and Plant Pathology**	**2:2:2**	2:1:1
2	**HARD CORE 1.2**	**Phycology, Bryophytes, Pteridophytes and Gymnosperms**	**2:2:2**	2:1:1
3	**HARD CORE 1.3**	**Systematics of Angiosperms**	**2:2:2**	2:1:1+ (2 credits for submission of tour report) 2:1:3
4	**SOFT CORE 1.1****	**Fungal Biology and Biotechnology**	**2:2:2**	2:1:1
5	**SOFT CORE 1.2****	**Algal Biology and Biotechnology**	**2:2:2**	2:1:1
6	**SOFT CORE 1.3****	**Lichenology and Mycorrhizal Technology**	**2:2:2**	2:1:1
7	**SOFT CORE 1.4****	**Phytopathology**	**2:2:2**	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.

SECOND SEMESTER				Credits: 18
No.	**Course/Paper Code**	**Title of the Course / Paper**	**Hrs/Week L:T:P**	**Credits**
1	**HARD CORE 2.1**	**Reproductive Biology of Angiosperms and Plant Morphogenesis**	**2:2:2**	2:1:1
2	**HARD CORE 2.2**	**Cell Biology and Genetics**	**2:2:2**	2:1:1
3	**HARD CORE 2.3**	**Plant Breeding and Evolutionary Biology**	**2:2:2**	2:1:1
4	**SOFT CORE 2.1***	**Plant Anatomy and Histochemistry**	**2:0:2**	2:0:1
5	**SOFT CORE 2.2***	**Ethno-Botany and Intellectual Property Rights (IPR)**	**2:0:2**	2:0:1
6	**SOFT CORE 2.3***	**Economic Botany**	**2:0:2**	2:0:1
7	**OPEN ELECTIVE 2.1**	**Medicinal Plants**	**2:2:0**	2:1:0
	** 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
	* Any one soft core 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
6	**OPEN ELECTIVE 4.1**	**Plant Diversity and Human Welfare**	**2:2:0**	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.			

Semester- Wise Credit Pattern:
I Semester= 22 [HC- 12+2=14 + 08 (SC)]
II Semester= 24 [HC- 12 + 08 (SC) + 04 (OE)]
III Semester= 18 (HC- 08 + 06 (SC) + 04 (OE)]
IV Semester= 20 (HC-12 +04 (SC) + 04 (OE)]

In total= 46 HC + 26 (SC) + 12 (OE)= The Department is offering 84 Credits of B.Sc. Honors/ M.Sc. Botany (CBCS) Course including three Open Elective Course to the outside Department Students/

Important Note:
Student is required to earn the credit for qualifying B.Sc. Honors/ M.Sc. Botany from Department of Botany as follows:

Hard Core offered by the Department= 46 (Against maximum of 56)
Soft Core offered by the Department = 26 (Against minimum of 16)
Minimum Open Elective to be earned by the Student (Outside the Department) = 04
A total of 76 Credit is required for qualifying B.Sc. Honors/ M.Sc. Botany Course.

SCHEME OF EXAMINATION/ASSESSMENT
MODEL QUESTION PAPER (THEORY)
JSS COLLEGE FOR ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS) OOTY ROAD, MYSURU- 25

POST GRADUATE DEPARTMENT OF BOTANY

M.Sc., Degree ------Semester Examination May/June-20--
BOTANY
Course/Paper: ……
Course/Paper Code……..

Time: 3 Hrs **Max Marks: 70**

Instructions: 1) Answer all questions.
2) Draw neat and labelled diagrams wherever necessary.

I. Answer the following; (10MCQs of 1 Marks each) **10 X 1 = 10**
2 from Unit I
3 from Unit II
2 from Unit III
3 from Unit IV

II. Answer the following; **4 X 5 = 20**
2 from Unit I with internal choice
2 from Unit II with internal choice
2 from Unit III with internal choice
2 from Unit IV with internal choice

III. Answer the following; **4 X10 = 40**
2 from Unit I with internal choice
2 from Unit II with internal choice
2 from Unit III with internal choice
2 from Unit IV with internal choice

SCHEME OF PRACTICAL EXAMINATION/ASSESSMENT
MODEL QUESTION PAPER (PRACTICALS)

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

POST GRADUATE DEPARTMENT OF BOTANY

M.Sc., Degree I Semester Examination May/June-2018
BOTANY
Course/Paper: ……
Course/Paper Code……..

Time: 3 Hrs **Max Marks: 70**

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

Sl. No.	PO
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

Sl. No.	COURSE	PSO
1.	Algal Biology and Biotechnology	Phylogeny, thallus organisation, economic and ecological importance of alagal 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

Sl. No.	COURSE	CO
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, programed 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 megasporogeneis, 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 Sytematic Bacteriology; C. R. Woese- Three domain classification of Bacteria; Archaebacteria 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.

References

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2) Willey, J, Sherwood, L. and Woolverton, C.J. 2013. Prescott`s Microbilogy 9th edn. Mc Graw- Hill Educations.
3) Wagner, E.K, and Hewlett, M.J. 2009. Basic Virology. Blackwell Science Ltd. 2nd edn. USA.
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5) Conrat, F.H., Kimball, P.C. and Jay, L. 1988.V irology. Prentice Hall, Englewood Chiff, New Jercy.
6) Jawaid, A. Khan and Jeanne Dijkstra. 2002. Plant Viruses as Molecular Pathogens. Food Products Press, NY
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11) Mehrotra, R. S. 2003. Plant Pathology. 2nd edn. Tata Mc Graw-Hill Pub. Co. Ltd., New Delhi.
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13) Flint, S.J. Enaquist, L.W., Rancnicllo, V. R. and Skalka, A.M. 2009. Principles of Virology pathogenesis and control. 3rd edn. APS Press, USA.
14) Hall, R. 2014. Plant Virology, 5th edn. Elsevier, USA.
15) Aneja, K.R. 2003. Experiments in Microbiology plant Pathology and Biotechnology, 4th edn. New Age International Publishers, New Delhi.
16) Holt, J.G., Krige, N.R., Sneath., P.H.A. Stuley, J.T. and Williams, S.T. 2010. Bergey`s Manual of Determinative Bacteriology, 9th edn. Williams and Wilkins, USA.

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; Stelar 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 Pteriodophytes).

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, Botanico-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, Nympheaceae, 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 analysisrooted and unrooted trees; Data analysis- alignment, substitution, model building; Phylogentic 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.

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BOTANY: I SEMESTER - SOFT CORE 1.1
FUNGAL BIOLOGY AND BIOTECHNOLOGY

Theory-32 Hrs

Unit-1: Introduction and historical overview of mycology; General characteristics and importance of fungi in human life; Fungi –Taxonomy and Systematics; Fungi in genetic and applied research; Estimation of Fungal diversity; Quantitative Indices- species richness, species evenness and species abundance; Molecular methods used for fungal diversity estimation-nuclear genome, messenger RNA transcripts, Ribosomal/DNA sequence comparisons and mitochondrial genome.

Unit-2: Macro fungi and micro fungi living on plant substrata; Lignicolous macrofungi; Lichenized fungi; Sequestrate fungi; Endophytic fungi; Saprobic soil fungi; Fungi in stressful environment; Mutualistic, arbuscular, and endomycorrhizal fungi; Yeasts; Fungicolous fungi; Fungi in fresh and marine water habitats; Fungi associated with aquatic animals; Fungi as parasites of humans and plants; Fungi associated with animals, insect, arthropod and nematodes; Coprophilous fungi.

Unit-3: Fungal Fermentation and Food Products: Food and Beverages; Single cell proteins-Myco-proteins; Food processing by fungi-bread, soybean products, cheese and fermented milk; Fungal secondary metabolites-antibiotics, immunosuppressive agents, anti-tumour agents, fungal toxins as medicines; Fungal pigments; Steroid transformation; Fungal enzymes; Bio-control agents; Application of molecular biology in fungal biotechnology.

Unit-4: Mushrooms and fungi in medicine; Toxic macromycetes; Mushroom cultivation; Model organisms- *Saccharomyces cerevisiae*/*Neurospora crassa*; Bio-deterioration of food grains and mycotoxins; Fungal communities of herbivore dung; The fungal communities of composts; Fungal interactions and practical exploitation; Heavy metals in fungi-accumulation and sorption; Biotechnology of wood rotting fungi.

Practicals-32 Hrs

1) Study of Myxomycetes and Chytridiomycetes
2) Study of Plasmodiophoromycetes and Oomycetes
3) Study of Zygomycetes
4) Study of Ascomycetes
5) Study of Basidiomycetes
6) Study of Deuteromycetes 7)Study of Lichens
8) Study of VAM fungi
9) Detection of aflatoxin B1
10) Cultivation of Oyster mushroom.
11) Alcoholic fermentation of grape juice by *Saccharomyces*.
12) Cultivation of *Penicillium* and testing antibiotic principle.
13) Study of edible and poisonous mushrooms.
14) Study of fungal model organisms - *Saccharomyces cerevisiae*/*Neurospora crassa*

References:

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BOTANY: I SEMESTER - SOFT CORE 1.2
ALGAL BIOLOGY AND BIOTECHNOLOGY

Theory-32 Hrs

Unit-1:Algal Biology: Historical development of Phycology and contributions of Phycologists; Thallus organization in algae-Cyanophyceae, Chlorophyceae, Charophyceae, Euglenophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae; General characteristics, algal classification, affinities and phylogeny- polyphasic approach; Molecular markers for phylogenetic study; Algal physiology- ultra-structure of cells; Photosynthesis and respiration.

Unit-2: Algal blooms and Toxins: Blooms produced by algal groups; Toxins produced by cyanobacteria, diatoms, dinoflagellates, prymnesiophytes and eugleoids; bioaccumulation and biomagnification; effects of toxins on aquatic life and humans; Scenario in coastal waters of India- monitoring and safety measures; Algal communities of extreme environments- Thermal hot springs, cold springs, snow and ice; **Fresh water algae**-Ecological classification of fresh water organisms; Lentic communities of algae (pond, lake, bog, swamp); Lotic communities (streams, rivers, rapids; **Marine algae-** Marine biota; zonation; quantitative study of phytoplanktons, marine communities of algae.

Unit-3: Algal Biotechnology: Algal culture techniques; general principles; physical parameters; culture media; strain improvement; **Algal cultivation methods-**conventional, advanced; **Cultivation of microalgae-*Spirulina*** and ***Dunaliella***; Media, seeding, cultivation systems, harvesting; processing, drying methods, packaging, marketing; Algal cultivation and production in India; **Cultivation of macroalgae- *Porphyra;*** Nutritional value; importance of life cycle; methods of cultivation in advanced countries; Pillar, semi raft floating and open sea cultivation.

Unit-4: Applications of algae/products: Pollution indicators, treatment of waste water plants, heavy metal toxicity and phyco-remediation; Bio-fouling and biofuel production; Algal products as sources of nutraceuticals; Food colorants; Aquaculture feed; Therapeutics and cosmetics; Medicines; Dietary fibres from algae and uses; Biotechnological applications of algal silica and oils.

Practicals-32 Hrs

1) Study of fresh water planktonic forms in the lake samples.
2) Study of fresh water diatoms.
3) Chlorophyceae: *Ulva, Caulerpa, Halimeda, Acetabularia.*
4) Xanthophyceae: Mounting of *Botrydium* from soils.
5) Phaeophyceae: *Dictyota, Sargassum, Cystophyllum.*
6) Rhodophyceae: *Gracilaria, Gelidium.*
7) Cyanophyceae: *Microcystis*, *Nostoc, Spirulina.*
8) Estimation of carotene content in algal cells .
9) Culturing of microalgae: *Spirulina/ Chlorella/Scenedesmus/Dunaliella.*
10) Applications of algal products: Agar, spirulina tablets/powder, beta-carotene, phycobiliproteins, triglycerides, Mycosporine like amino acids (MAA), diatom silica as nanoparticles.
11) Visit to National Institute of Oceanography, Goa.
12) Study of algal herbaria.

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5) Murthy, A.V.S.S. 2005. A text book of algae. I.K. International Pvt., Ltd., New Delhi.
6) Odum, E. P. Fundamentals of Ecology. 3rd edn. Toppan Co., Ltd., Japan.
7) Round , F. E. 1973. Biology of the algae. Edward Arnold Ltd., London.
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11) Chu, W. 2012. Biotechnological Applications of Microalgae. IeJSME 6(1): S24-S37.

BOTANY: I SEMESTER - SOFT CORE 1.3
LICHENOLOGY AND MYCORRHIZAL TECHNOLOGY

Theory-32 Hrs

Unit-1: Introduction: Photobionts- identification, reproduction, and taxonomy of photobionts; Occurrence within lichens; Mycobionts- Lichenized versus nonlichenized fungi; Bryophilous and folicolous lichens; Thallus morphology and anatomy; Growth forms - crustose lichens, foliose lichens, fruticose lichens; Vegetative structures- Homoiomerous thallus, stratified thallus, cortex, epicortex, and epinecral layer, photobiont layer and medulla, lower cortex, Attachment organs and appendages; Cyphellae and pseudocyphellae; Cephalodia (Photosymbiodemes); Reproductive structures- sexual reproduction in lichen-forming ascomycetes; Mating systems, dikaryon formation, Ascomal ontogeny, Ascosporogenesis; 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; Phoshate solubilisation; Ecological significance of AM fungi; Importance of mycorrhiza in evolution of land plants; Role of mycorrhiza in agriculture, horticulture and forestry.

Practicals-32 Hrs

1-3) Survey of lichen vegetation in the study area: Frequency, density and abundance.
4) Determination of species richness and species diversity.
5) Isolation and maintenance of cyanobionts and phycobionts
6) Isolation and maintenance of mycobionts

7) Analysis of secondary metabolites of lichens.
8) Biological activity of secondary metabolites of the lichens.
9) Culture methods for lichens and lichen symbionts.
10) Root clearing and staining technique to study arbuscular mycorrhizal fungi.
11) Assessment of % root colonization of arbuscular mycorrhizal fungi.
12) Isolation and identification of arbuscular mycorrhizal fungi.

References:

1) Thomas H. Nash , 2008. Lichen Biology, 3rd edn. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK
2) Awasthi D.D. 2000. Lichenology in Indian subcontinent: A supplement to "A hand book of lichens". Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.
3) Awasthi D. D. 2013). A hand book of lichens , Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.
4) Sally E. Smith and David J. Read (2008). Mycorrhizal Symbiosis. 3rd edn. Academic Press, New York.
5) Larry Peterson R., Hugues B. Massicotte, Lewis H. Melville, 2004. Mycorrhizas: Anatomy and Cell Biology, CAB International, UK.

BOTANY: I- SEMESTER - SOFT CORE 1.4
PHYTOPATHOLOGY

Theory-32 Hrs

Unit-1: Concept of plant disease, Economic aspects of plant diseases; Types of plant diseases- Infectious diseases and non-infectious diseases; Causative agents of plant diseases; Angiospermic parasites; Development of plant pathology; Plant pathology in practice- Plant Clinic and Plant Doctor Concept; Parasitism and pathogenicity; Disease triangle; Infections and colonization; Weapons of plant pathogens; Effect of pathogen on physiology of host plant (photosynthesis, translocation and transpiration, respiration, permeability, transcription and translation).

Unit-2: Defence mechanisms in Plants- Pre-existing structural and chemical defences, induced structural and biochemical defences; Plant disease epidemiology- Elements of an epidemic and development of epidemics; Plant Disease forecasting; Genes and Diseases, Gene for gene concept, non-host resistance; Types of plant resistance to pathogens (Horizontal and Vertical Resistance); 'R' Genes and 'avr' genes; Genetics of virulence in pathogens and resistance in host plants; Breeding for disease resistance.

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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; Potao Spindle Tuber Disease (PSTVd)
10) Study of effect of pathogens on seed germination and vigour index.
11) Study of effect of fungicide on seed-borne pathogens.
12) Study of Fungal bio-control agents.

References:

1) Agrios, G. N. 2005. Plant Pathology 5th edn. Academic Press, San Diego.
2) Dickinson, M. 2003. Molecular Plant Pathology, Garland Publishing Inc, CT.
3) Ingram,D.S. and Robertson, N.F. 1999. Plant Diseases, Collins Publishers, London.

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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, ruminate 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, pleuripotency, 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 meresteme 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, Grevellia 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.
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Chasan, R. 1994. Tracing tracheary element development. The Plant Cell 6:917-919.
11) Lyndon, R. F. 1990. Plant Development : The Cellular basis. Unwin Hyman, London.
12) Aloni, R. 1987. Differentiation of vascular tissues. Annu. Rev. Plant Physiol. 38:179- 219.
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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; C**oncept 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.
6) Snustad, D.P., Simmons, M.J. and Jenkins, J.R. 1997. Principles of Genetics. Hohn Wiley & son's inc. New York.
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9) Strickberger, Monroe W. 2000. Evolution. 3rd Edn. Jones & Bartlett Publishers, Inc. 40 Tall PineDrive 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, NewYork NY f 0016, USA.
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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- g**ene 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.

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3) 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.
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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 anamalous secondary growth in the following examples: Stem of *Aristolochia*, *Nyctanthes, Pyrostegia, Peperomia, Tinospora, Achyranthes*.
4) Study of Ecological anatomy.
5) Study of Vasculature in floral organs.
6) Studying double staining technique.
7-11) Embedding: TBA method, embedding for electron microscope, Sectioning**,** Microtomes, whole mounts maceration.
12) Histochemical- PAS Test**,** Sudan black- lipids**,** Feulgen reaction – Nucleic acids.

References:

1) Abraham, F. 1982. Plant Anatomy. 3rd edn. Pergaon Press. Oxford.
2) Cariquist, S. 1967. Comparative Plant Anatomy- Holt Reinert and Winston, New York.
3) Cutter, D. G. 1971. Plant Anatomy- Part 1, Cell and Tissues Edward Arnold London.
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5) Eames and McDaniel, 1947. Plant Anatomy. 2nd edn., McGraw Hill, New York.
6) Esau, K. 1965, Plant Anatomy, Joh Wiley and Sons, New York.
7) James, D. Mauseth, 1998. Plant anatomy The Benzamin/ Cummins Publishing Co.Inc.
8) Esau, K. 1979, Anatomy of seed plants- first Wiley eastern reprint. New Delhi.
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: II SEMESTER- OPEN ELECTIVE 2.1
MEDICINAL PLANTS

Theory-32 Hrs

Unit-1: Medicinal Plants: History, scope and importance of medicinal plants; Indigenous medicinal sciences; History, origin, panchamahabhutas, saptadhatu and tridosha concept, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e-tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit-2: Medicinal Plants Conservation: Conservation of endangered and endemic medicinal plants; Endemic and endangered medicinal plants; Red list criteria; *In-situ* conservation-biosphere reserves, sacred groves, national parks; *Ex situ* conservation- botanic gardens, ethno medicinal plant gardens; Propagation of medicinal plants - objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit - 3: Funding for Cultivation of Medicinal Plants: Sources of financial aids for medicinal plant cultivation: Aims and objectives, Functions and activities of the board, Schemes and Projects for Financial assistance, Funding of projects; Procedure for processing project proposal for approval, Implementation and monitoring.

Unit- 4: Ethno botany and Folk medicines: Definition; Ethno botany in India: Methods to study ethno botany; Applications of Ethno botany: National interacts. Ethno medicine. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases. Brief introduction to poisonous plants.

References:

1) Trivedi, P. C. 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2) Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn.
3) Agrobios, India.
4) Yoganarasimhan, S.N. Medicinal Plants of India- Vol 1- Karnataka, Interline Publishing Pvt. Ltd.

BOTANY: III- SEMESTER - HARD CORE 3.1
BIOCHEMISTRY AND PLANT PHYSIOLOGY

Theory -32 Hrs

Unit-1: Biochemistry- Brief account of plant structural and functional molecules- carbohydrates, proteins, lipids and nucleic acids**;** classification, structural and functional properties of bio molecules; Biochemistry of cell membranes; **Lipids-**building and storage molecules, classification and significance; **Proteins-** classification, structure- primary, secondary, tertiary and quaternary structure; properties of proteins; **Enzymes**- Nomenclature, nature and properties of enzymes, active sites, co-enzymes, kinetics of enzyme action, catalysis, specificity and inhibition, allosteric enzymes, ribozyme and abzyme.

Unit-2:Solute transport: Transport of solutes across the membranes Transmembrane proteins, Transport of ions, solutes and macro-molecules, Mechanism of translocations in phloem; Role played in signal transduction pathway stomatal physiology; **Phytosynthesis in higher plants** (i) Photophosphorylation - Calvin cycle; **Photorespiration** - C4 – Pathway, CAM in plants; Oxidative Phosphorylations; Glycolysis -TCA – Cycle and terminal oxidation.

Unit-3: Plant Hormones- plant hormones-discovery, biosynthesis, metabolism, transport and physiological effects of plant hormones and their applications; **Nitrogen metabolism** -(i) Molecular mechanism of N2 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 (Q10) of water uptake
7) Separation of chlorophyll pigments/Anthocyanin by TLC
8) Protein analysis by SDS PAGE method.
9) Estimation of Alpha-amylase activity in germinating seedling.
10) Silver staining of proteins.
11-12) Visit to Molecular Biology Laboratories.

References:

1) Barkla, B.J., and Pantajo, O. 1996. Physiology of ion transport across the tonoplast of higher plants. Ann. Rev. Plant Physiol. 47: 159-184.
2) Clayton, R.K. 1980. Photosynthesis: Physical mechanisms and chemical patterns. Cambridge Uni. Press, Cambridge.
3) Cohn, E.E., and Stumf, P.K. 1992. Outlines of Biochemistry. Wiley Eastern Pvt. Ltd.
4) Kozaki, A., and Takeba, G. 1996. Photorespiration protects C3 plants from

photooxidation. Nature 384: 557- 560.
5) Taiz, L., and Zeiger, E. 1998. Plant Physiology. Sinaur Associates Inc. Publishers, Sunderland Massachusetts.
6) Mukherji, S., and GHosh, A.K. 1996. Plant Physiology. New Central Book Agency Pvt. Ltd. Kolkatta, India.
7) Rabinowithc, E., and Jee, G. 1969. Photosynthesis. Willey Press, New York.
8) Rudier, W., and Thummlar, K. 1994. The Phytochrome, Chromophore I. Photomorphogenesis in Plants, II Edition, Netherlands, 51-69.
9) Spanswick, R.M. 1981. Electrogenic ion pumps. Ann. Rev. Plant Physiol. 32: 267-289.
10) Mc Elroy, W.D. 1995. Cell Physiology and Biochemistry. Prantice Hall of India.
11) Walsh, C.T. 1979. Enzymatic reaction mechanisms. Editors: W.H. Freeman, New York.
12) Webb, E. 1984. Enzyme nomenclature. Academic Press, Orlando Fla.
13) Zimmermann, M.H., and Milburn, J.A. Transport in Plants. 1. Phloem transport (Encyclopedia of Plant Physiology. New Series Vol. 1), Springer, New York.
14) Devline and Witham, 1986. Plant Physiology. CBS Publs. and Distributors, New Delhi.
15) Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons. Inc., NewYork, USA.
16) Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer Verlag, New York, USA.
17) Singhal *et al*. 1999. Concepts in Photobiology, Photosynthesis and Phytomorphognesis, Narosa Pub. House, New Delhi.

BOTANY: III- SEMESTER - HARD CORE 3.2
MOLECULAR BIOLOGY

Theory-32 Hrs

Unit-1: Organization of chromosomes and genes in prokaryotes and eukaryotes - Operon, interrupted genes, gene families, unique and repetitive DNA, heterochromatin, euchromatin, transposons, mitochondrial and chloroplast genome organization, Transposable elements in prokaryotes and eukaryotes, genetic and evolutionary significance, **DNA replication**- patterns, Messelson and Stahl's and Taylor's experiment, enzymes of replication, mechanism of DNA replication in prokaryotes and Eukaryotes, proof reading and error correction mechanisms.

Unit-2: Molecular mechanism of mutation, repair and recombination:- Mutation-DNA damage by spontaneous mutations, physical and chemical mutagens and their molecular mechanisms, **Repair mechanisms**- direct reversal of damage, base and excision repair, recombinational repair, SOS repair, translation repair synthesis, transcription coupled repair, **Recombination**- homologous recombination, models of recombination, mechanisms, protein machinery of homologous recombination, genetic consequence of homologous recombination, gene conversion, site specific recombination, mechanism and biological significance, non homologous recombination- transposition, molecular mechanisms of transposition- conservative, replicative and retro-transposition.

Unit-3: RNA synthesis, processing and translation: transcription activators and repressors, promoters, RNA polymerases and transcription factors, mechanism of transcription in prokaryotes and eukaryotes, **RNA processing**- capping, polyadenylation, splicing, alternative splicing, RNA editing, exon shuffling and RNA transport, **Translation and processing**- ribosomes, tRNA aminoacylation, aminoacyl tRNA synthetase, genetic code, wobble hypothesis, deciphering of the code, translation mechanism , translation proof reading, translation inhibitors and post translational modifications.

Unit-4: Regulation of gene expression in Prokaryotes: Operon concept, regulation at transcription initiation- lac and trp operon control, regulation of lytic and lysogenic cycles in lambda phage, regulation beyond transcription initiation-premature termination- trp operon, ribosomal proteins as translational repressors, riboswitches, **Regulation of gene expression in eukaryotes**-transcription activators and repressors, regulation after transcription initiation- alternative splicing, translational control in ferretin and tranferrin 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:

1) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Rafi, Keith Roberts, and Peter

Walter. 2008. Molecular biology of the cell, 5th edn., Garland science, Taylor & Francis Group, LLC, 270 Madison Avenue, NewYork ,USA.
2) Alberts, B., Bray, D., Lewis, J , Raff, M., Roberts, K and Watson, J.D. 1999 . Molecular biology of the cell. Garland Publishing, Inc., New York
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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, adrogenesis 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, Lamda 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.
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BOTANY: III- SEMESTER- SOFT CORE 3.1
MOLECULAR GENETICS OF PLANTS

Theory-32 Hrs

Unit-1: Plants as genetic tools in Biology: *Arabidopsis, Rice, Maize, Saccharomyces;* Genome organization in plants; *Arabidopsis thaliana*- an experimental model for understanding plant development and functions; Plant genes and regulation; nucleus and chromatin organization; Histones and histone modifications; DNA packaging, organization and types of DNA sequences; functional and non- functional sequences, organization of plant nuclear genes, plastid genes and mitochondrial genes.

Unit-2: Genes responding to hormones, phytochrome, responses to abiotic stresses; Genes induced by water stress and freezing stress; Genes involved in photosynthesis and nitrogen fixation and their regulation; Molecular development of leaf and flower - ABC and revised model of flower development; Genes involved in fertilization, seed development, embryo development.

Unit-3: Genetics of *Agrobacterium:* Biology and genetics of *Agrobacterium tumefaciens;* The Ti- plasmid, *Vir* genes and expression, Mechanism of T-DNA transfer and integration; Basic features of vectors for plant transformation; Proteomics, genomics and bioinformatics; Structural and functional genomics, comparative genomics - biochemical, evolutionary, physiological and phylogenomics; Tools to study functional genomics.

Unit-4: Proteomics- functional and comparative proteomics; Protein distribution, characterization and identification, differential display proteomics, detection of functional linkages; Pharmacogenomics; Bioinformatics- tools of bioinformatics, data bases and data base management, bioinformatics in taxonomy, biodiversity, agriculture; Bioinformatics in drug design and drug discovery.

Practicals-32 Hrs

1) *Arabidopsis thaliana*- study of plant system and its biology.
2) *Arabidopsis* RNA extraction (total and polysomal) for Northern blotting.
3) Expression of foreign genes in plant cells through *Agrobacterium tumefaciens* (Chart)
4) Production of tobacco transgenic plants and assay for the introduced transgenic (Chart)
5) Co-cultivation of tobacco *Agrobacterium tumefaciens*
6) -12) Learning gene bank formats- EMBL format, FASTA format, Swiss- PROT, Ex PASy

References:

1) Buchmann, B.B., Gruissem, W., and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. ASPP Press, USA.
2) Ausubel, F.M., Brent, R., Kingston, R.E., Moore, D.D., Seidman, J.G., Smith, J.A., and Struhl, K. 2005. Current protocols in molecular biology. Current Edition.
3) Brown, T.A. 2000. Essentials of Molecular Biology. Vol. I & II, Oxford University Press.
4) Potrykus, I., and Spangenberg, G. 1995. Gene transfer to plants. Springer, Berlin, Heidelberg.
5) Watson, J.D., and Baker, T.A., Bell, S.P. Gannm, A. and Levine, M. 2004. Molecular Biology of Genes. 5th edn., Pearson Education.
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BOTANY: IV- SEMESTER- SOFT CORE 3.2
MOLECULAR PLANT PATHOLOGY

Theory-32 Hrs

Unit-1: Concepts and scope of physiological and molecular plant pathology; Molecular approaches to plant disease diagnosis; Nucleic acid based probes for detection of plant pathogens including non-culturable organisms; **Pathogenicity and Disease Development**-factors; induced resistance, virulence and pathogenecity factors; Plant-pathogen interactions with emphasis on incompatible interactions and induced resistance.

Unit -2: Pathogenesis: Necrogenic plant pathogenic bacteria with emphasis on hrp and avr genes and virulence factors; Fungal plant pathogens with emphasis on virulence and pathogenicity factors; Plant viruses with emphasis on virus replication, virus transport in plants and control of plant viruses with transgenic plants; **Signal Transuduction-** recognition of the pathogen by the host, transmission of the alarm signal to the host defense providers; Necrotic defense reaction, defense through hypersensitive response; Molecular basis of induced biochemical reaction; Local and systemic acquired resistance (SAR).

Unit-3:Genetics of Plant Diseases and Resistance: Genes and diseases; physiological specialization among plant pathogens; Variability in viruses, bacteria and fungi; Levels of variability in pathogens and loss of virulence in plant pathogens; Genetics of virulence in pathogens and of resistance in host plants; Molecular plant breeding for disease resistance.

Unit-4: Genetics and molecular basis of host-pathogen interaction: Evolution of parasitism; genetics oh host-pathogen interaction; Gene for gene relationship; Criteria for gene for gene type relationship; Molecular basis of host pathogen interaction; Host-parasite-interaction. **Biotechnological methods of plant disease management;** Genetic engineering and crop protection; Cross protection; Gene silencing and disease control- mechanism of gene silencing and control of viral diseases; Engineered resistance to viral, bacterial, fungal and insect diseases of crop plants.

Practicals-32 Hrs

1-2) Testing hypersensitivity reaction on *Nicotiana and Bajra.*
3) Estimation of lypoxygenease 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. Encylopedia 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**- t**ypes 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: **Phytochemisrty:** 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. 5th 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 2nd edn. New Age International Pvt Ltd. New Delhi.
5) Harborne, J.B. 1984. Phytochemical Methods, 2nd edn. Chapman and Hall, London. Harborne J.B., 1973. Phytochemical methods a guide to modern techniques of plants analysis. Chapman and Hall Ltd. London.

BOTANY: III SEMESTER- OPEN ELECTIVE 3.1
PLANT PROPAGATION TECHNIQUES

Theory-32 Hrs

Unit-1: History, scope and importance of plant propagation; Propagation structures with reference to green house equipment and media; Seed propagation – the development of seeds, techniques of seed production and handling principles and media.

Unit-2: Vegetative propagation: Techniques of propagation by cuttings; stem cuttings – hard wood, semi hard wood, soft wood and herbaceous, leaf cuttings, leaf bud cuttings, root cuttings; Biology and techniques of grafting: Whip and tongue, wedge and cleft, bark, side grafting, approach.

Unit-3: Techniques of budding: T- budding patch budding, chip budding, ring budding; Layering and its natural modifications- simple layering, tip layering, mound or stool layering, air layering, compound or serpentine layering and trench layering; Propagation by specialized stems and roots.

Unit- 4: Micro propagation – techniques and applications in forestry and horticulture; Advantage, limitations and applications of vegetative propagation, Somaclonal variations; Propagation methods of some selected plants – Citrus, gape, mango, mulberry, hibiscus, rose, Croton, Eucalyptus.

References:

1) Abbott, A.J. and Atkin, R.K. (eds.) 1987. Improving vegetatively propagated crops. Academic press, New York.
2) Bose, T.K., Sadhu, M.K., and Das, P., 1986. Propagation of Tropical and Subtropical Horticultural crops, Nowya Prakash, Calcutta.
3) Hartmann and Kester, 1983. Plant propagation
4) Hartmann, H.T., Kester E.D., Davis, F.T. and Geneve, R.L. 1997. Plant propagation. Principles and practices. Prentice Hall of India Private Limited, New Delhi.
5) Krishnamurthy. H.M. 1981. Plant Growth substances including application in Agriculture.
6) L.M. Pierik 1987. In vitro culture of Higher plants Murtinus Nijhoff pub. Dordrecht.
7) M.K. Razdan 1994. An Introduction to Plant tissue culture, Oxford and IBH Pub. Co., PVT. Ltd., Bombay and Calcutta.
8) Mac Donald, B. 1987. Practical woody plant propagation for nursery growers. Portland, OR: Timber press.
9) Sadhu, M.K. 1989. Plant propagation Wiley eastern Ltd. N. Delhi.

BOTANY: IV- SEMESTER- HARD CORE 4.1

ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY

Theory-32 Hrs

Unit-1: Introduction and scope of Ecology: Plants and the environment- plant adaptation, ecotypes, habitat ecology- fresh water and marine water ecology (ecosystems), wetlands and their characteristics; Ecosystem function; The distribution of biomes; Major Terrestrial Biomes; Forests-Tropical Forests-Temperate Forests, Taiga, Grasslands, Savanna, Temperate Grasslands/Prairies, Tundra, Deser and Chaparral.

Unit-2: Environmental Biology: Global warming: Greenhouse gases - causes and consequences; Ozone depletion- causes and consequences; Air, water and soil pollution - major pollutants, their source, permissible limits - and control methods; Radioactive pollution- Ionising radiation, disposal of radioactive waste, nuclear accidents; Environmental Education Programmes - WWF, UNEP, MAB; Role of plants in solving energy crisis and ameliorating global warming.

Unit-3: Biodiversity and Conservation Biology: Science in the service of Biodiversity, biodiversity and its value, biodiversity issues, concerns, management; Biodiversity hot spots; Biodiversity- threats and current status of biodiversity; IUCN categories, Red Data book and Red lists, invasive alien species as threat to biodiversity; Conservation strategies- past, present, and future; Attitudes about conservation; conservation movements; CITES (Convention on international trade in endangered species), WCU (World Conservation Union); Endangered species Act. 2002 (GOI); Protected areas, Network of India- history, size, scale and management; Heritage trees.

Unit-4: Phytogeography: Biogeography of the world, India and Karnataka; Climatic zones, tectonics, continental movements; Types of plant distribution – discontinuous distribution - land bridge theory, continental drift; continuous distribution-cosmopolitan, circumpolar, circumboreal, circumaustral, pantropical; Distribution of plants - islands; Phytochorea of the world, India; Plant dispersal, migrations and isolation; Eendemic plants of Western Ghats and Eastern Himalayas; Origin, distribution and acclimatization of coffee, cardamom, sugarcane, cashew, ragi, maize, wheat, rice and cotton; Remote sensing and GPS, study of vegetation by GIS (Geographical Information system).

Practicals-32 Hrs

1) Study of local vegetation by quadrate method.
2) Water analysis for pollution studies.(Bio-monitoring: TDS, Hardness, Chlorides, CO_2 COD, DO, BOD)
3) Rapid detection of bacteriological quality of water with special reference to feacal coliforms.
4) Morphology and anatomy of plants in relation to habitats - Xerophytes, Mesophytes, Hydrophytes.
5) *In situ* and *Ex situ* method of conservation.
6) Eminent phytogeographers of the world (photos).
7) Continental drift (charts).
8) Application of Remote Sensing, GIS and GPS in Forestry and Wild life management.
9) Biogeography of the world – Oceans, deserts, islands, mountains.

10) Biogeography of India –rivers, mountains, islands.
11) Floristic regions of world – India and Karnataka.
12) Study of endemic plants of India.
13) Origin, acclimatization and distribution of Coffee, Cardamom, Sugarcane, Cashew, Ragi, Maize, Wheat, Rice and Cotton.

References:

1) Polunin, N. 1961. Introduction to plant geography.
2) Good R.D. 1974. Geography of the flowering plants.
3) James H. B. 1998. Biogeography.
4) Cain, S.A. 1944. Foundations of plant Geography.
5) Croiat, 1952. Manual of Phytogeography.
6) Edgar A. 1972. Plants, Man and Life.
7) Valentine, D. H. 1972. Taxonomy, Phytogeography & Evolution.
8) Phil Gibson J. and Gibson Terri, R. 2006. Plant ecology.
9) Primack, R. B. 2006. Essentials of conservation biology.

10) Ricklefs, R. E. 2001. The Economy of Nature.
11)Narasaiah M. L., 2005. Biodiversity and Sustainable Development.
12)Tondon P, Abrol Y. P, Kumaria S., 2007. Biodiversity and its significance.
14) Krishnamurthy K. V. 2007. An Advanced Textbook on Biodiversity: Principles and Practice.
15) Christian Leveque and Jean-Claude Mounolou (2003). Biodiversity.
16) Jeffries Michael J. 2006. Biodiversity and conservation.

BOTANY: IV- SEMESTER- SOFT CORE 4.2
PROJECT WORK

BOTANY: IV- SEMESTER- SOFT CORE 4.1
SEED TECHNOLOGY

Theory-32 Hrs

Unit-1: Seed Technology: Introduction to seed science and technology and its goals; Development of seed technology industry in India; Seed as basic input in agriculture; Seed Biology - Seed development, morphology and anatomy of dicot and monocot seeds; Seed structure and functions; Seed programmes and organizations; Seed village concept, seed production agencies, seed industry and custom seed production in India; International Seed Science and Technology Organizations.

Unit-2:Seed Production: General principles of seed production in self and cross pollinated and vegetatively propagated crops; Hybrid seed production; Maintenance of inbred lines and breeders seeds; Synthetic and composite seeds; Improved seed and their identification; Germplasm banks; **Seed Processing**-Harvesting, seed drying, seed cleaning and grading; Equipments; Seed Storage- types of storage structure; seed factors affecting storage life, effect of storage on relative humidity, temperature and moisture; Seed deterioration; Seed treatment.

Unit-3: Seed Quality Testing: Devices and tools used in seed testing; ISTA and its role in seed testing; Seed sampling- physical purity and heterogeneity test; Seed moisture content-importance and determination and methods; Viability and vigour testing; Genetic purity testing -objective and criteria for genetic purity testing, seed health testing, field and seed standards, designated diseases, objectionable weeds; Significance of seed borne diseases, seed health testing and detection methods for seed borne fungi, bacteria, viruses and nematodes; Preparation and dispatch of seed testing reports, storage of guard samples, application and use of seed standards and tolerances.

Unit- 4: Seed Certification: Principles and philosophy of seed certification, purpose and procedures, national seed programme; National Seed Corporation (NSC) - agencies responsible for achieving self-reliance in seed production and supply of quality of seeds (State Seeds Corporation; National Seed Development Council (NSDC); Central Seed Committee(CSC) ; Seed market surveys, seed industry in relation to global market; Concept of WTO, GATT, IPR, Plant Variety Protection and its significance seed technology; UPOV and its role.

Practicals-32 Hrs

1) Determination of physical purity of seed samples.
2) Determination of density or weight per thousand seeds.
3) Determination of seed Heterogeneity.
4) Visual examination of dry seeds for disease symptoms.
5) Determination of moisture content by hot air oven method.
6) Seed viability test- TTC method.
7) Determination of seed germination by TP/BP/Sand method.
8) Evaluation of seedlings vigour by BP/Sand methods.
9) Seed vigour evaluation by (a) conductivity test (b) Hiltner's test (c) Performance test(d) Accelerated ageing test (e) Cold test.
10) Examination of suspensions obtained from washings of seed.
11) Infection sites studied by planting seed components.
12) Detection of seed-borne fungi and their characters of five seed borne pathogens. Vist: Visit to seed industries/seed companies/ seed research stations.

References:

1) ACAR.2009. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.

2) ACAR.2013. Handbook of Horticulture. Indian Council of Agricultural Research, New Delhi.

3) Agarawal, P. K. 2005. Principles of Seed Technology.2nd 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. 4th 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 2nd 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) Agarawal, P. K. 2005. Principles of Seed Technology.2 nd 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. 5th 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. 2nd edn. Chapman and Hall, London.
4) Harborne J.B. (1973) Phytochemical methods a guide to modern techniques of plants analysis. Chapman and Hall, London Ltd.

BOTANY: II SEMESTER - OPEN ELECTIVE 4.1
PLANT DIVERSITY AND HUMAN WELFARE

Theory-32 Hrs

Unit -1: Plant Diversity and Significance: Role of plant diversity in ameliorating energy crisis and global warming; Types of biodiversity-genetic diversity, species diversity, plant diversity at the ecosystem level; Agro-biodiversity and cultivated plant taxa, wild taxa; **Values and uses of Biodiversity-** Ethical and aesthetic values, precautionary principle, methodologies for valuation, uses of plants and microbes.

Unit -2: Loss of Biodiversity: Major causes of for biodiversity loss; Loss of genetic diversity, Loss of species diversity; Loss of ecosystem diversity; Loss of agro-biodiversity; Projected scenario for biodiversity loss; Management of Plant Biodiversity- Organizations associated with biodiversity management; Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations; Biodiversity information management and communication.

Unit -3: Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation, Biodiversity awareness programmes, Conservation of Heritage Trees.

Unit-4: Role of plants in relation to Human Welfare: Importance of forestry their utilization and commercial aspects, Avenue trees, Ornamental plants of India, Alcoholic beverages through ages, Fruits and nuts- Fruit crops of Karnataka and their commercial importance; Wood and its uses.

References:

1) Krishnamurthy K. V. 2007. An Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IHB Publishing Co. Pvt. Ltd. New Delhi.
2) Christian Leveque and Jean-Claude Mounolou, 2003. Biodiversity. John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
3) Jeffries Michael J. 2006. Biodiversity and conservation, 2nd edn. Taylor and Francis Group, New York.

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(AUTONOMOUS)

OOTY ROAD, MYSORE-570 025

Postgraduate Department of Commerce

2019-20

MCD230 Corporate Tax Law and Planning

Course Objective:

CO1: Deliberate in detail with examples different types of companies under corporate income tax CO2: Understand the detail of different sources of income for corporate assesses CO3: Specify in depth impudence of tax planning CO4: Understand in depth procedure for assessment

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, shut down or continue.

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

MCB050 ENTREPRENEURIAL DEVELOPMENT

Course Objective:

CO1: Write down in detail with examples skills of an young entrepreneurs
CO2: Write down in detail with examples techniques of project planning, implementation and execution
CO3:Identify in detail with examples institutional support to entrepreneurs
CO4: Learn the characteristics of MIS in project

Module – 1: Entrepreneurship: Need, Scope, Entrepreneurial Competencies and Traits, 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, Relationship between Small and Large Units; Indian MSME Sector - Nature, Contribution to Economy, Problems and Government Schemes; and MSMEs Act, 2006.

Module – 2: Entrepreneurial Development Programs and Small Business: Relevance and Achievements of EDPs, Role of Government in Organizing such Programs, Women and Rural Entrepreneurs - Present Status in India. Small Business: Concept and Definition, Role of Small Business in Modern Indian Economy, Small Entrepreneur in International Business, 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, Scope and Importance, Role of Project Manager. Project Appraisal - Preparation of a Real Time Project, Feasibility Report containing 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, Factory Design and Layout, and Feasibility Report Preparation.

Module – 4: Project Planning: Functions, Project Objectives and Policies, Identifying Strategic Project Variables; Statement of Work; Mild Stone Schedules Tools for Planning Hierarchy of Plans. 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

MCC210 Indirect Tax Law and Practice

Course Objective:

CO1: To comprehend the principles of taxations, objectives of taxes and its impact, shifting and incidence process of indirect taxes in market orientated economy
CO2: To understand the implications of indirect taxes on the taxable capacity consumers, dealers and of the society at large and its changes
CO3: To make them to be a tax consultant in preparing the tax planning, tax management. Payment of tax and filling of tax returns
CO4:To understand the impact of tax on Domestic, National and International Trade and educating the students as a tax audit, consultant and mangers

Modul-1: **Excise Duty**: Nature of Excise Duty-Definitions-Basis of Duty Payable-Basis of Assessable Value-Transaction Value as Assessable Value-Inclusions in and Exclusions from Transaction Value-Valuation Rules to Determine Assessable Value-Sale to a Related Person. Excise Duty on Small Scale Industries.

Module-2: **Value Added Tax:** Concept of value added. Cascading Effect of Taxes CENVAT, Cascading Effect of Taxes: CENVAT on Inputs-CENVAT on Capital Goods- Dealers' Invoice for CENVAT. Exemptions from Excise Duty- Payment of Duty-Returns-Assessment-Recovery and Refunds Administrative Set Up of Central Excise,

Modul-3: **Customs Duty:** Customs Act, 1962 and the related Rules, Circulars and Notifications; Customs Tariff Act, 1975 and the related Rules. Principles governing levy of customs duty, types of duty including protective duty, safeguard duty, countervailing duty and anti-dumping duty and exemption from customs duties. Basic principles of classification of goods and valuation of goods. Customs authorities, appointment of customs ports, warehousing stations. Provisions governing conveyance, importation and exportation of goods, special provisions regarding baggage, goods imported or exported by post, and stores.

Modul-4: **Service Tax** :Scope of Service Tax-Taxable Service- Administration of the Act-Exemptions from Service Tax-Rate of Service Tax- Computation of Service Tax in Case of Advertising Agency Services: Banking and Financial Services-General Insurance Services-Telephone and Pager Services-Tour Operating Services.

MCC250 Marginal costing and Decision making

Course Objective:

CO1:Identify the detail of wide range of managerial decisions
CO2: Deliberate the detail of techniques of controlling cost through standard costing
CO3: Understand the detail of managerial cost control decisions
CO4: Learn the detail of direct costing

Module 1: Introduction: Meaning- terminology- Scope & Concepts- Cost Behavior Analysis- Break Even Analysis- Approaches of Break Even Analysis in relation to cost & revenue. Factors- Multi-product 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: Direct Costing: Meaning- Importance & Preparation of income statements- Comparison with Absorption Costing- Arguments in Favour of Direct Costing- Criticisms of Direct Costing. Value Analysis & Value Engineering: Basic Concept of Value- Constitution of a Value Analysis Team-Procedures Underlying Value Analysis Study- Benefits From & Resistance to Value Analysis Study- Reporting to Management- Objectives of Reporting- Reporting Needs of Different Management Levels- Types of Reports- General Principles of Reporting- Modes of Reporting- Reports to the Board of Directors- Reports to Top Management- Reporting to top Divisional Management- Reports to Junior Management Level- Preparation of Reports- use of Reports by Management- Case Studies.

MCC030 - Management of Non-profit organization

Course Objective:

CO1: Understand the Non-profit Sectors
CO2: Specify the Characteristics of Financial Reporting
CO3: Learn in depth training and development
CO4: Write down the details Governance and professionalism

Module 1: The world of non-profit enterprises – third sector, nonprofits sector, social enterprises; Economic, Sociological and Structural theories of nonprofits; Contemporary role of nonprofits; Nonprofits vis-à-vis State and Business

Module 2: Accounting & Finance – Financial reporting in nonprofits; Distinct needs of nonprofit accounting; Sources of funds and their implications; Basic tenets of fund management in nonprofits

Module 3: Human Resource Management – Volunteers & Staff, Critical issues of compensation, quality and retention, Training and development, Incentives and Motivation

Module 4: Governance and Professionalism – Governance process and Board role; Credibility and legitimacy issues; Professionalism, Productivity and measurement of quality

MCB 260: RETAIL MANAGEMENT

Module 1: Retailing Introduction to Retail: What is Retail?- Functions of a retailer-The Marketing-Retail equation The Rise of the Retailer – Proximity to customer – Rise of consumerism-Global retail market Challenges and opportunities-Empowered consumer-Technology enabled effectiveness Evolution of Retail in India-Drivers of Retail change in India-Emergence of young earning India Size of Retail in India: Clothing ,Textiles and Fashion accessories-Food And Food services Books & Music, Communication accessories –Emerging Sectors-FDI in retail-Retail Realities : Beyond Urban Boundaries –Challenges to Retail Development in India – Threat of new entrants –Substitutes, Bargaining Power of suppliers and buyers, Intensity of rivalry

Module 2: Retail Models And Theories Of Retail Development The Evolution of Retail formats – Theories of retail development-Environmental, Cyclical and Conflict Theory-The Concept of life cycle in Retail-Innovation, accelerative growth- Maturity Decline-Phrase of growth in retail markets-Business models in retail-Classification based on ownership /Merchandise offered/Franchising /Non Store Retailing/Direct selling/Direct response marketing/Telemarketing/Fairs and Road Shows/Event Management/Automated Vending/kiosks/ The Cash & Carry/credit Marketing/Brand Management.

Module 3: Customer Relationship Management (Crm) CRM : What is CRM-Common Misconceptions-Definition-Components off CRM-Defining CRM Concepts – Customer Life Cycle- B to B CRM- Understanding Goal of CRM-Using Customer touch points – Deciding who should lead the CRM Functions : Marketing/Sales/Customer Services/ Product Support-Channel and other partners-CRM Planning – Developing Strategy- Building CRM Component-Analyzing and Segmenting Customers Taking it to Customers – Get Ready : Avoiding Common Barriers, GETSET: Organising for success and go: Developing your CRM strategy-CRM Building : Infrastructure, Information, Process, Technology, People – Managing quality information, Quality systems, Customer privacy.

Module 4: Services Management: Distinctive characteristics service operations-Service Bench marking-Service strategy - Designing the service enterprise – Service quality-Service facility location-Managing service operations-Service-Supply relationships vehicle routing.

MCD250 Tools and Techniques of control

Course Objective

CO1: Deliberate the detail of cost control and management tools
CO2: Learn in detail with examples costing system for job and process oriented manufacturing environments
CO3: Identify the classification and characteristics of uniform costing and inter-firm comparison
CO4: Learn in depth objectives and criticism of management audit

Module 1: Budgetary Control: Objectives of Budgetary Control-Preparation of the Budget-Functional Budgets-Sales Budgets-Production Budget-Cost Budget-Plant Utilization Budget Capital Expenditure Budget-Selling & Distribution Cost Budget-Purchasing Budget & Cost Budget-The Master Budget-Operation of Budgetary Control-Flexible Budgetary Control-Zero-Base Budgeting-Case Studies.

Module 2: Standard Costing: Objectives-Principles-Determination of Standards for Material-Labor-Direct Expenses & Overhead Costs-Variable and Fixed Costs-Case Studies.

Module 3: 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.

Module 4: Uniform costing & Interfirm Comparisons: Objectives and Purposes Underlying Uniform Costing-Development of Uniform Costing-Cost Audit-Meaning & Definition-Inclusion of Clause B to Sec.208 to Sub Sec. (d) to Sec. 209-Indian Companies Act 1956-Appointment of Cost-Cost Audit Programme-Records Relating to Materials-Labor Overhead-Depreciation-Stores & Spare Parts-Work-in-progress and Incomplete Contracts-Cost Auditor's Report-Application of Cost Audit Report Rules, 1963-Sachar Committee's Report. Management Audit: Meaning & Definition-objectives & Criticisms-Types of Audits-Argurments for & Against Management Audit-Social Audit-Steps Underlying Social Audit Programme-Social Audit Report-Limitations of Social Audits-Case Studies.

MCB240 **Human Resource Management**

Course Objective:

CO1: Specify in depth human resource planning
CO2: Understand in detail with examples human resource development
CO3: Specify the characteristics of reward system
CO4: Deliberate in detail with examples 360 degree appraisal

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 Organisation 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-organisation of training programmers-methods-advantages and limitations of training. Evaluation of training programme 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.

MCD210 Supply Chain Management

Course Objective

CO1: Deliberate the detail of foundational role of logistics management
CO2: Understand in detail with examples evaluation of marketing channels
CO3: Learn in depth channel management
CO4: Identify the detail of staffing the sales team

Module 1 **Introduction to Sales Management:** Sales Management: Its Nature, Rewards, and Responsibilities, Social, Ethical, and Legal Responsibilities of Sales Personnel. Building Relationships through Strategic Planning, The Market-Driven Sales Organization, Forecasting Market Demand and Sales Budgets Design and Size of Sales Territories, Sales Objectives and Quotas, staffing the Sales Team **-** Planning for and Recruiting Successful Salespeople, Selection, Placement, and Socialization of Successful Salespeople, Training the Sales Team **-** The Management of Sales Training and Development, Contents of the Sales Training Program: Sales Knowledge and the Selling Process, Directing The Sales Team - Motivating Salespeople toward High Performance, Compensation for High Performance, Leading the Sales Team

Module 2 **Marketing Logistics :** Logistics and its importance, Functions of Logistics management - Procurement /Purchasing, Inward Transport, Receiving, Warehousing, Stock Control, Order Picking, Materials Handling, Outward Transport, Physical Distribution Management, Recycling, Returns, and Waste Disposal, Importance of Communication in Logistics, Technology in Logistics- Electronic Data interchange (EDI), Artificial Intelligence, Expert Systems, Communication Technology, Bar Coding and Scanning, Streamlining the Logistics Process, Strategic Issues in Logistics Management

Module 3 **Marketing Channels:** Evolution of Marketing Channels- The Production Era, The Sales Era, The Marketing Era, Relationship Marketing Era, Channel member and their roles, Roles of Channel Members, Channel Functions, Designing marketing channels - Channel Structure, Channel Intensity, Types of Channel Intermediaries at Each Level, Channel Flows and Cost.Importance of Channel Integration, Vertical Marketing Systems, Types of vertical marketing systems - Corporate VMS, Administered VMS, Contractual VMS, Horizontal Marketing Systems, Hybrid channel system, Designing and Managing Hybrid Channel Systems

Module 4 **Channel Management:** Recruiting Channel, Members - Recruiting as a Continuous Process, Recruiting Manufacturers, Screening, Criteria for Selecting Channel Members - Sales Factors, Product Factors, Experience Factors, Administrative Factors, Risk Factors, Motivating Channel Members, Distributor Advisory Councils, Modifying Channel Arrangements - PLC Changes, Customer-Driven Refinement of Existing Channels, Growth of Multi-Channel Marketing Systems, Managing Channel Relationships - Cooperation and coordination, Conflict, Power

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

2018-19

JAVA Programming

Course Code : CSA 210

UNIT 1: -

History and evolution of Java,An overview of Java,Data types, variables and arrays,

Operators, Control statements.

UNIT 2 : -

Introducing classes ,A closer look at methods and classes, Inheritance, Packages and interfaces.

UNIT 3 : -

Exception handling, Multithreaded Programming,Enumeration, Autoboxins.

I/O, Applets.

UNIT 4 : -

String handling, Collection framework, Introduction to J2EE,

Java servlet,Java server pages (JSP) and HTML,JDBC objects.

TEXT BOOKS:

1. The complete reference Java – 7th Edition – Herbert Schildt – Tata Mcgraw hill Edition.
2. The complete reference J2EE – Jem Keogh – Tata Mcgraw hill Edition.

REFERENCE BOOKS:

1. Programming with Java A primer – 4th Edition – E Balagurusamy – Tata Mcgraw Hill.
2. Head First Java – 2nd Edition

J.S.S. College of Arts, Commerce and Science
(Autonomous)
Ooty Road, Mysuru-570 025

DEPARTMENT OF ZOOLOGY (PG)

Programme outcome, Programme specific outcome, Course outcome and curriculum for Postgraduate Zoology
(2018-2019 & onwards)

Program Outcome

1. Imbibe the knowledge with facts and figures related Zoology.
2. Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.
3. Identify, formulate, research literature, and analyze complex problems reaching substantiated conclusions using first principles of mathematical, biological, physical and chemical sciences.
4. Will be able to think creatively to propose novel ideas in explaining facts and figures or providing new solution to the problems.
5. Develop scientific outlook not only with respect to Zoology but also in all aspects related to life.
6. Realize that interdisciplinary knowledge in other faculties can have greatly and effectively influence which inspires in evolving new scientific theories and inventions.
7. Imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality.
8. Develop various communication skills such as reading, listening, speaking, etc.
9. Realize that acquiring knowledge is a continuous process and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life.

Programme Specific outcome:

At the completion of M.Sc. in Zoology the students are able to:

1. Understand the classification and taxonomic aspects of the animal world (chordates and non-chordates). The students will be able to identify the taxonomic group of a given animal based on the external characteristics.
2. Understand the basic concepts of Animal physiology. The students will be able to identify and understand the important life processes which are essential for continuation of life on earth.
3. Understand the nature and structure of biomolecules and basic concepts of Biological chemistry.
4. Understand the concepts of Genetics, Cell Biology and Molecular Biology.
5. Understand the basic principles and concepts of environmental science, ecology and nature conservation.
6. Understand the importance of knowledge of wild life and animal behaviour for conservation and balancing the nature.
7. Understand the tools and techniques employed in Biological research and experiments.
8. Understand the process of evolution.
9. Understand the concept and applications of sericulture, apiculture, animal husbandry, Lac culture etc.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
OOTY ROAD, MYSURU
PG DEPARTMENT OF ZOOLOGY
Syllabus Adopted from the academic year 2018-19

Semester	HC / SC	Paper title	CREDITS			Total Credits
			L	T	P	
I	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**
	Any two of the Soft core paper may be opted					**20**
II	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**
	Any two of the Soft core paper may be opted					**20**
III	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**					**20**
IV	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**					**16**

Total credits

Hard Core - 52 Credits

Soft Core - 20 Credits

Open Elective - 04 Credits

Total credits required to complete M.Sc Course - 76 Credits

M.Sc, I SEMESTER
HC 1.1 Non Chordata

32hrs

Course Outcome:
After completing the course student will be able to

1. Understand the classification of major and minor invertebrate phyla
2. Give some examples and basic characteristics of some examples of each phylum
3. Understand the evolutionary pathway and its significance
4. Adaptive characters of animals coming under different invertebrate phyla

UNIT I Basic concepts of animal taxonomy: **8 hrs**

A. Introduction and history of taxonomy
B. Species concept
C. Zoological classification - theories of classification - taxonomic ranks – hierarchy
D. Zoological nomenclature: Binomial nomenclature, trinomial nomenclature-ICZN
E. taxonomical keys: key to the species
F. Linnaean taxonomy and classical taxonomy - level of taxonomy.

Unit II : Classification, Locomotion and Nutrition: **8 hrs**

A. General Characteristics of Non chordata.
B. Locomotion: Muscle filaments and myonemes,
Flagella and cilia. Amoeboid movement.
C. Nutrition in Protozoa: Filter feeding in polychaetes, Filter feeding and digestion in Deuterostomia and molluscs.
D. Respiration:
Structure and function of respiratory organs- Skin, gills, book lungs and Trachea. Respiratory pigments

Unit III: **8 hrs**

A. Excretion and osmoregulation:
Osmoregulation in fresh water and marine Invertebrates
Structure and function of excretory organs- Coelom, Coelomoducts, Nephridia, Maliphigian tubules and Coxal glands
B. Nervous system:
Primitive nervous system: Coelenterata and Echinodermata
Advanced nervous system: Annelida, Arthropoda(Crustacea and insecta) and Mollusca (Cephalopod)
C. Sense organs and their importance

Unit IV: **8 hrs**

A. Invertebrate paleontology and larval forms:
Free living and parasitic Larval forms
B. Fossil: types and importance of fossil study, overview of Geological Time Scale

NON CHORDATA –PRACTICALS **4x16=64 Hrs**

1. PROTOZOA; **4x12=48 hrs**

Slides : 1) *Trypanosoma cruzi* 2) Plasmodium – signet ring stage 3) Ceratium 4)*Leishmania donovani* 5) Vorticella 6) Noctiluca 7) Radiolaria 8*) Entamoeba histolytica* 9) Foraminifera 10) Opalina

2. PORIFERA;

a) Slides: 1)Sponge spicules 2)Sponge gemmules

b) Specimen: 1) Grantia 2) Euspongia 3) Clypeaster

3. CNIDARIA:

a) Slides: 1) Obelia polyp and Medusa 2) Pennaria 3) Aurelia-tentaculocyst

b) Specimens: 1) Physalia 2) Gorgonia 3) Spongodus 4) Zoanthus 5) Favia 6) Pennatula 7)Sea anemone 8) *Corallium rubrum*

4. HELMINTHES:

a) Slides: 1) *Fasciola hepatica* 2) *Ancylostoma*

b) Specimens: 1) Planaria 2) Male and female *Ascaris lumbricodes* 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) Rhinocerous beetle 6)Spider 7) Gongylus 8) Belostoma 9) Limulus 10) Squilla 11) Eupagarus 12) Julus

7. MOLLUSCA :

Specimens: 1) Aplysia 2) Glochidium 3) Loligo 4) Chiton 5) Cypreae 6) Octopus 7)Sanguinolaria 8) Chicoreus 9) Ficus 10) Lambis 11) Mytillus 12) Doris 13) Onchidium 14) Oliva 15) Murex 16) Turritella 17) Cardium

8. ECHINODERMATA:

Specimens: 1) Sea Urchin 2) Linckia 3) Echinodiscus 4) Holothuria 5) Antedon

9. MINOR PHYLA: —1) Lingula

10. LARVAL FORMS:

Slides: 1) Cercaria 2) Trochophore 3) Megalopa larva 4) Nauplius 5) Zoea 6) Mysis

7) Phyllosoma 8) Protozoea 9) Bipinnaria 10) Veliger 11) Tornaria

12) Glochidium 13) Pluteus

11. Field Study: Visit to different areas around the college campus, to observe and study Non chordates in their natural habitat. **4x2=8 hrs**

II. Study of Nervous system, Respiratory system, Reproductive system and Excretory system in invertebrates by employing computer animation/charts: **4x2=8 hrs**

REFERENCES :

1. Barnes, R.D.1974. Invertebrate Zoology, III edition. W.B Saunders Co., Philadelphia
2. Barrington, E.J.W, 1976. Invertebrate Structure and Function. Thomas Nelson and Sons Ltd.,London.
3. Hyman L,H. 1940. The invertebrates. Vol. 1. Protozoa through Ctenophora, McGraw hill Co.,N.Y.
4. Hyman. L H. 1959. The Invertebrates smaller coelomate groups, Vol. V. McGraw Hill Co.,
5. Hyman. L. H. 1951. The Invertebrates. Vol. 2. McGraw Hill Co., N.Y.
6. Hyman. L H. 1968. The invertebrates Vol. 8. McGraw Hill Co., N.Y and London.
7. Simpson, G C. Principles of Taxonomy.

M.Sc, I SEMESTER
HC -1.2 BIOLOGICAL CHEMISTRY

32 hrs

Course Outcome:

After completing the course student will be able to

1. Identify the five classes of polymeric biomolecules and their monomeric building blocks.
2. Explain the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action.
3. Understand types, Structure, biochemical properties and functions of vitamins.
4. Explain how the metabolism of organic compounds leads ultimately to the generation of large quantities of ATP.

UNIT I Chemical Bonds and Carbohydrates: 8 Hrs

A. Structure of an atom, orbitals, chemical bonds - covalent, co-ordinate, ionic and hydrogen; Vander-Waal's force; hydrophobic interactions; Normality and Molarity of solutions.

B. Carbohydrates – Chemistry and biological properties

UNIT II Proteins and Lipids: 8 Hrs

A. Proteins- Chemistry and biological properties, Christian Anfinsen's experiment, Biological values of proteins

B. Lipids: Chemistry, triglycerides; prostaglandins and steroids –biosynthesis, Chemical importance of lipids.

UNIT III Enzymes: 8 Hrs

A. Enzymes: Nomenclature – current status; factors influencing velocity of enzyme reaction, enzyme dynamics and enzyme inhibition.
Ribozymes and abzymes; co-enzymes, isozymes, clinical importance.

UNIT IV Nucleic acids & Vitamins: 8 Hrs

A. Nucleic acids: Chemistry, alternative models of DNA,

B. Vitamins and trace elements – chemical nature, vitamins as co-enzymes, Deficiency diseases, role of trace elements

Biological Chemistry practicals 4x16=64 Hrs

1. Qualitative analysis for identification of carbohydrates (Starch, Glycogen, Sucrose, Lactose, Maltose, Glucose, Fructose).
2. Qualitative analysis for identification of Proteins (Egg albumin, Casein, Gelatin, Peptone)
3. Precipitation reaction of proteins (Egg albumin, Peptone)
4. The absorbance curves for two dyes and demonstration of Beer-Lambert's law.
5. Estimation of amino acids by Sorenson's formal titration (Arginine, Alanine, Leucine, lysine)
6. Determination of concentration of Glucose and Maltose by calibration curve.
7. Determination of amylase activity.
8. Determination of effect of temperature, pH and incubation period on amylase activity.
9. Test for non-esterified fatty acid.
10. Demonstration of gel electrophoresis.

REFERENCES

1. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology, Oxford University press, London.
2. Conn, E. E., 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, 2nd Edn, W.H..Freman
4. Guyton. A.G. 1986, Text book of Medical Physiology, 7th Edn., Saunders Publication
5. Harper, H. A. 1993. A review of Physiological Chemistry, Lange Medical Publication, 2nd Edn.
6. Lehninger, A. L., Nelson, D. L. and Cox, M. M., 2nd Edn. 1993. Principles of Biochemistry,CBS Publishers and Distributors, New Delhi.
7. Oser, B. L. (Ed.) 1993. Hawk's Physiological Chemistry. Tata Graw Hill Publishing Co. Ltd.New Delhi.

M.Sc., I SEMESTER
HC – 1.3 CYTOGENETICS

32 Hrs

Course Outcome:

After completing the course student will be able to

1. Described the fundamental molecular principles of genetics
2. Understood the structure and function of DNA & RNA
3. Understand about the transmission, distribution, arrangement, and alteration of genetic information and how it functions and is maintained in populations
4. Described the basics of genetic mapping
5. Explain basic structure of animal cell and its organelles
6. Describe the functions and organization of cell organelles

Unit I: Introduction to the Cell & Cell Organelles **8 hrs**

A. The origin and evolution of the cell, From molecules to first cell, from Prokaryotes to eukaryotes, from single cell to multicellular organisms.
B. Membrane Structure and Function,
C. Structural organization and functions of intracellular organelles- The nucleus, Mitochondria, Lysosomes, Peroxisomes, Golgi apparatus, and endoplasmic reticulum.

Unit II: Cell Cycle and Cell signalling **8 Hrs**

A. Phases of cell cycle.
B. Biochemical studies with oocytes, eggs and early embryos.
C. Regulation of cell cycle: Molecular mechanisms regulating mitotic events.
   Regulation of cell cycle progression.
   Check points in cell cycle regulation.
   Cell cycle control in polytene cells.
D. Molecular basis of signal transduction
E. Cellular aging and death: (a)Causes of aging
   (b)Cellular changes due to aging
   (c)Theories of aging
   (d) Apoptosis
   (e) Longivity 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 Chrmosomal mutations **8 Hrs**

A. Structure and organization of eukaryotic chromosomes
B. Structural and numerical variations of chromosomes, Chromosomal rearrangements and their cytogenetic consequences with examples from plants, Drosophila and Man,

Practical applications of chromosome rearrangements - Balancers and attached X-chromosome in Drosophila. Cytogenetic effects of ionizing and nonionizing radiations

CYTOGENETICS PRACTICALS	**4X16 =64 Hrs**
1) Life cycle of *Drosophila melanogaster*	1x4=04hrs
2) Preparation of culture media. Culture of Drosophila - Methods of maintenance.	1x4=04hrs
3) Study of morphology of *Drosophila melanogaster*	1x4=04hrs
4) Mounting of Sex comb of *Drosophila melanogaster*	1x4=04hrs
5) Mounting of Wing of *Drosophila melanogaster*	1x4=04hrs
6) Study of mutants of *D. melanogaster*	1x4=04hrs
7) Preparation of genital plate of *D. melanogaster*	2x4=08hrs
8) Chi square Analysis of F1, F2 and Test cross progeny in *Drosophila melanogaster* to understand pattern of inheritance of different characters and to demonstrate.	3x4=12hrs
a) Law of segregation	
b) Law of Independent assortment	
c) Sex-linked inheritance	
9) Temporary squash preparation of Mitotic chromosomes from root tip meristem of *Allium cepa*	2x4=08hrs
10) Temporary squash preparation of Meiotic chromosomes from testis of *Poicelocerus pictus*	2x4=08hrs
11) Study of Barr body using buccal smear of volunteers	1x4=04hrs

REFERENCES:

1. Alberts, B., A. Jhonson, J. Lewis, M. Raff, K. Roberts and P. Walter 2008. Molecular Biology of the cell. V Ed. Garland Science, New York.
2. Brachet, J. 1985. Molecular Cytology, Academic Press, N. Y.
3. Furukawa, R., and M. Fechheimer. 1997. The structure, function and assembly of actin filament bundles. Int. Rev. Cytol. 175: 29-90.
4. Lewin B. (1997) Gene VI Oxford University Press, Oxford
5. Lodish, H., A. Berk, C.A Kaiser, M.P. Scott, A Bretscher, H. Ploegh, P. Matsudaira. 2008. Sixth Edition, Molecular Cell Biology. W. H. Freeman and Co., N. Y.
6. Pollard, T. D. and W. C. Earnshaw. 2002. Cell Biology. Saunders
7. Russel P.J (1998) Genetics. The Benjamin Cummings Publishing Co Inc.
8. Snustad D.P and M.J.Simons. (1997) Principles of Genetics. John Wiley and Sons Inc. N.Y.
9. Strickberger M.W. (1977) Genetics. MacMillan Collier Co. Pvt Ltd
10. Watson J.D, Hopkins, N.H, Roberts J.A, Steitz and A.M.Weiner. (1987) Molecular biology of gene. The Benjamin Cummings Publishing Co Inc.
11. Wolfe, A. 1995. Chromatin: Structure and function. Academic Press, N. Y.

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M.Sc., I SEMESTER
SC – 1.4 TOOLS AND TECHNIQUES OF BIOLOGY

48 hrs

Course Outcome:
After completing the course student will be able to

1. Describe the methodology involved in biotechniques.
2. Describe the applications of bioinstruments
3. Demonstrate knowledge and practical skills of using instruments in biology and medical field.
4. Perform techniques involved in molecular biology and diagnosis of diseases
5. Update current knowledge regarding biomedical engineering involving new methods and the instrumentation.

UNIT I: MICROSCOPY: 12hrs

Basic principles of microscopy, Types of microscopes and their biological applications Bright-field microscope, numerical aperture, limit of resolution, types of objectives, ocular & stage micrometers, Electron Microscope, SEM, Confocal microscope.
Dark-field microscope
Phase-contrast microscope
Differential interference contrast microscope
Fluorescence microscope
Photomicrography and image processing

UNIT II: SEPARATION TECHNIQUES: 12hrs

Centrifugation - Basic principles, Types of rotors, Clinical, high speed & ultracentrifuge
Electrophoresis – Agarose and polyacrylamide gel, Two-dimensional, Isoelectrofocussing
Chromatography - Paper and Thin layer chromatography, Column chromatography, Gel filtration, Ion-exchange, Affinity, Introduction to FPLC and HPLC

UNIT III: 12hrs

A. Radio-tracer techniques
Unit of radioactivity and half life, Measurement of radioactivity (β and γ emission), Applications of radioisotopes, Safety measures
B. Techniques in immunodetection: Immunoblotting and immunofluorescence
C. Immunological techniques: Immunodiffusion and Imunoelectrophoresis

UNIT IV: 12hrs

A. Cell culture techniques: Design and functioning of tissue culture laboratory; Culture media, essential components and preparation; Cell viability testing
B. Cytological techniques: Mitotic & Meiotic chromosome preparations from insects and vertebrates Chromosome banding techniques (G-, C-, Q-, R- banding etc.)
C. Molecular cytological techniques: In situ hybridization (radiolabelled & non-radiolabelled methods), FISH, and Restriction banding
D. Molecular biology techniques: Southern hybridization and Northern hybridization DNA sequencing Polymerase chain reaction (PCR)

TUTORIALS 2x16 = 32 Hrs

REFERENCES

1. Alberts et al: Molecular Biology of the Cell, Garland, 2002
2. Karp: Cell and Molecular Biology, John Wiley & Sons, 2002
3. Lodish et al: Molecular Cell Biology, Freeman, 2000
4. Pollard & Earnshaw: Cell Biology, Saunders, 2002
5. Ruthman: Methods in Cell Research, Bell & Sons, 1970.

6. Boyer: Modern Experimental Biochemistry and Molecular biology (2nd Ed.), Benjamin/Cumin, 1993
7. Freifelder: Physical Biochemistry (2nd Ed.), Freeman, 1982
8. Holme and Peck: Analytical Biochemistry (3rd Ed.), Tata McGraw Hill, 1998
9. Plumer: An Introduction to Practical Biochemistry (3rd Ed.), Tata-McGraw Hill, 1990
10. Switzer and Garrity: Experimental Biochemistry 92nd Ed.), Freeman, 1999
11. Wilson and Walker: Practical Biochemistry (3rd Ed.), Cambridge Univ. Press, 2000

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M.Sc., I SEMESTER
SC – 1.5 CHRONOBIOLOGY

48 hrs

Course Outcome:

After completing the course student will be able to

1. Understand the concept of Chronobiology
2. Identify the way by which circadian rhythms affect life from the genome to the complex behaviour of the individual
3. Acknowledge the role of Chronobiology and chronodisruption on several physiopathological events
4. Acknowledge the input of the synchronizers on homeostasis
5. Characterize the biological relevance of several chronotypes
6. Acknowledge the relevance of circadian rhythms on therapeutic interventions
7. Acknowledge the importance of scientific research on Chronobiology
8. To interpret study designs and scientific parameters related to Chronobiology.

UNIT I: Introduction: **4 hrs**

History, Biological rhythms, Biological clocks, Significance of biological timekeeping

UNIT II: Biological rhythms: **10 hrs**

A. Types of rhythms- Circadian, Circatidal,Circalunar, Circannual
B. Methods of measurement
C. Properties: Entrainment, Re-entrainment, Phase angle difference, Freerun, Phase shift, Phase response curve, Arrhythmia.

UNIT III: Factors influencing biological rhythms: **10 hrs**

A. Environmental: Photoperiod -Photoreception and photo-transduction;
   The physiological clock and measurement of day length;
   Role of photic and non-photic cues in seasonality,Other zeitgebers
   Reversal of roles of principal and supplementary cues.
B. Evolution of photoperiodism: comparative studies; Circannual rhythms and seasonality.

UNIT III: Circadian pacemaker system: **8 hrs**

A. Suprachiasmatic nuclei, B. Pineal gland, C. Optic lobes.

UNIT IV: Molecular basis of circadian rhythms **8 hrs**

A. Clock genes, B. Drosophila, C. Mouse

UNIT V: Applied Chronobiology: **8 hrs**

A. Human circadian rhythms: Melatonin: Input or output signal of the clock system, Clock function (dysfunction); Human health and diseases
B. Applications of circadian rhythm principles: Jet-lag/shift work, Depression and

sleep disorders, Chronopharmacology and Chronotherapy

TUTORIALS **2X16=32 Hrs**

References

1. Binkley, S. (1990): The clockwork sparrow: time, clocks, and calendars in biological organisms, Prentice-Hall, New Jersey.
2. Chandrashekaran, 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, 2nd edition, Sunderland Publishers, Massachusetts.
5. Saunders D.S., C.G.H. Steel, X., afopoulou (ed.)R.D. Lewis. (3rd Ed) 2002: Insect Clocks, Barens and Noble Inc. New York, USA
6. Shapiro, C. M. and Heslegrave, R. J. (1996): Making the shift work, Joli Joco Publications, Inc. Toronto.
7. Vinod Kumar (ed 2002) : Biological Rhythms Narosa Publishing House, Delhi/ Springer-Verlag, Germany

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M.Sc., I SEMESTER
SC – 1.6 HISTOLOGY AND HISTOPATHOLOGY

48 Hrs

Course Outcome:

After completing the course student will be able to

1. Understand the applications of dyes and its classification.
2. Know the functional morphology of various mammalian organs.
3. Imbibe the knowledge on histochemical techniques.
4. Describe the etiology and pathology of liver cirrhosis and atheroscleorsis.
5. Explain histopathology of breast and prostate tumours.

UNIT – I Basics of Histology **8Hrs**

A. Objectives and applications
B. Tissue fixation : Objectives, methods, chemical fixatives-types and chemistry of fixation; Physical methods-:freezing and microwave fixation; choice of fixatives, fixation artifacts.
C. Dyes. –Natural and Synthetic, Classification

UNIT-II Functional Morphology (mammalian) **8 Hrs**

A. Histological organization of GI tract- stomach and intestine,
B. Histological organization of lungs & kidney
C. Histological organization of spleen & thymus,
D. Bone and bone marrow.

Unit-III Histochemistry **8 Hrs**

A. Principles and methods of application
B. Classical histochemical Techniques: for localization of glycoproteins (PAS), nucleic acids (Feulgen) and steroid dehydrogenase activity.

Unit-IV Immunohistochemistry **8 Hrs**

A. Principles, method of application
B. Imunohistochemistry techniques for localization of proteins in endocrine cells (Pituitary cell types or islet of Langherhans)

C. Immunofluorescence: In situ hybridization of nucleic acids

UNIT-V Histopathology **8 Hrs**

A. Morphological alterations in cells due to disease,
B. Types of degeneration: clouding, hyaline, hydrophic and fatty degeneration.
C. Etiology, pathogenesis and histopathology of Liver cirrhosis and atheroscelerosis
D. Neuropathology of alcoholism and methanol poisioning.

Unit-VI Histopathology of tumors **8 Hrs**

A. Malignant and non-malignant
B. Types of carcinoma
C. histopathology of breast and prostate tumors

PRACTICALS **2x8= 16 Hrs**

I. Histology:

1. Microtomy and staining: Hematoxylin-eosin - Demonstration 2x2=4 hrs
2. Histology: 2x2=4 hrs

Observations of permanent slides of mammalian organs – stomach, intestine, spleen, liver, kidney, lungs, testis, epididymis, vas deferens, ventral prostate, seminal vesicle, ovary, uterus and Fallopian tube.

II. Histometry: **2x3=6hrs**

Histometrical measurements and statistical analysis of some tissues.

III. Histopathology: **2x1=2hrs**

Study of histopathological changes (permanent slides) – gastric ulcers, cirrhosis of liver, breast tumors, cystic follicles of ovary, pancreas in diabetics, cryptorchid testis and leukemia.

REFERENCES:

1. Boyd,W. 1976:A text book of Pathology. Structure and function in disease, 4th edition. Lea and Fibiger, 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

Course Outcome:

After completing the course student will be able to

1. Understand the classification of chordates
2. Give some examples and basic characteristics of some examples of protochordates
3. Give some examples and basic characteristics of some examples of vertebrates
4. Understand the evolutionary pathway and its significance
5. Analyse adaptive characters of animals coming under different vertebrate classes

UNIT I General characters and outline classification of Chordata **8hrs**

A. General and Comparative study: Comparision of three Protochordates, Subphyla in terms of General comparision, Habits and habitats,

B. Alimentary canals and associated glands, Pharynx, Food and feeding and excretory system in Protochordates.
C. Adaptive radiation in vertebrates – fishes, amphibians, reptiles, aves and mammals

UNIT II **8hrs**

A. **Integument and its Derivatives**: Epidermal Integument or Skin Functions, Structure & its Derivatives (Glands, Scales and scutes, digital cornifications, horns, feathers, hairs), Integument in different classes of Chordates.
B. **Nervous system**- Development of Brain, spinal cord, Peripheral nerves and sense organs

UNIT III **8hrs**

A. **Respiratory System**: Introduction Respiratory organs: Gills (Internal or true gills, External or Larval gills). Lungs and Ducts, Accessory Respiratory organs and Swim Bladders.
B. **Circulatory system:** Evolution of heart and aortic arches

UNIT IV **8hrs**

A. **Digestive System:** Introduction Embryonic Digestive Tract
Alimentary Canal: Divisions, Digestive Glands
B. **Urinogenital System:** Vertebrate kidneys and ducts, Gonads and their ducts

CHORDATA PRACTICALS **4x16=64 Hrs**

1. **Protochordates**: Specimens:1)Amphioxus , Herdmania
Slides- Salpa (sexual), Doliolum

2. **Fishes** : 1) *Rhinobatus* 2) *Hippocampus* 3) Goldfish (aquarium fish) 4) *Clarius*
5) *Anabas* 6) Coffer fish 7) *Acipenser* 8) *Periopthalmus* 9) *Triacanthus*
10) *Notopterus* 11) *Exocoetus* 12) *Diodon hysterix* 13) *Echenenis 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. Canbridge University Press, London.
2. Barrington, E.J.W. 1965. The Biology of Hemichordata and Protochordata, Oliver and Boyd, Edinbourgh.
3. Colbert, E. H, 1969. Evolution of the vertebrates, John Wiley and Sons, Inc., N.Y.
4. Kent, C. G. 1954. Comparative anatomy of vertebrates
5. Kingsley, J.S. 1962. Outlines of Comparative anatomy of vertebrates. Central book depot Allahabad.

M.SC., II SEMESTER
HC – 2.2 ANIMAL PHYSIOLOGY

32 Hrs

Course Outcome:

After completing the course student will be able to

1. Understand the mechanism of transport of molecules, stepwise release of energy , aerobic and anaerobic respiration
2. Describe the physiology of digestive and respiratory system of human beings.
3. Understand the blood composition, types, groups and circulatory system.
4. Describe the physiology of excretory system and nervous system of human beings.
5. Know the physiology of sense organs, muscles and reproductive system.

UNIT I: Membrane Transport, Bioenergetics & Circulation — 8 Hrs

A. Membrane Transport:

Molecular mechanisms of passive and active transport.

B. Bioenergetics:

a) Energy – Concept, laws of thermodynamics
b) Redox potential
c) Stepwise release of energy through cytochromes, production of ATP, uncoupling of oxidative phosphorylation,inhibitors.
d) Anaerobic and aerobic breakdown of glucose, alternate pathway – HMP shunt and glucoronic 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.
Hyppothalamo - 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) Neurcendocrinology of Reproduction, Physiology and Behaviour.Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells andFertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial control of reproduction, Cambridge University press,London.
2. Barrington, E. J. W (1976) An introduction to general and comparative endocrinology,Oxford University press, London
3. Raghavendra Puri (2003) Mammalian endocrinology Vol. I & II, Dominant Publishers and Distributors, New Delhi.
4. Eckert, R and Randall, D. 2002, Animal physiology, 2nd Edn, W.H..Freman

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

M.Sc., II SEMESTER
HC – 2.3 ENTOMOLOGY

32hrs

Course Outcome:
After completing the course student will be able to

1. Understand insects encountered in agricultural fields.
2. Envisage an insight on economically important pests of various foods, fiber and household
3. Understand various insect pest management methods and its significance
4. Learn to apply various agricultural equipment and understand the effect of chemicals and its dosages in agricultural pest management
5. Learn to apply the pest control methods wisely to minimise ecological backlash
6. Discuss the evolutionary significance of insect plant interaction and insect animal interaction.

Unit I: General Entomology **10 hrs**

A. Classification of class Insecta up to orders with suitable examples; Integument appendages.

B. Insect Endocrinology

I. Insect Hormones and their regulation**:** Chemistry and functions of hormones, Hormones in metamorphosis, Ecdysis and Diapause

II. Semiochemicals:**:** Allelochemicals and Pheromones (Primer & releaser)

Unit II: Agricultural Entomology **10hrs**

A. Role of insects in plant pollination

B. Insects pests: Classification and categories of pests, origin and emergence of pests, pest out breaks and pest resurgence
Structure, life history, significance, nature of damage and control methods of major pests of sugarcane, Paddy and Coconut.

C. Structure, life history, significance, nature of damage and control measures of stored grain pests: (a) *Sitophilus* (b) *Trogoderma* (c) *Rhizopertha* (d) *Tribolium* (e) *Bruchus* (f) *Sitotruga* (g) *Ephestia*

Unit III: General and household insect pests **06hrs**

A. Structure, life history, significance, nature of damage and control measures of following general pests: (a) grasshoppers & locusts (c) termites (d) aphids (e) hairy caterpillars

B. Household pests: Cockroaches, Ants, Wasps, Silverfish, furniture beetle, and their control

Unit IV: Medical Entomology **06hrs**

A. Insect vectors: Role of insect as vectors of human diseases (Malaria, filariasis, Kala azar and their control)
Mosquitoes as pests and their control.
Housefly: A human health hazard and its control

B. Arboviral diseases: Dengue, chicken gunya, swine flu.

PRACTICALS: **4x16=64 Hrs**

1. Collection and preservation of dead insects for systematic studies & field report 4x4=16 hrs

2. Identification of different insects upto orders- House fly, Cockroach :
Mosquitoes, stored grain beetles, destructive insects, important crop and household pests
4x4=16 hrs

4. Fixing and preservation of dead insects by Plastination technique. 4x4=16 hrs
5. Field studies of insects to understand their habit: Ants, Butterflies, termite, wasps, Moths. 4x2=08 hrs
6. Study of insect mouth parts: Mosquito, Cockroach, House fly, Butterfly 4x2=08 hrs

REFERENCES:

1. Awasti V.B. 2009 Introduction to general entomology 3rd Ed. Scientific publication (India), Jodhpur
2. Awasti V.B.2007, Agricultural Insect Pests and their control. Scientific publishers (India) Jodhpur
3. Trigunayat M.M. 2009, A Mannual of practical entomology, scientific publishers, Jodhpur, India.
4. Dhaliwal G.S. Ramsingh and B.S. Chillar 2006, Essentials of Agricultural entomology. Kalyani Publishers, New Delhi.
5. L . K Jha. Applied Agricultural Entomology. New central book agency. Culcutta

M.Sc., II- SEMESTER
SC – 2.4 DEVELOPMENTAL BIOLOGY

48 Hrs

Course Outcome:

After completing the course student will be able to

1. Understand the molecular concepts of developmental biology during fertilization.
2. Know about Noble prize concepts during frog development viz., Nucleocytoplasmic interactions.
3. Explain on axis development in drosophila.
4. Describe endocrine and molecular control in metamorphosis of insects and amphibians.
5. Explain the various stages of chick embryonic development.

Unit I:

A) Introduction : Descriptive V/s. Experimental Embryology **8hrs**

B) Fertilization : a) An overview of structure and differentiation of egg and sperm
b) General sequence and molecular events during fertilization

Unit II: Early development - I **8 hrs**

a) Nucleocytoplasmic interactions in early development: An overview of Nuclear 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 morphongenesis : 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 dechorionation and observation of embryos 2X2=04hrs
4. Study of Imaginal discs – the precursors of adult structures in *Drosophila* 3X2=06hrs
5. Demonstration of window technique to observe chick embryo development 2X2=04hrs
6. Effect of thyroid hormone on development in frog 2X2=04hrs
7. Study of various developmental stages in frog up to tadpole stage 2X2=04hrs

REFERENCES:

1. Balinsky, B.I., 1965. An introduction to embryology, W.B.Saunders company.
2. Gilbert, S. F. 2006, Developmental Biology, 8th Ed.Sinauer Associates Inc.,
3. Kalthoff, 2000, Analysis of Biological Development, 2nd Ed., McGraw-Hill Science, New Delhi, INDIA. Massachusetts, USA.
4. Vasudeva Rao, 1994. Developmental Biology: A modern synthesis, Oxford & IBH, New Delhi.
5. Wolpert, Beddington, Brockes, Jessell, Lawrence,Meyerowitz, (3rd Ed., 2006)Principles of Development, , Oxford University Press, New Delhi, INDIA.
6. Wolpert, L, Beddington, R Jessell, T. Lawrence P, Meyerowitz, E, Smith J., 2001, Principles of Deveopment Oxford University Press Oxford.
7. Ann Kiessling and Scott C. Anderson, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, 2003. Jones and Bartlett Publishers, Boston MA, USA

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M.Sc., II SEMESTER
SC – 2.5 IMMUNOLOGY

48hrs

Course Outcome:

After completing the course student will be able to

1. Outline the key components of the innate and adaptive immune responses.
2. Describe about cell types and organs which are involved in an immune response¬
3. Describe the Infectious diseases, hypersensitivity, autoimmune disorders,¬ immunodeficiency diseases

Unit I: Introduction to immunity **8hrs**

A. History; types of immunity – Innate and acquired immunity.
B. Cells and Organs of immune system: Cells: Lymphocytes (T & B cells), monocytes, macrophage; eosinophills, basophills, neutrophils and mast cells.
C. Primary and secondary lymphoid organs: Bone marrow, Thymus, Spleen, Lymph nodes

Unit II: Antigens and Immunoglobulins **8hrs**

A. Antigens: factors influencing immunogenicity, adjuvant, epitope, hapten
B. Immunoglobulins: Basic structure of the immunoglobulin;
Types and functions of immunoglobulins.
C. Monoclonal antibodies:Antigen-antibody reactions

Unit III: Immune response **8hrs**

A. Humoral and cell mediated immune responses
B. Primary and secondary immune modulation; Cytokines; role of complement system in immune response (Classical pathway, Alternate pathway);
C. Immune response against bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections;

Unit IV Immunotechniques **8hrs**

A. Agglutination; Precipitation;
B. Immunofluorescence; RIA, ELISA, Immuno-electrophoresis and Western blotting.

Unit V Major histocompatibility complex and Hypersensitivity **8hrs**

A. Transplantation and graft rejection,
B. Genetic organization of H2 and HLA complexes, HLA typing;
C. Immediate and delayed hypersensitivity.

Unit VI Vaccines and Vaccination **8hrs**

A. Types of Vaccines and their significance
B. Vaccine delivery systems.
C. Congenital and acquired immunodeficiencies

TUTORIALS **2X16=32 Hrs**

References:

1. Austyn, J.M. and Kathym, J. Wood. 1993. Principles of cellular and molecular Immunology. Oxford University Press. Oxford.
2. Benjamin, Elisunshine, Geoffrey Leskowitz.1996. Immunology: A short course. 3rd Edition. New York.
3. Kubey, J.M. 1990. Essential Immunology. 6th Edition. Blackwell Scientific Publication, New York.
4. Rao, C.V. 2002. An introduction to Immunology. Narona Publishing House, New Delhi.
5. Rotti, I. 1994. Essential Immunology. Blackwell, London.
6. Stibes, D.P. and Terr, A.I. 1991. Basic and Clinical Immunology. 7th Edition. Appleton and Large. California.

M.Sc., II SEMESTER
SC – 2.6 EVOLUTIONARY BIOLOGY

48 Hrs

Course Outcome:
After completing the course student will be able to

1. Understand that many of the organisms that inhabit the Earth today are different from those that inhabited it in the past
2. Understand that the propositions underlying Darwin's theory of evolution.
3. Explain adaptation, providing examples from several different fields of biology
4. Explain how the molecular record provides evidence for evolution
5. Understand the Human origin and evolution.

UNIT I Emergence of concept of evolution: 8 Hrs

A. Pre Darwinian concepts, Darwinism and its impact in the development of synthetic theory.
B. Neodarwinism: Birth of population genetics, Components of population genetics, Mendelian population, gene pool, allele frequencies and genotype frequencies,

UNIT II Speciation: **8 Hrs**

A. Concept of species,
B. Types of species
C. Models of speciation,
D. Patterns and mechanisms of reproductive isolation,
E. Hybridization, polyploidy and speciation.

UNIT III Molecular evolution 8 Hrs

A. Phyletic gradualism and punctuated equilibrium.
B. Micro and macroevolution.
C. Molecular evolution: Selectionists theory of evolution, Neutral theory of evolution and Molecular clock and emergence of non-darwinism,

UNIT IV Phylogeny 8 Hrs

A. Phylogenetic trees : Construction with nucleic acid and amino acid sequences,
B. Types of trees and Techniques employed in construction of phylogenetic trees,
C. Molecular phylogenetics of Homo sapiens.

UNIT V Population genetics and Evolution 8 Hrs

A. Gene pool, gene frequency, Hardy-Weinberg Law.
B. Destabilizing forces of evolutionary equilibrium (Mutation, Migration, Selection, Meiotic drive and genetic drift).
C. Founder effect, Isolating mechanisms and speciation.
D. Micro Macro and Mega evolution, Co-evolution.

UNIT VI Genome and Evolution **8 Hrs**

A. Genes and gene clusters
B. Origin of new genes by gene duplication (Ohno's concept)
C. Selfish DNA
D. Karyotypic evolution (Drosophila).

TUTORIALS 2X16=32Hrs

REFERENCES:

1. Dobzhansky Th, (1951) Genetics and origin of species, 3rd Edn. Chapman and Hall, London.
2. Dobzhansky Th, Ayala F.J, Stebbins G.L and J.M. Valentine, (1976) Evolution, Surjeet Publication, New Delhi.
3. Futuyama D.J (1986) Evolutionary Biology, Sinuauer Associates Inc. USA
4. Hartl D.L (2000) A primer of population genetics, Sinuauer Associates Inc. USA
5. Jha A.P (1992) Genes and Evolution - John Wiley Publicaion, New Delhi

6. King M (1993) Species evolution - The role of chromosomal change. The Cambridge University Press, Cambridge

M.Sc., III SEMESTER
HC – 3.1 MOLECULAR BIOLOGY AND BIOTECHNOLOGY

32 hrs

Course Outcome:
After completing the course student will be able to

1. Know nucleic acids, DNA replication and its mechanism.
2. Understand transcription and its modifications.
3. Explain genetic code, enzymes, factor and the process of translation.
4. Analyse gene regulation, lytic and lysogenic cycles in prokaryotes.
5. Understand gene regulation in eukaryotes.
6. Explain molecular mechanism of DNA damage repair.

Part A: Molecular Biology

Unit I Introduction to nucleic acids **8hrs**

A. DNA Replication: i) Enzyme components of replication unit ii) Mechanism with emphasis on Dna A in initiation, Co-ordinated synthesis, End replication in eukaryotes iii) Fidelity.
B. Transcription: i) Transcription apparatus and process (RNA polymerase, cisregulatory elements, terminators, transcription factors). ii) Post transcriptional modifications of mRNA in eukaryotes (G-cap, Poly tail, Splicing).
C. Translation: i) Genetic code (major features, usage of different codons). ii) Enzymes, factors and the process (Aminoacyl t-RNA synthatase, 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.
Indetification of Recombinants: Genetic selection, Use of chromogenic substrates, Insertional inactivation.
Analysis of recombinant DNA clones: Characterization of clones, Restriction mapping, Southern hybridization.
Polymerase chain reaction and DNA sequencing-Maxam and Gilbert's method, Sanger's method, Automated DNA sequencing

Unit IV: **8 hrs**

C. **Applications of Biotechnology:**
Production of medicinally important products – vaccines, Gene therapy, AIDS therapy, Biofertilizers, biopesticides, medicine and human health

D. **Animal Biotechnology**
Animal cell and Tissue culture: Principles of cell culture, cell and tissue types, cell lines, transformation.
Cell and tissue culture media: Natural and defined, role and components of serum in culture.
Applications of tissue culture: Tissue culture in biomedical research karyological studies, amniocentesis, mutagenesis, Cytotoxicity assays.

PRACTICALS **4x16=64 Hrs**

1. Extraction of DNA by rapid method.
2. Extraction of DNA by standard method.
3. Estimation of DNA concentration by Diphenylamine method.
4. Localization of DNA in prefixed paramecium slides by Feulgen staining
5. Localization of nucleic acids in prefixed paramecium slides by Toluidine blue staining
6. Estimation of RNA concentration by Orcinol method
7. PCR amplification of DNA and gel electrophoresis.
8. Restriction digestion and gel electrophoresis.
9. Isolation of plasmid DNA from bacteria.
10. Molecular biology problems

REFERENCES

1. Griffiths A J F, H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart 2000. An introduction to genetic analysis. W. H. Greeman. New York.
2. Lewin, B 2003 Genes VIII. Oxford University Press. Oxford
3. Dale, Jeremy W and Schantz, Malcom V. 2002. From Gene to Genomes. John Wiley and Sons Ltd,NY,USA
4. Das, H.K. 2007. Text book of Biotechnology.Wiley India Pvt. Ltd. New Delhi
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7. Primrose, S.B., Twyman, R.M., and Old, R.W. 2001. Principle of Gene Manipulation (6th edn). Blackwell Science Ltd, London
8. Singh .B.D. 2006. Biotechnology. Kalyani Publishers, New Delhi
9. Sobti, R. C. and Pachauri, Suparna S. 2009. Essentials of Biotechnology. Ane Books Pvt. Ltd. New Delhi

M.Sc., III SEMESTER
HC – 3.2 REPRODUCTIVE BIOLOGY

32 hrs

Course Outcome:
After completing the course student will be able to

1. Understand structure and function of reproductive organs
2. Explain the structure of reproductive cells
3. Describe the role of internal cues in reproduction
4. Describe the role of external factors in reproduction
5. Analyse the role of endocrine glands and their secretions in reproduction
6. Identify the factors affecting fertility
7. Know different types of assisted reproductive technologies.

UNIT I: Male reproduction: **8 hrs**

A. Functional morphology of male reproductive system
B. Kinetics of spermatogenesis – wave and cycle
C. Hormonal control of mammalian testis and spermatogenesis
D. Ultrastructure of spermatozoa
E. Abnormalities of sperm
F. Brief description of histomorphology and hormonal control of male accessory organs viz., epididymis, vas deferens, seminal vesicles, ventral prostate, bulbourethral gland and preputial gland
G. Sperm maturation – morphological and biochemical events, influence of accessory organ secretions
H. Biochemistry of semen and capacitation

UNIT – II Female reproduction : **8 hrs**

A. Origin and migration of primordial germ cells; genetic and hormonal control of differentiation of gonads and gonadal ducts in mammals.
B. Female Reproductive System-Functional morphology of mammalian ovary, Fallopian tube and uterus.
C. Ovarian steroid hormones and their actions

UNIT III: Reproductive cycles in Mammals: **8 hrs**

A. Comparison of estrous and menstrual cycles
B. Menstrual cycle : Different phases, changes in the ovary and uterus and hormonal control
C. Implantation – Process, Types and hormonal control
D. Pregnancy – length of gestation, hormonal control
E. Parturition – Process of birth and influence of hormones
F. Lactation – Hormonal control of mammary gland, development and lactogenesis

UNIT – IV: Fertility and reproductive management **8 hrs**

A. Fertility control – Need, principles of different male and female temporary and permanent contraceptive methods.
B. Assisted Reproduction: Causes of infertility, Artificial insemination, different methods of assisted reproduction (*In-vitro* Fertilization, Gamete Intra Fallopian tube Transfer, Zygote Intra Fallopian tube Transfer).

PRACTICALS **16X4=64 hrs**

1. Demonstration of surgical technique by video clipping
2. Counting of spermatozoa in semen sample collected from volunteers
3. Staining of spermatozoa for abnormalities in semen samples collected from volunteers /clinical samples
4. Study of different contraceptive devices
5. Observation of permanent Histology slides
   a. Comparative morphology of ovary
   b. Comparative morphology of testis
   c. Comparative study of male accessory organs
   d. Comparative study of female accessory organs
6. Observation of permanent slides of T.S of endocrine glands
   a. Pituitary gland b. Thyroid gland c. Adrenal gland d. Pancreas

REFERENCES

1. Adler N. T (1981) Neurcendocrinology of Reproduction, Physiology and Behaviour.
2. Austin, C. R and R. V. Short (eds) (1972) Reproduction in mammals. (1) Germ cells andFertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial control of reproduction, Cambridge University press,London.
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8. Jones, R. E (1991) Human Reproductive Biology press N.Y
9. Knobil, E and Neil J. D (1994) The physiology of reproduction, Vol. I & II. Raven press, New York.

M.Sc., III SEMESTER
HC – 3.3 ECOLOGY AND WILDLIFE

32 hrs

Course Outcome:

After completing the course student will be able to

1. Demonstrate and Understand ecological relationships between organisms and their environment.
2. Present an overview of diversity of life forms in an ecosystem.
3. Explain and identify the role of the organism in energy transfers
4. Describe the Habitat ecology and Resource ecology
5. Understand the types of environmental Pollution and their management
6. Scope, Values and Conservation strategies of wildlife.

Part-A Ecology

UNIT - I **8 hrs**

A. Ecosystem: Historical account, Scope, Basic concepts and Approaches to the study of Environmental Biology. Components of Environment - An overview of abiotic factors and Biotic factors. Concepts of habitat and Ecological niche. Ecotone and Edge effect. Food chains, Food-webs and their structure in Ecological Pyramids in aquatic, terrestrial and parasitic Environments.

B. Population Ecology: Introduction. An overview of important population attributes – Density, Natality, Growth rates, Growth forms and concept of carrying capacity, Patterns in human population growth and its explosion -Remedial measures. Mortality - life tables and survivorship curve, sex ratio, age distribution, dispersal and dispersion, aggregation and Allee's principle, population fluctuation and cyclic oscillations and Population interactions.

UNIT - II **8 hrs**

A. Community Ecology Concept of community - community structure and attributes, concept of climax Species diversity in community and it's measurement- Alpha diversity- Simpson's diversity index, Shannon index, Fisher's alpha, rarefaction. Beta diversity- Sorensen's similarity index, Whittaker's index, Evenness, Gamma diversity. Drivers of species diversity loss and conservation.

B. Bioecology of Freshwater Zooplankton: Definition, Types and adaptations of Zooplankton. Brief study of organizations, life cycles and Ecological importance of Rotifers, Cladocerans, Copepods-Calanoids, Harpacticoids and Cyclopoids, and Ostracods. Mass culturing of Zooplankton.

C. Microbial Ecology: Ecological role, beneficial and pathogenic Microorganisms. Indicator Microorganisms. Role of microorganisms in biodegrading and bioremediation of organic and metal pollution.

Part B Wildlife Biology

UNIT – III **8hrs**

A. Scope and values of wildlife (Ecological, Aesthetic, Scientific, Recreational, Medicinal)

B. Causes of wildlife depletion: Degradation and destruction of natural habitats, Exploitation for commercial purposes, Deforestation, Agricultural expansion, Urbanization and Industrialization, forest fires and hunting.

C. Wildlife corridors, Human-wildlife conflicts

D. Wildlife awareness and education, Wildlife and tribal welfare

UNIT – IV

A. Conservation strategies: Red data book, protected area network, Role of NGOs in conservation.

B. Wildlife act and legislation: Wildlife Protection Act 1972; Biological Diversity Act 2002.

C. Wildlife conservation projects in India (with special reference to Project Tiger, Project Hungul and Gir Project)

D. In-situ conservation: Bioreserves, National parks, Wildlife sanctuaries and Safari's in India

E. Management of Bioreserves, National parks, Wildlife sanctuaries and Safari.

F. Ex-situ conservation: Zoo garden, Management of Zoos, Captive breeding, Artificial insemination, Cryopreservation (techniques and applications) Germplasm banks,

PRACTICALS: **4X16=64 Hrs**

1. Qualitative and Quantitative study of freshwater planktons.
2. Determination of species diversity by Shannon-Weiner Index
3. Determination of species diversity by Simpson's index
4. Field visit to Sewage pond, Natural lake (and if possible river): Collection of water samples and study of physico-chemical parameters such as colour, pH, temperature, conductivity, total solids and turbidity
5. Estimation of Dissolved Oxygen in three natural (sewage, pond and Tap) water samples.
6. Estimation of free Carbon di-Oxide in three natural (sewage, pond and Tap) water samples.
7. To study the relationship between Dissolved Oxygen and free Carbon di-Oxide, if any, in three natural (sewage, pond and Tap) water samples.
8. Determination of BOD in three natural (sewage, pond and Tap) water samples
9. Determination of COD in three natural (sewage, pond and Tap) water samples
10. To study the relationship between BOD and COD, if any, in three natural (sewage, pond and Tap) water samples
11. Collection, observation of planktons (Phytoplankton and Zooplankton) from polluted and non-polluted water bodies.
12. Estimations of bacterial abundance in different water samples – using DEMT.
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

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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.
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12. Saharia, V.B. 1982. Wildlife in India. Natraj Publishers. Dehara Dun.

M.Sc., III SEMESTER
SC 3.4 ETHOLOGY

48 Hrs

Course Outcome:

After completing the course student will be able to

1. Evaluate the learning and instinct behavior.
2. Explain the mechanisms in instinct and behaviour
3. Explain how animals learn
4. Compare learning and instinct behaviour.
5. Analyse any problem about animal behaviour
6. Explain the importance of evolution for animal behaviour.
7. Explain evolution and behaviour.
8. Explain natural selection and behaviour.
9. Explain the relationship between predators and prey
10. Explain social behaviour.

UNIT - I **8 Hrs**

A. Descriptive versus experimental approaches

B. Reflexes and complex behaviour- Latency, after discharge, summation, warm up, fatigue inhibition and feedback control

C. Instinctive Behaviour - Fixed action pattern, Types of sign stimuli and releasers as triggers, Genetic basis of instinctive behaviour.

UNIT- II **8 Hrs**

A. Development and behaviour- Causes of behavioral changes during development, development of bird song.

B. Learning- Classical conditioning experiment, latent and insight learning. Social learning, learning sets and play.

C. Importance of early experience – Critical period- Filial imprinting, Sexual imprinting in birds, Imprinting like process in mammals.

UNIT- III Foraging and anti-predator behaviour **8 Hrs**

i. Anti predator behaviour – avoiding detection through colour and Markings (Mullarian mimicry)

ii. Warning coloration
iii. Batesian mimicry

UNIT-IV Biological communication **8 Hrs**

i. Forms of signals,
ii. Visual communication with suitable examples,
iii. Auditory Communication
iv. Tactile and Chemical communication

UNIT -V Sexual Behaviour **8 Hrs**

i. Hormones and sexual behaviour – Selected examples of courtship and mating behaviour.
ii. Pheromones in Insects and Mammals
iii. Lee Boot, Whitten, Bruce, Collidge and Castro-Vandenberg effect/s
iv. Selected examples of courtship and mating behaviour

UNIT-VI Social Behaviour **8 Hrs**

i. Introduction
ii. Advantages of grouping
iii. Social organization in insects with special reference to ants and honeybees
iv. Social organization in sub human primates
v. Altruism, Kin selection and Genetic control of behaviour

TUTORIALS – On the basis of the proposed chapters. **2x16 = 32 Hrs.**

REFERENCES

1) Goodenough J.E., Mc Guire B. and Wallace R. A. (1993) Perspectives on Animal Behaviour. John Wiley and sons, New York.
2) Tinbergen (2006) Social ehaviour in Animals. J.V. Publishing House Jodhpur India.
3) Vandenbergh. J.E.(Ed) (1983). Pheromones and Reproduction in mammals. Academic Press. NewYork.
4) Agrawal, K.C. 2000. Biodiversity. Agrobios. India.

M.Sc., III SEMESTER
SC – 3.5 POLLUTION AND TOXICOLOGY

48hrs

Course Outcome:

After completing the course student will be able to

1. broader understanding of how science and the scientific method work to address environmental problems.
2. Earth's major systems (ecosystems and biogeochemical cycles), how they function and how they are affected by human activity (population growth, air, water and soil pollution, ozone depletion, global warming, and solid waste disposal).
3. the interaction of human society (urban sprawl, energy use/generation, resource consumption and economics) with the Earth's systems.

Part A - Pollution **24 hrs**

Unit I: **8 hrs**

A. Concept of Biosphere: Its components, hydrosphere, atmosphere, and lithosphere, Origin of life in the biosphere.

B. Water pollution: Definition, sources Types and classification of pollutants. Effects of Water Pollution, River Pollution, Oxygen sag curves and Eutrophication Drinking water: Collection, purification and distribution. Wastewater treatment: Primary, secondary and tertiary treatment.

Unit II: **8 hrs**

A. Atmospheric pollution: Primary and secondary air pollutants. Biological effects of Nox, SOx, 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.

UnitIII: **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.
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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.
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M.Sc., III Semester:
OPEN ELECTIVE-(For Science discipline students).
CONCEPTS OF ZOOLOGY.

48 Hrs

Course Outcome:
After completing the course student will be able to

1. Broader understanding of Zoology and its concepts
2. Understand the concepts and basics of animals taxonomy
3. Understand the basics of histology
4. Describe the structure and basic functions of organ systems
5. Explain ecological concepts and effects of environmental pollution
6. Explain the mechanism of inheritance.

1. Introduction: **8 Hrs**

a) Branches of animal science: Taxonomy, Animal Physiology, Genetics, Developmental Biology, Evolution, Ethology, Ecology, Applied Zoology, Entomology, Histology, c) Indian Wildlife- Status, Causes of wildlife depletion, Wildlife corridors, Conservation strategies- *In situ* and *Ex situ* d) e) Animals and human welfare.

2. Animal Taxonomy: **4 Hrs**

a) Carl Linnaeus – Taxonomic hierarchy: Kingdom, Division, Phylum, Class, Order, Family and Binomial nomenclature

3. Animal cells and Tissues : **8 Hrs**

a) Brief description of animal cell (light and ultra structure) b) Functions of cell organelles c) Structure and functional diversity in animal cell d) Cell division: Types and significance e) Structure and functions of basic tissues.

5. Structure and functions of organ systems: **16 Hrs**

a) Human alimentary canal and outlines of digestion and absorption
b) Respiration: Human respiration – exchange of gases.
c) Circulation : Structure of human heart, Blood vessels and capillaries, composition of blood, blood coagulation.
d) Excretion : Mammalian kidney and urine formation.
e) Locomotion in vertebrates – Swimming, walking running, flying
f) Nervous system and their functions, A brief account of human endocrine system
g) Reproduction : Asexual and sexual reproduction, significance of sexual reproduction, outlines of human reproduction and fertility control

6. Ecology and Environmental Biology: **8 Hrs**

a) Abiotic and Biotic factors b) Environmental Pollution – brief account of Air, Water and Noise pollution.

7. Heredity: **4 Hrs**

a) Continuity of life – Mendel's laws b) Structure of chromosomes c) DNA and RNA

TUTORIALS **2x16=32 Hrs**

REFERENCES :

1. Barnes, R. D. 1974. Invertebrate Zoology, III edition, W. B. Saunders Co., Philadelphia.
2. Barrington, E. J. W. 1976. Invertebrate structure and function. Thomas Nelson and Sons
3. Ltd., London

4. Hyman L. H. 1940. The invertebrates Vol.1 Protozoa through Ctenophora, McGraw hill
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15. Young. J. Z., 1950. Life of vertebrates The Oxford University Press, London
16. Young J Z 1957 Life of mammals, Oxford University Press, London.

M.Sc., IV SEMESTER
HC – 4.1 ADVANCED GENETICS AND COMPUTATIONAL BIOLOGY

32 hrs

Course Outcome:
After completing the course student will be able to

1. Understand the genomic organization of prokaryotes and eukaryotes.
2. Know the applications of various model organisms in genomic research.
3. Able to analyse the pedigree, psychosomatic disorders, prenatal diagnosis and genetic counselling.
4. Recognise few heritable diseases in man.
5. Understand the basic concepts of genomics
6. Understand the basic concepts of proteomics
7. Understand the nucleic acid and proteinr databases and tools**.**

Part A-Advanced Genetics

Unit I: Genome organization: 3 hrs

Prokaryotes, Eukaryotic nuclear genomes - C-value paradox, Eukaryotic organelle genomes Split Genes Mobile genetic elements in Prokaryotes (bacteria) and Eukaryotes (Drosophila, maize and humans), Genome Projects of model organisms (*C. elegans*, *Drosophila* and Mouse).

Unit II: Cancer Genetics: 5 hrs

Cancer incidence and mortality, types of cancer, causes of cancer, properties of cancer cells, Genetic basis of Carcinogenesis- Oncogenes: proto-oncogenes, oncogenes, retroviral oncogenes in human cancer. Tumor suppressor genes: Functions of tumor suppressor gene products. Cancer as a multistep process. Animal models of cancer research: Transgenic mouse and Drosophila models.

Unit III: Human genetics: 5 hrs

History of human genetics, pattern of inheritance, pedigree analysis. Human genome: Organization, distribution of genes, gene families. Genetic basis of syndromes and disorders: Cystic fibrosis, Neurofibromatosis, Schizophrenia, Anxiety disorder, Congenital heart diseases, Dyslexia.

Unit IV: Quantitative genetics: 3hrs

Introduction, types of quantitative trait, Nature of quantitative traits and their inheritance-Polygenic inheritance (Multifactorial hypothesis) – analysis of continuous variation; Variations associated with polygenic traits.

Part B-Computational Biology

Unit VII: Introduction and Scope of the Computational Biology **4 hrs**

Genomics: Definition and types of genomics Structural genomics: whole genome shotgun sequencing, gene annotation, gene families and clusters. Orthologs and paralogs. Functional genomics: Transcriptome, Microarray technology.

Unit VIII: Proteomics: **4 hrs**

Definition, Protein structure determination, protein domains, protein folding, Computer aided protein structure analysis, Protein-protein interactions, Protein microarrays.

Unit IX: Nucleic acid sequence and Protein analysis: **4 hrs**

Alignment, similarity searches including remote similarity searches, secondary structure element, motifs, Single nucleotide polymorphism (SNP), Two dimensional polyacrylamide gel electrophoresis, Mass Spectrometry.

Unit X: Genomics and proteomics databases and tools: **4 hrs**

Nucleic acid sequence databases and tools: Genbank, UCSC, ENSEMBL, EMBL, DDBJ, BLAST vs FASTA, file formats-FASTA, GCG, Genscan and ClustalW. Protein sequence databases and tools: Uni- prot, PDB, PIR, BLAST, PSI- BLAST (steps involved in use and interpretation of results).

PRACTICALS:

1. Study of mitotic chromosomes of *Drosophila* species- *Drosophila melanogaster*, *Drosophila nasuta*.
2. Preparation of metaphase chromosomes from bone marrow cells of mouse.
3. Karyotypic studies of normal human chromosomes and syndromes.
4. Creation of pedigrees and study of patterns of inheritance.
5. Studies on phenotypes of different diseases and syndromes.
6. Study of Quantitative characters: Sternopleurals, Acrosticals – mean, standard deviation.
7. Data mining for sequence analysis.
8. Web– based tools for sequence searches and homology screening-BLAST, FASTA
9. Nucleic acid sequence databases: GenBank retrieval, GeneScan.
10. Proteomics data bases: Uni-Prot, PROSITE, PDB, PIR, ProtParam.
11. Annotations: ORF finder, Use of ARTEMIS or any other suitable software

REFERENCES:

1. The Human Genome 2001, Nature Vol. 409.
2. The Drosophila Genome. 2000, Science Vol. 267.
3. The Caenorhabditis elegans genome 1998. Science Vol. 282.
4. Introduction to Genetic Analysis. Griffiths, Anthony J.F.; Miller, Jeffrey H.; Suzuki, David T.; Lewontin, Richard C.; Gelbart, William M. New York: W.H. Freeman & Co.; 1999
5. Fundamental Neuroscience. Larry R. Squire, Darwin Berg, Floyd Bloom, and Sascha du Lac. Third Edition, Academic Press; 3 edition (2008)
6. Principles of Neural Science. Eric R. Kandel, James H. Schwartz, and Thomas M. Jessell. McGraw-Hill Medical; 4 edition(2000)
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8. The Molecular and Genetic Basis of Neurologic and Psychiatric Disease. Roger N Rosenberg, Salvatore DiMauro, Henry L Paulson, and Louis Pt (2007) Lippincott Williams & Wilkins; Fourth edition

9. Bioinformatics for Dummies, Claverie J. M., Notredame C., (2nd Ed., 2007), Wiley Publishing, Inc., New York, USA
10. Brown T. A. 2007, Genomes 3. Garland Science Publishing, New York.
11. A.Malcolm Campbell and Laurie J.Heyer. Discovering Genomimcs, Proteomics and Bioinformatics. 2004. Low Price edition. Pearson Education, Inc.

M.Sc., IV SEMESTER
HC – 4.2 APPLIED ZOOLOGY

32 hrs

Course Outcome:

After completing the course student will be able to

1. Explain plant insect interaction, origin of pest and its control.
2. Understand vectors and its communicable diseases.
3. Explain races of silkworm their disease and its control.
4. Know about the importance of insects in forensic science and medicine.
5. Know about aquaculture and its practices in India.

UNIT I: Aquaculture **8hrs**

Aquaculture in India: an overview – nutritional value and food security - Site selection and preparation of culture ponds - Fish culture: carps, marine fishes and ornamental fishes. Prawn culture: Freshwater prawns and marine shrimps. Fattening of crabs. Crayfish and Lobster - Molluscs: mussels, clams, chanks and oysters including pearl oyster. Live feeds: micro algae, micro-invertebrates (*Artemia* nauplii, Rotifers, Cladocerans, Copepods, Ostracodes) and worms as live baits – Water quality management and maintenance of sanitation - Plant and animal nutrients - Balanced diet (iso-nitrous and iso-caloric) - Artificial feed formulation – Low cost feed formulation - Aquatic weeds.

UNIT II: Sericulture **8hrs**

Salient features of Saturnidae and Bombycidae. Mulberry and non mulberry silkworms, classification based on voltinism, moulting and geographic origin.

Morphology and life cycle of *Bombyx mori*. Structure and functions of Silk glands.

Silkworm rearing technology: Building, equipments, disinfection, environmental factors, Seed cocoons, preservation, grainage activity, LSPs, egg production, incubation, artificial hatching.

Pests and diseases: Protozoan, Fungal, Viral and Bacterial diseases and their control measures. Silkworm pests and Predators

UNIT III: Apiculture **8hrs**

Scope and its importance, Classification and morphology of honey bees, species and races of honey bees, tribal life and bee hunting. sex seperation, comb building, orientation of comb, communication, collection of propolis and water.

Honey and its chemical composition, medicinal importance.

Eonomic importance of honey, wax, bee pollination, pollen and Venom.

UNIT IV: Vermiculture **8hrs**

A. Introduction to vermiculture. Definition, meaning, history, economic importance, their value in maintenance of soil structure. Useful species : Local species and Exotic species of earthworms. Role of four R's.

B. Taxonomy Anatomy, Physiology and Reproduction of Lumbricidae and Eudrilidae.

C. Earthworm Farming (Vermiculture) for home gardens, larger scale, Extraction (harvest), vermicomposting harvest and processing.

D. Nutritional Composition of Vermicompost for plants, comparison with other fertilizers

E. Enemies of Earthworms, Sickness

PRACTICALS: 16X4=64 hrs

1. Study of morphometric characters of Indian major carps.
2. Diversity of fishes.
3. Collection of phytoplankton and zooplankton from natural resources and their identification.
4. Study of morphology of honey bee and cast system.
5. Mounting of mouth parts, stinging apparatus of honey bee.
6. Study of digestive system of honeybee.
7. Study of structure and types of honey comb.
8. Study of bee plants.
9. Study of morphology of lifecycle of *Bombyx mori*
10. Study of digestive and silk gland of *Bombyx mori*
11. Study of Non mulberry silkworms and their food plants.
12. Field trip- Collection of native earthworms & their identification
13. Study of systematic position& External characters of locally available earthworm species.
14. Mounting of setae and identification of earthworm species.
15. Study of equipments used in Vermiculture.

REFERENCES

1. Ashok Kumar (2009) Textbook of Animal Diseases
2. Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.
3. G.S. Shukla, V.B. Upadhyay (2006) Economic Zoology.
4. Kevin, A and K.E.Lee (1989) " Earthworm for Gardeners and Fisherman" (CSIRO, Australia, Division of Soils)
5. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.
6. Pradip. V Jabde, (2005) Text Book of Applied Zoology.
7. R. L. Kotpal (2000) Modern Textbook of Zoology. Rastogi Publications
8. Satchel, J.E. (1983) "Earthworm Ecology" Chapman Hall, London.
9. Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.

M.Sc., IV SEMESTER
HC – 4.3 Project

Course Outcome:

After completing the course student will be able to

1. understand the concepts of Project Management for planning to execution of projects
2. find importance of reference work Using tools of information such as periodical , journals, online resources
3. break work down the tasks of project and determine handover procedures
4. Interpret, analyse and presentation of the results obtained and compare with similar works and draw conclusion.

M.Sc., Examination
(Scheme CBCS)
M.Sc., ZOOLOGY
HARD CORE- Model question paper

Time: 3 hrs **Max Marks: 70**

Instructions: ***1. Answer all questions***
2. Illustrate your answer wherever necessary

I. Write short notes on the following: **[8×2=16]**

1.
2.
3.
4.
5.
6.
7.
8.

II. Write elaborate notes on any FIVE of the following: **[5×6=30]**

9.
10.
11.
12.
13.
14.
15.
16.

Q3. Answer the following: **[2×12=24]**

17. (i)
Or
(ii)

18. (i)
Or
(ii)

M.Sc Examination
(Scheme CBCS)
M.Sc., ZOOLOGY
Softcore - Model question paper

Time: 3 hrs **Max Marks: 70**

Instructions: ***1. Answer all questions***
2. Illustrate your answer wherever necessary

I. Write short notes on the following: **[8×2=16]**

1.
2.
3.
4.
5.
6.
7.
8.

II. Write elaborate notes on any FIVE of the following: **[5×6=30]**

9.
10.
11.
12.
13.
14.
15.
16.

Q3. Answer the following: **[2×12=24]**

17. (i)
Or
(ii)

18. (i)
Or
(ii)

M.Sc Examination
(Scheme CBCS)
M.Sc., ZOOLOGY
Open Elective-Model question paper

Time: 3 hrs **Max Marks: 70**

Instructions: ***1. Answer all questions***
2. Illustrate your answer wherever necessary

I. Write short notes on the following: **[8×2=16]**

1.
2.
3.
4.
5.
6.
7.
8.

II. Write elaborate notes on any FIVE of the following: **[5×6=30]**

9.
10.
11.
12.
13.
14.
15.
16.

Q3. Answer the following: **[2×12=24]**

17. (i)
Or
(ii)

18. (i)
Or
(ii)

BCA21001

I SEMESTER

BSC 1A) Computer Fundamentals & MIS
Credit (L: T: P = 4: 0: 0)

Course Outcome:

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

CO1: Explain the details of computer systems

CO2: Learn the classifications and characteristics of computer systems

CO3: Understand in details with examples software

CO4: Identify the characteristics of devices

CO5: Learn the classifications and characteristics of software

CO6: Understand the classification and characteristics of Memory units

CO7: Learn the classification and characteristics of CPU

CO8: Identify the characteristics of Computer Components

CO9: Understand the classification and characteristics of Computer Technologies

CO10: Learn the details of Computer Applications in Education and research

CO11: Identify in details with examples MIS

CO12: Specify in depth MIS

Unit - 1 15 Hours

Introduction: Introduction to computer systems, uses, types.

Human Computer Interface: Types of software, Operating systems as user interface, utility programs

Devices: Input and output devices (with comparisons and practical demo), keyboard, mouse, trackball, scanner, OCR, OMR, bar code reader, mark sensing, monitor, printer, plotter

Unit – 2 15 Hours

Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks

Computer Organization and Architecture: CPU, registers, system bus, main memory unit, cache memory, Inside a computer SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.

Unit – 3 15 Hours

Overview of Emerging Technologies: Bluetooth, cloud computing, big data, data mining, parallel computing and embedded systems.

Use of Computers in Education and Research: Data analysis, Homogeneous designs, statistics, Google Scholar, Domain specific packages such as SPSS, Mathematica, etc.

Unit – 4 15 Hours

MANAGEMENT INFORMATION SYSTEM: Introduction to data and information, Types of Information, Types of information Systems, Impact of MIS, Role and Importance, Managers and Activities in IS, Types of Computers Used by Organizations to Setting up MIS, Hardware support for MIS

Reference Books:

1. A. Goel, Computer Fundamentals, Pearson Education, 2010
2. P. Norton, Introduction to Computers, Tata McGraw Hill Education, 2010
3. V. Rajaraman, Fundamentals of Computers, PHI Learning, 2014

[illegible]

[illegible]

DSC 1A: Computer Fundamentals & MIS Lab
Credit (L: T: P = 0: 0: 2)

LIST OF EXPERIMENTS

1. Study and Identification of standard desktop personal computer
2. Commissioning of Motherboard and its interfacing components
3. Install and configure computer software and system components
4. Disk formatting, partitioning and DOS booting, system commands
5. Install, upgrade and configure Windows operating systems
6. Network Cabling, connection and NIC cloning
7. Identify, install and manage network connected [illegible] configuring IP address and Internet connection
8. Install, upgrade and configure Linux operating systems
9. Installation, functions and configure the software
10. Installation of printer and scanner software
11. Maintainability and Reparability of hardware
12. Trouble shooting and Debugging Techniques

UCA23B01

I SEMESTER

DSC 1A: Object Oriented Programming in C++
Credit (L: T: P = 4: 0: 0)

Course Outcome:

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

CO1. Facilitate the classification and comprehension of Basic of Problem Solving Techniques

CO2. Understand the details of Basic of Problem Solving Techniques

CO3. Learn in depth Basic concepts of OOPs and C++ Programming Language

CO4. Furthermore the details of Control Structures & Arrays in C++

CO5. Furthermore the details of Functions in C++

CO6. Learn the details of strings & pointers in C++

CO7. Learn the details of Structures and Unions in C++

CO8. Furthermore the details of Program Development using OOPs Concepts

Unit - I **15 Hours**

Problem solving aspects: Introduction, Problem definition, Problem analysis, Design of problem solution, Algorithm, Flowchart, Coding, Debugging, Types of errors in programming, Program Documentation and Program maintenance.

Techniques of Problem Solving: Flowcharts, algorithms, structured programming concepts, Programming methodologies viz- top-down and bottom-up programming.

Introduction to C++: Structure of C++ program, Tokens, Keywords, identifiers and constants, Basic Data Types, User-defined data types, Derived data Types, Symbolic constants, Declaration of variables, input-output Statements

Operators: Introduction, types of operators, Scope resolution operator, Memory management operators, Manipulators, Expressions and their types, Operator precedence and Evaluation

Unit - 2 **15 Hours**

Control structures: Selection statements - if statement, if-else, nested if, if-else-if ladder, switch statement with examples **Iterative / Looping statements:** for Loop, while loop, do-while loop with examples, Jumping Statements: Break, continue, goto, exit with examples

Arrays: Definition, declaration, initialization of 1D, 2D arrays with examples programs

Unit - 3 **15 Hours**

Functions: Function definition, types of functions, categories of functions, main function, Function prototype, Call by Value, Recursion, Inline functions, Default arguments, const arguments, math. Built-in functions, passing array as an argument, function overloading

Strings: Introduction, Initialization, operations on Strings and String functions

Pointers: Definition, Declaration, initialization, void pointer, pointer variables, pointer arithmetic, Accessing variable through pointers

Unit –4

Structures and Unions: Definition, Declaration, initialization, Nested structures, Accessing structure members, Passing of Structures, Array of structures

Unions: Definition, Declaration, Difference between structures and unions

Object Oriented Concepts: Concept of OOPS, Benefits of OOPS and Applications of OOPS

Classes and Objects: Specifying a Class, Defining class member and member functions, declaring member functions outside the class, Access Specifiers, Object Definition, Creating objects, Accessing members inside and outside the class, Difference between structure and class

Reference Books:

1. [illegible] "Computer Fundamentals", [illegible] Publications, [illegible].
2. [illegible] Computer Fundamentals, Pearson Education, [illegible].
3. [illegible] Oriented Programming with C++, [illegible], [illegible] Programming in Object-oriented Programming, New Delhi, [illegible]
4. [illegible] Oriented Programming with C++, [illegible] Hall of India
5. Robert Lafore, An introduction to Object-Oriented Application Development, Thomson learning, [illegible]
6. [illegible] to C++ Programming Language, Addison Wesley, [illegible]

IECA21004

UNCERTAIN

BSC 3.6: Object Oriented Programming in C++ Lab

Credit (L: T: P = 0: 0: 2)

Part-A

1. Program to find the roots of a quadratic equation.
2. Program to find whether given number is even or odd.
3. Program to find largest of 3 no's using nested if.
4. Program to display fibonacci sequence using switch statement.
5. Program to calculate simple & compound interest.
6. Program to find sum & mean of n elements in a one dimensional array.
7. Program to generate Pythagorean triples upto a given no.
8. Program to find factorial of a given no.
9. Program to search an element in a one dimensional array.
10. Program to display a pyramid numbers & their sum.

Part-B

1. Program to swap two no's using call by reference.
2. Program to illustrate inline function.
3. Program to illustrate friend function.
4. Program to illustrate operator overloading.
5. Ping program to illustrate inline function.
6. Program to illustrate multiple inheritance.
7. Program to create a class called employee. Write a program to illustrate inline function using array of objects.
8. Program to create a class called student & to accept & display necessary details of a student using derived class.
9. Program to create a class called bank & accept customer data.
10. Program to illustrate function over loading.

BCBE0301

II SEMESTER

DSC 4A: Data Structures and File Processing
Credit (L: T: P = 4: 0: 0)

Course Outcome:

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

CO1. Learn the classification, characteristics and understanding of Data structures

CO2. Understand in depth Primitive & non Primitive Data structures with its Applications

CO3. Specify the details of Searching Techniques

CO4. Specify the details of Sorting Techniques

CO5. Understand in details with examples Basic Concepts of Memory Management Techniques

CO6. Understand in depth File System Operations

CO7. Specify the characteristics of File Organization Methods

CO8. Understand in details with examples of Storage Devices

Unit – 1 15 Hours

Basic Data Structures: Introduction- Primitive and non-primitive, Abstract data structures, Operations, Data representation, Arrays - Memory representation of one and two dimensional arrays, Stack – Operations, Applications – Recursion, infix to postfix conversion, evaluation of postfix expression, **Note:** Necessary implementations, Queues – Operations, Applications, circular queue operations, D-queue, priority queue - most of priority queues.

Unit – 2 15 Hours

Pointers and operations, Dynamic memory allocation, Linked list – Singly linked list operations, Circular linked list – Operations, Applications of linked list, doubly linked list operations, representations and Operations.

Trees: terminologies, Types,Memory Representation,varying Arrays and Linked Lists and Operations on binary trees, Introduction to Graphs

Unit – 3 15 Hours

Searching and sorting – sequential and binary search, sorting – bubble, insertion, quick sort and heap sort, comparison of different sorting techniques, Memory management: Garbage collection algorithms for equal sized blocks, storage allocation of objects with mixed size, buddy system.

Unit – 4 15 Hours

Physical Devices: Characteristics of storage devices such as disks and tapes, I/O buffering

Basic File System & Operations: Introduction to File, Create, open, close, read, write, File System Access, read/write, allow, protection mechanisms

File Organizations: Sequential, ordered sequential, direct, inverted, multi-list, directory systems

Reference Books:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

ECH2101

II SEMESTER

DSC 4A: Data Structures and File Processing Lab

Credit (L: T: P = 0: 0: 2)

Part - A

1. Program to find lower triangular and upper triangular matrices for the given matrix.
2. Write an interactive program to insert an element in the given position and delete an element at the specified position on the given array.
3. Program to search an element using the method of sequential with locations in linear order.
4. Program to sort the given 10 x N matrix row-wise and column-wise using bubble sorting technique.
5. Write an interactive program to search an element in the given linear array using linear and binary searching techniques.
6. Write a program to merge two sorted arrays.

Part - B

1. Write an interactive program to implement the following operations on stack using arrays
   a. PUSH b. POP
2. Program to implement Towers of Hanoi problem.
3. Write an interactive program to perform insertion and deletion operations in Linear Queue using arrays.
4. Write an interactive program to perform insertion and deletion operations in Circular Queue using arrays.
5. Write an interactive program to insert a node at a desired list in the front, delete a node from the rear and display.
6. Write an interactive program to implement the stack operations using and to evaluate a postfix expression using linked list.

Note: Lecturer May Change the Programs without decreasing Theory Paper

(CBCS001)

II SEMESTER

DSC 1A: Operating Systems with Linux
Credit (L: T: P = 4: 0: 0)

Course Outcome:

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

CO1 Learn to install a OS example as Linux or Ubuntu

CO2 Learn the details of operating system organization

CO3 Understand the classification and characteristics of Process Management and Scheduling mechanisms

CO4 Understand in depth Memory Management and allocation strategies

CO5 Learn to develop solid examples basic concepts of shell scripting

CO6 Understand in depth basic Linux environment

Unit - I **15 Hours**

Introduction: Systems Software, Operating Abstraction, OS examples, Types of operating systems – Multiprogramming, Batch, Time Sharing, Single user and Multiuser, Preemptive, Distributed & Real Time Systems.

Operating System Organization: Factors in operating system design, basis OS functions, implementation considerations, process models, methods of requesting system services, system calls and system programs.

Unit - II **15 Hours**

Process Management: System view of the process and resources, scheduling, the OS, process address space, process abstraction, process hierarchy, Thread model

Unit - III **15 Hours**

Scheduling: Scheduling Mechanisms, Strategy selection, non-preemptive and preemptive strategies.

Memory Management: Mapping addresses, linked vs. memory space.

Unit - IV **15 Hours**

Memory allocation strategies: fixed partition, variable partition, paging, virtual memory

Shell introduction and Shell Scripting: What is shell and various type of shell, Various commands in Linux, Different modes of operation in vi editor, What is shell script, Writing and executing the shell script, Shell Layers (user defined and system variables), Reserved Variables, Positional Parameters, Escape sequence, Quotes, Back quote operator, Command Line Processing, Exit status of command, Decision making in Shell Scripts (if, else, nested-if, elif), Loops in shell, Functions, Local and global variables, Command Line Arguments (Positional Parameters), Interrupt processing, Debugging shell scripts.

Reference Books:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]

BE IIIZS101

III SEMESTER

BME 6xx: Operating Systems with Linux Lab

Credit (L: T: P = 0: 0: 2)

Subject: Lab based on Operating Systems

Note: Following exercises can be performed using Linux or UNIX

1. Usage of following commands: ls, pwd, cp, rm, mv, who, who am i, cat, mkdir, rmdir, more, tail
2. Usage of following commands: cal, cat (append), cat (concatenate), tee, cp, mod, date
3. Usage of following commands: chmod, grep, kpsd (show), fg/(right), bg
4. Write a shell script to check if the number entered at the command line is prime or not.
5. Write a shell script to modify "cal" command to display calendars of the specified months.
6. Write a shell script to modify "cal" command to display calendars of the specified range of months.
7. Write a shell script to accept a login name. If not a valid login name display message – "Invalid login name" else "valid"
8. Write a shell script to display date in the mm/dd/yy format.
9. Write a shell script to display on the screen initial output of "who" command along with the total number of users.
10. Write a shell script to display the multiplication table any number.
11. Write a shell script to compare two files and if found equal asks the user to delete the duplicate file.
12. Write a shell script to find the sum of digits of a given number.
13. Write a shell script to merge the contents of three files, sort the contents and then display them page by page.
14. Write a shell script to find the LCD (least common divisor) of two numbers.
15. Write a shell script to perform the tasks of basic calculator.
16. Write a shell script to find the factors of a given number.
17. Write a shell script to find the factorial of a given number.
18. Write a shell script to check whether the number is Armstrong or not.
19. Write a shell script to check whether the file have all the permissions or not.
20. Program to count the presence of special character "*".

ECC21001

III SEMESTER

DSC 7A: Programming in JAVA
Credit (L: T: P = 4: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to:
CO1: Definitions on depth java programming fundamental
CO2: Specify in details with examples Basic java OOPs Concepts
CO3: Understand in depth OOPs Concepts
CO4: Understand in depth java Interfaces and packages
CO5: Deliberate the details of Exception handling in java
CO6: Deliberate the details of Multithreading & I/O operations in java
CO7: Identify the classification and characteristics of File handling in java
CO8: Examine details of File handling in java
CO9: Assess the characteristics of Applet Programming

Unit - I 15 Hours

Introduction to Java: Features of Java, JDK Environment, Object Oriented Programming Concepts, Principles of Programming Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA, JDK Environment

Java Programming Fundamental: Structure of java program, Data types, Declaration of variables, scope of variables, Keywords, operators, separators, literals, Machine security, I/O, Command line arguments, Decision Making statements, iterative statements, jumping statements, type conversion and casting

Unit - 2 15 Hours

Classes and Objects: Defining a Class, Field Declaration, Methods Declaration, Creating an Object, Accessing class members, Assigning Object Reference Variables, Access specifiers, Constructor, Types of Constructors, this keyword, instance variable hiding, Garbage Collection, Finalize method, method overloading, overloading Constructor, Understanding static, Introducing final, Recursion.

Inheritance: Definition, Types of inheritance, Member Access, Uses of Super, Method Overriding, Dynamic Method Dispatch, Abstract class and Methods, Uses final, Object Class, Nested and Inner classes

Arrays and Strings: Arrays, Creating an array, Types of Arrays, arrays accessing methods, operations, String class methods, String Buffer methods.

Unit - 3 15 Hours

Abstract Class, Interface and Packages: Modifiers and Access Control, Abstract Class and methods, Interfaces, Packages, Concepts, definitions, JAVA API packages, using interfaces, creating packages, Accessing Packages, using packages, adding a class to a package, hiding class, static import

Interface: Introduction, Defining Interfaces, Implementing Interfaces, Nested Interfaces, Extending interfaces, Accessing Interface variables

Exception Handling: Introduction, Types of Errors, Exceptions, Syntax of Exception handling code, Multiple catch statements, multiple catch Statements, Nested try Statements, Throw, Throwing our own exceptions, Exits statement, java built in exceptions classes

Unit : 6 **15 Hours**

Multithreading: Introduction, Creating Threads, Extending the Thread Class, Implementing runnable interface, Declaring the Class, Implementing the run () Method, starting new thread, stopping and blocking thread, thread life cycle, thread Priority

Input and Output: Concept of Streams, Stream Classes, Byte Stream classes, Character Stream classes, reading Console input, Writing Console Output, reading & Writing Files

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

References Books:

1. Joel Murach, Anne Boehm, Murach's Java Servlets and JSP (Murach: Professional Guide), 3rd Edition, 2014
2. Paul Deitel, Harvey Deitel, Java SE 8 for Programmers, 3rd Edition, 2015
3. Herbert Schildt, Java: The Complete Reference, 9th Edition, 2014
4. Balaguruswamy, Programming with JAVA, 3rd Edition, 2007

BCC21101

III SEMESTER

DSC 7A: Programming in JAVA Lab

Credit (L: T: P = 0: 0: 2)

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 largest of three numbers using ternary operator
3. Write a java program to find out roots of the quadratic equation
4. Write a java program to check whether given date is valid or not
5. Write a java program to implement switch Statement using nested if statement
6. Write a java program to generate the following pattern

```
                    A
                  A B A
                A B C B A
              A B C D C B A
            A B C D E D C B A
```

7. Write a java program to find sum of all digits of a given number and given number format, reject illegal

8. Write a program to create an array of 10 integers. Accept values from the user in the array. Input another number from the user and find how many numbers are equal to given number present, how many are greater and how many are less than the number taken.

9. Write a java program to join the given strings using StringBuffer.

10. Write a java program to find the mean and sum of the given natural numbers.

PART B

1. Write a java program [illegible] to process Natural and Living (Class and Object)
2. Write a java program to check whether several characters in a String are consecutive or not. (Constructor)
3. Write a java program to Encapsulate Method Overloading
4. Write java program to generate Student marks card (Using Inheritance)
5. Write a java program to calculate Salary for different employees using abstract class
6. Write a java program to Demonstrate Method Overriding
7. Write a java program to find user's own exception number for the variables a and b. If any other character except number is entered from the user to caught by Number Format Exception object. After that use getMessage() to print the information about the exception number
8. Write a java program to Demonstrate multiple Inheritance using Interface
9. Write a java program to Demonstrate exception handling
10. Write a applet program to generate the following pattern

[illegible]

III SEMESTER

[illegible] Database Management Systems

Credit: [illegible]

Course Objective

[illegible]

Unit - I 15 Hours

Introduction to Database Management Systems: [illegible] Purpose of database systems. Characteristics of DB – Roll [illegible] Data models: network, hierarchical, and data. Hierarchical model: [illegible] Physical data organization. Indexing: B+ tree index files, B tree index files, Hashing. Relational Model: Concepts, Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus, Query by Example, Overview of the SQL Language: Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Subqueries, Complex Queries, Views, Modification of the Database, Joined Relations, Data Definition Language, Embedded SQL, Dynamic SQL, Other SQL Features.

Unit - II 15 Hours

Entity Relationship and Enhanced ER Modelling: Entity types, Entity Sets, Attributes and Keys, Relationship Types, Roles and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, Design Issues, Subclasses, Superclasses, Specialization, Generalization, Constraints and Characteristics of Specialization and Generalization, Relationship types of degree higher than two, Data Modeling using Entity and Value sets, Modeling of UNION types using categories.

Unit - III 15 Hours

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

Database design: ER and EER to relational mapping, Functional dependencies, normal forms based on primary keys, second normal form, third normal form, BCNF.

Unit - IV 15 Hours

[illegible] SQL: [illegible] SQL as a "real" data sub-language, SQL commands and data types, operators and expressions, [illegible] Queries.

[illegible] Data and data [illegible] Queries, [illegible] Commands for data insertion, updates, deletion, Basic data retrieval queries, SELECT statement, Select-from-where, group by and having clauses, Aggregate operator, Null values, comparisons involving NULL and three-valued logic, Nested queries, Complex retrieval queries, Views, Specification of constraints, Index definition, Examples of queries in SQL.

Characters, tokens in a machine-level representation
Constants in a machine-level program
Introduction to graph [ref: 1's, 2's, 3's, 4's, 5's, 6's, 7's, 8's, 9's, 10's]
Simple data structures in C (Using Arrays, Structures, Unions and Pointers), Structures, Nested Structures, Arrays of Structures, Unions, Bit Fields, Self-referential Structures, Dynamic Memory Allocation, Linked Lists, Linked Stacks and Linked Queues, Enumerated Types, Command Line Arguments, Pointers to Functions, Typedef, Bit Fields

Reference Books:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010.
2. R. Ramakrishnan, J. Gehrke, Database Management Systems, 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw-Hill, 2010.
4. E. Horowitz, S. Sahni, Fundamentals of Data Structures in C++, 2nd Edition, Universities Press, 2008.

BCC2204

III SEMESTER

DSC 8.1: Database Management Systems Lab

Credit (L: T: P = 0: 0: 2)

Software Lab based on Database Management Systems

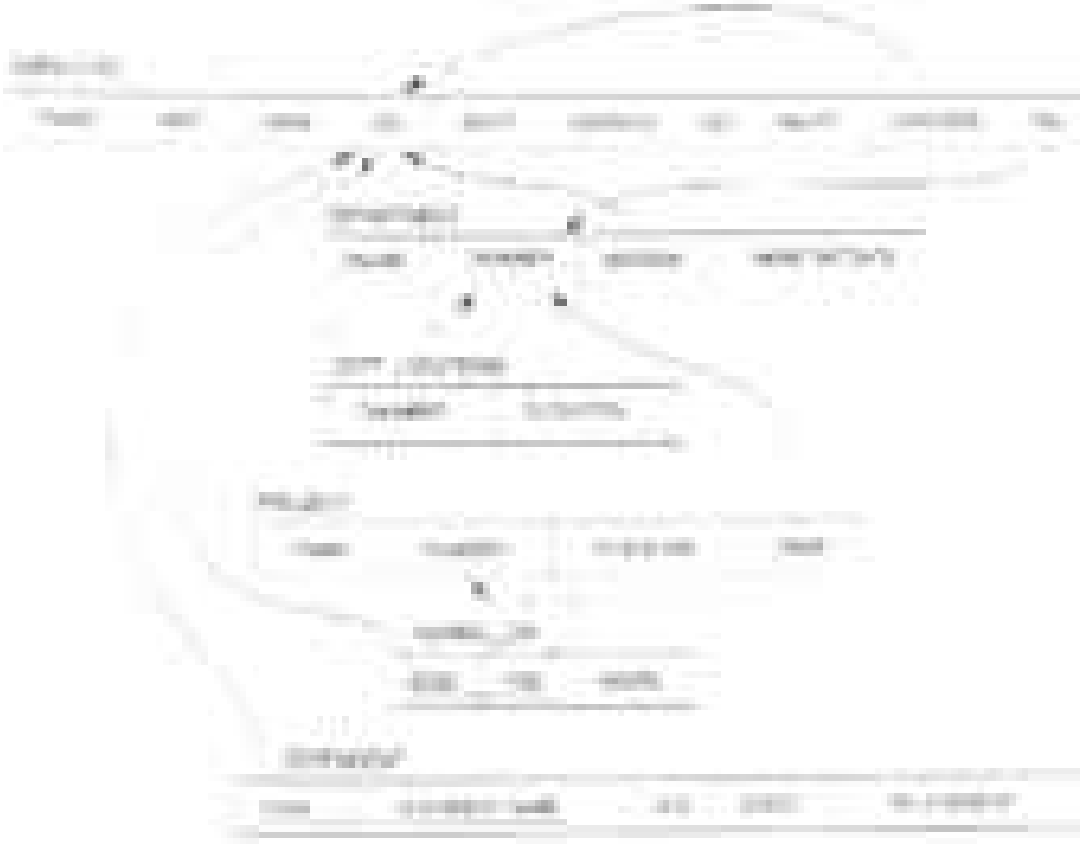
The following exercises must be introduced in the laboratory. **Note:** MS Access / MySQL may be used.

DDL Commands

- Create table, alter table, drop table

DML Commands

- Select, update, delete and insert statements
- Constraint specification using Boolean and comparison operators such as =, <, >, <=, >=, <>
- Arithmetic operators and aggregate functions (Count, sum, avg, Min, Max)
- Multiple table queries (join on different and same tables) + Nested subquery statements
- Set manipulation using (any, in, exists, all, not in, not exists, union, intersect, minus, except, etc.)
- Categorization using group by, ……having
- Arranging using order by



1. Create tables with appropriate foreign key constraints.
2. Populate the tables with data.
3. Perform the following queries on the database.
   a. Display all the details of all employees working in the company.
   b. Display any location, Income, address of employees who work in accounting dept ?
   c. Retrieve the firstname and address of the employees whose name is 'Franklin T Wong'.
4. Retrieve the name and salary of every employee.
5. Retrieve all distinct salary values.
6. Retrieve all employee names whose address is in 'Bellaire'.
7. Retrieve all employees who were born during the 1950s.
8. Retrieve all employees in department 5 whose salary is between 30000 and 40000(inclusive).
9. Retrieve the number of all employees who do not have supervisors.
10. Retrieve SSN and department name for all employees.
11. Retrieve the name and address of all employees who work for the 'Research' department. Use for every project located in 'Stafford'. List the project number, the controlling department number and the department manager's last name, address and birth date.
12. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
13. Retrieve all combinations of Employee Name and Department Name.

[illegible]

[illegible]

[illegible]

Course Outcome:

[illegible]

Unit - 1 **15 Hours**

Introduction to Web Design: Introduction to HyperText Markup Language (HTML), Header Levels, Embedding Text, Graphical Elements, Inserting Images, Lists, Hyperlinks, tables. **Frames:** Introduction, Features, Frame attributes of frames, Creating web pages. **HTML:** Basics of DHTML, DHTML modules, Extensions, Events, collections, table of elements, Internet [illegible].

Unit - 2 **15 Hours**

Cascading Style Sheets: Introduction, Understanding the Basic CSS syntax, Types of style sheets, text and fonts, and background properties, Font properties, Font properties, and border properties, Margin properties, padding list & table properties, CSS - [illegible]. [illegible] - The positioned Property, float and clear, the display, Internet and Printers, Visual Effects.

[illegible] - Browser Compat, Border Images, Backgrounds, Colors, Gradients, Shadows, Text Effects, Web Fonts, 2D & 3D Transforms, Transitions, Animations.

Unit - 3 **15 Hours**

Javascript: Introduction, Use script in HTML, Use script functions, comments, Expressions, Data types, operators, Conditional statements, Loop statements, Arguments Property, Arrays, Array & Boolean Objects, Math & Date Objects, String & Number Objects, Scripts and event handling, & Some document objects.

Unit - 4 **15 Hours**

Events: Introduction, syntax, taxonomy, Events, Effects, Help/Show, Fade, Slide, Animate, stop (), Callback, Chaining.

jQuery HTML: Introduction, Get (or) Add, Remove, CSS Classes, css (), Dimensions.

jQuery Traversing: Introduction, Dimensions, Siblings & Filtering.

Bootstrap: Introduction, Grid Basic, Typography, Forms, Tables, Images, Jumbotron, Alerts, Buttons, Wells, List Groups, Cards, Breadcrumbs, Pagination, Basic, Navbar, Themes, Layouts, Panel Groups, Context Forms, Carousel, Modals, Tooltip, Popovers, Tabs, Scrollspy, Affix, Grid, Responsive Utilities, Glyphs, Filters.

Reference Books:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]

ECC23B5

III SEMESTER

BSC 9A: Web Technologies Lab

Credit (L: T: P = 0: 0: 2)

1. Program for forwarding URL
2. Creating a Webpage having Hyperlink
3. Creating Types of Lists (Ordered, Unordered, Definition)
4. Creating a Nested List
5. Creating a Time Table
6. Creating a HTML document having vertical frames
7. Creating Student Application Form
8. Program to insert audio & video files
9. Creating Internal & External Style Sheets
10. Program to Margin & Padding
11. Program to create a Greeting card
12. Program to image transparency
13. Program to generate a Dynamic event in JavaScript
14. Program to display Random Colors in JavaScript
15. Program to create Pop-up Boxes
16. Program to generate multiplication table
17. Program to find even and odd numbers
18. Program to add 2 numbers
19. Program to find factorial of a numbers
20. Program to generate 2 different patterns
21. Program to change background color after 5 sec in page load
22. Display reverse of a given number
23. Display Hello World (alert)
24. Design simple Experiment with the Using Bootstrap
25. Design Web page using Bootstrap and Jquery

SCS23501

IV SEMESTER

DSC 10A: Numerical Analysis and Statistics
Credit (L: T: P = 4: 0: 0)

Course Outcomes:

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

CO1. Understand the details of Computer Numerical data and arithmetic

CO2. Understand the classification and characteristics of Iterative Methods in numerical analysis

CO3. Differentiate in details with examples Matrices and linear system of Equations

CO4. Specify in details with examples Interpolation

CO5. Understand in depth Numerical integration and differentiation

CO6. Learn the details of Importance and Limitations of statistics

Unit : I **12 Hours**

Computer Arithmetic: Fixed- and Floating-point representations, Normalization of numbers, Errors in numbers;

Iterative methods: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson method

Unit : II **09 Hours**

Matrices and Linear System of Equations: LU decomposition method, Gauss elimination, Gauss-Jordal and Gauss Jacobi for solving system of equations

Interpolation: Polynomial interpolation, Newton-Gregory forward and backward interpolation, Newton's divided difference interpolation formulae

Unit : III **10 Hours**

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rule,

Numerical Differentiation: Euler's, modified Euler's and Runge-Kutta (RK) 2nd order and 4th order

Unit : IV **15 Hours**

Statistics: Definitions, Importance, Functions and Limitations of statistics

Graphic presentation: Frequency distribution, Histogram, Frequency polygon, Frequency curve and Ogive, Measures of central tendency: (Mean, Median, Mode) Dispersion, Correlation, Regression

Reference Books:

1. E.V. Krishnamurthy, Sh. Kavi, Introductory numerical analysis, 2nd Ed., Wiley, 2021.
2. S. Sawant, S.S. Iyengar, Introduction to Parallel Algorithms, Wiley Interscience, 1994.
3. A. Khanal, B.B. Subedee, An introduction to numerical methods: A MATLAB approach, Chapman and Hall/CRC, 2021.
4. K. Ipsilon, A friendly introduction to Numerical Analysis, Pearson Education, 2007.
5. S.S. Sinha and S.P. Ghosal, An introduction to Programming and Numerical Methods, Mc Graw Hill Education, 2019.
6. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 7th Ed., New Age International Publishers, 2021.
7. Computer oriented numerical methods by V. Rajaraman
8. Statistics Theory and Practice by R.S.N Pillai, Sapna edn
9. Practical statistics by S.P. Gupta

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IV SEMESTER

DSC 18A: Numerical Analysis and Statistics Lab
Credit (L: T: P = 0: 0: 3)

Software lab based on numerical techniques and statistics

1. Bisection method
2. Regula falsi method
3. Newton-Raphson
4. Secant
5. LU decomposition
6. Gauss elimination
7. Gauss-Jacobi
8. Gauss-Seidel
9. Euler's
10. modified Euler's
11. Runge Kutta 2nd order
12. Runge Kutta 4th order
13. Trapezoidal
14. Simpson's 1/3 rd Rule
15. Simpson's 3/8 th Rule
16. Finding the mean, median and mode of a set of data
17. Finding the range of a set of data
18. Finding the standard deviation of a set of data
19. Pearson's forward and Backward Interpolation
20. Newton's divided difference

CCBD2001

IV SEMESTER
DSC 11A: J2EE
Credit (L: T: P = 4: 0: 0)

Course Outcome(s):

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

CO 1. Learn the details of Basic elements of J2EE

CO 2. Get to know the details of Concepts of Multi-Tier Architectures

CO 3. Understand the characteristics of Enterprise Application Strategy

CO 4. Write clever to depth Basic Concepts of JDBC

CO 5. Identify in details with examples implementation of SQL Commands Using JDBC objects

CO 6. Learn in details with examples Basic Concepts of Servlets

CO 7. Learn in details with examples Basic Concepts of JSP

Unit - I **15 Hours**

Introduction: The ABC of Programming Languages, taking programming languages up a notch, the beginning of java, java byte-code, the advantages of Java, J2EE and J2SE.

J2EE Multi-Tier Architecture: Distributive systems, the Tier, J2EE Multi-Tier architecture, Client Tier implementation, Web Tier implementation, Enterprise JavaBeans Tier implementation, Enterprise Information Systems Tier implementation, Challenges

J2EE Best Practices: Enterprise Application Strategy, The enterprise application, clusters, Session Management, Web Tier and Java Server pages, Enterprise Java Beans Tier, The perils of using inheritance, Immutable classes, Performance Enhancements, The power of finalizers, The power of threads, The power of Serialization.

Unit - 2 **10 Hours**

RDBMS Database Concepts: Data, Databases, Database Schema, the Art of Indexing

JDBC Objects: The concept of JDBC, JDBC Driver Types, JDBC packages, A Brief Overview of the JDBC Process, Database Connection, Associating the JDBC / ODBC Bridge with the database, Statement Objects, Result Set, Transaction Processing, and Metadata.

Unit - 3 **10 Hours**

RMI and Embedded SQL: Model Programs, Model A Program, Model B Program, Advice, Creating a Table, Dropping a Table, Indexing, Creating an Index, Dropping an Index, Inserting Data into tables, Inserting a Row, Inserting the systems date into a column, Inserting the system User into a column, Inserting a Timestamp into a column, Selecting Data from a Table, Selecting all data from a Table, Requesting rare columns, Requesting multiple columns, Renaming rows, Requesting rows and columns, AND, OR, and NOT clauses, Joining multiple compound expressions, equal & not equal operators, Less than & greater than operators, Less than equal to & greater than equal to, BETWEEN, LIKE, IS NULL Operator, DISTINCT Modifier, Summaries

Unit – 6

Metadata: Number of columns in result set, Data type of a column, Name of a colu
Column Size, updating Tables: Updating a row and columns, updating multiple rows, Dele
Data from a table, Deleting a Row from a table, locating tables, Calculating Data Using
and ordering data, sub queries, view

Java Servlet: Java Servlets and common gateway interface programming: Benefits of
a Java servlet, A simple Java Servlets, Anatomy of a java Servlet: Development Strategy
Reading Data from a client, Reading HTTP request Headers, Sending Data to a Client
writing the HTTP response Header, Working with cookies, Tracking Sessions, Ja
reference guide.

JAVA Server Pages: JSP installation, JSP Tags: Variables & objects, Methods, Cont
Statements, Loops, Textcon, Request string, Parsing other information, User sessi
cookies, Session objects, Quick reference guide.

Reference Books:

1. The complete reference (JSP seventh edition) and J (complete edition) overview
2. (JSP) The complete reference – McGraw-Hill Education

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IV SEMESTER
DSC 11A: J2EE Lab
Credit (L: T: P = 0: 0: 2)

1. Program for Create JDBC Connection
2. Application to access the database using the java Database Connectivity (JDBC)
3. Perform a Database Query and Store Results
4. Write a program to display a day of a given date
5. Write a program to display request header information.
6. Write a program to calculate income tax of a customer using JavaBean
7. Write a program to display cookie value, cookie age and cookie path
8. Write a program in JSP that to set and then display the cookie
9. Write a program for Quick sort algorithm.
10. Write a JAVA Servlets Program to implement a database which using Servlets (user name and password should be accepted using HTML and displayed using a Servlet)
11. Write a JAVA Servlets Program to download a file and display it on the screen (A link has to be provided in HTML, when the link is clicked corresponding file has to be displayed on screen)
12. Write a Java Servlets Program to implement Request (HttpServlet object must include () and forward () methods)
13. Write a Java Servlets Program to implement and demonstrate get() and Post methods using HTTP Servlets Class.
14. Write a Java Servlets Program to implement send Redirect () method using HTTP Servlets Class.
15. Write a JAVA Servlets Program to implement sessions (Using HTTP Session interface).
16. Write a JAVA JSP Program to print ID value and ID name numbers.
17. Write a JAVA JSP Program to implement verification of a particular user login and display a welcome page.
18. Write a JAVA JSP Program to get student information through a HTML and create a JAVA Bean Class, populate bean and display the same information through another JSP.
19. Write a JAVA JSP Program which uses Java plugin tag to run a applet.
20. Write a JAVA JSP Program which implements request login and also use Tag Support Class.

ECD13001

IV SEMESTER

DSC 11A: Software Engineering and Software Testing
Credit (L: T: P = 4: 0: 0)

Course Outcomes:

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

CO 1. Understand in details with examples Concepts of Software process
CO 2. Specify the details of Software requirements and analysis
CO 3. Learn in depth Design concepts and principles of software engineering
CO 4. Understand in depth software Configuration Management and Project Management
CO 5. Learn in details with examples Software Testings
CO 6. Specify in depth issues in software engineering

Unit - 1 [illegible]

Software Process: Introduction, S/W Engineering Paradigm, life cycle models (waterfall, incremental, spiral, evolutionary, prototyping, object oriented). System engineering, computer based system, verification, validation, life cycle process, development process, system engineering hierarchy.

Software requirements: Functional and non-functional, user, system, requirement engineering process, feasibility studies, requirements, elicitation, validation and management, software prototyping, prototyping in the software process, rapid prototyping techniques, user interface prototyping, S/W documents.

Unit - 2 [illegible]

Software Analysis: Analysis and modeling, data, functional and behavioral models, structured analysis and data dictionary.

Design Concepts and Principles: Design process and concepts, modular design, design heuristic, design model and documents, Architectural design, software architecture, data design, architectural design, transform and transaction mapping, user interface design, user interface design principles, Real time systems, Real time software design, system design, real time executives, real time operating system, monitoring and control systems.

Unit - 3 [illegible]

Software Configuration Management: The SCM process, Version control, Change control, Configuration audit, SCM standards.

Software Project Management: Measures and measurements, S/W complexity and software science, size oriented, data and logic structure oriented, information flow oriented, Estimation for Software Projects, Empirical Estimation Models, Project Scheduling

Unit – 6 **12 Hours**

Testing: Taxonomy of software testing, levels, test activities, types of s/w test, black box testing, and testing boundary conditions, structural testing, test coverage criteria based on data flow, mutation testing, regression testing, testing in the large, S/W testing strategies, strategic approach and issues, unit testing, integration testing, validation testing, system testing and debugging.

Trends in Software Engineering: Reverse Engineering and Re-engineering – overview – Case Study of CASE tools.

Reference Books:

1. Roger S. Pressman, Software engineering: A practitioner's Approach, McGraw-Hill
2. Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2001
3. Pankaj Jalote, An integrated Approach to Software Engineering, Springer Verlag, 1997
4. James F. Peters and Witold Pedrycz, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2000
5. Ali Behforooz and Frederick J. Hudson, "Software Engineering Fundamentals", Oxford University Press, New Delhi, 1996
6. Pfleeger, " Software Engineering", Pearson Education India, New Delhi, 1999.
7. Carlo Ghezzi, Mehdi Jazayeri and Dino Mandrioli, "Fundamentals of Software Engineering", Prentice Hall of India, New Delhi, 1991.

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IV SEMESTER

Dsd: LLx: Software Engineering and Software Testing Lab

Credit (L: T: P = 0: 0: 2)

Lab based on Software Engineering

1. Problem Title
   - Problem Statement
   - Process Model
2. Requirement Analysis
   - Creating a Data Flow
   - Data Dictionary
   - Use Cases
3. Project Management
   - Computing FP
   - Effort
   - Schedule, Risk Table, Timeline chart
4. Design Engineering
   - Architectural Design
   - Data Design, Component Level Design
5. Testing
   - Black Box Testing, Sample Program like
   - ITC Room Information (Write an application about the Test number and Test name and Item
   - Car Pooling (Locomotion a web based software application that enables the
   - Employee online attendance application to avoid the facility of carrying attendance
   - Result Improvement and Prescription Management System
   - Advanced Road Mapping Management Software
   - Parking Allocation System
   - Wholesale Management System

U22CS601

V SEMESTER

DSE 1A: Elective: Data Communication and Computer Networks
Credit (L: T: P = 4: 0: 0)

Course Objectives:

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

CO 1) Learn in depth Concepts of Data Communication and network Systems

CO 2) Learn in depth Transmission Media

CO 3) Understanding the various classification and characteristics of Signals

CO 4) Understand in details with examples Network Models

CO 5) Learn in depth Error Detection and Correction Algorithms

CO 6) Get Exposure to hands on with examples Switching Concepts

CO 7) Get Exposure the classification and characteristics of networking and internetworking Devices

Unit – 1 **15 Hours**

Data Communications: Components, Data Representation, Data Flow

Networks: Network criteria, Physical Structures, Topology (Mesh, Star, Tree, Bus, Ring, Hybrid)

Categories of Networks: LAN, MAN, WAN

History of Network: Protocols and Standards, Standards Organizations, organizations.

Addressing: Physical, Logical, Port, Specific.

Unit – 2 **15 Hours**

Transmission Media: Guided Media – Twisted pair cable, co-axial cable, optical fiber, 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 vs 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 Concepts: Working principle of circuit switching and packet switching, Circuit switched networks, Data phases, efficiency, delay, Data gram network, routing tables, delay, efficiency, virtual.

Error Detection and Correction: Types of Errors, Redundancy, Error detection vers Correction

Error Detection: Parity check, Cyclic Redundancy Check (CRC), Check Sum, Correction : Retransmission, Forward Error Correction, Point error Correction.

Unit - 4 (12

Networking and Internetworking Devices: Connecting Devices – Hubs, Bus amplifiers, Bridges – Link bridges, transparent bridges, Source route bridges, Bridges, Layer and 3 layer switches.

Routing Concepts: Types, Shortest path, Routing

Wireless Lan's: Bluetooth - Architecture, Bluetooth layers.

Network Layer: IPV4, IPV6 addresses

Transport Layer: UDP – user datagram, operations, Applications TCP – Service segment, STCP – flow/crtl, packet format.

Application Layer: : SMTP, SNMP, HTTP, FTP

Reference Books:

1. [illegible]
2. Computer Network – Tanenbaum – 3rd Edition
3. Computer Network – Larry L. Peterson & Bruce S. Davie

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V SEMESTER

DSE 1A: Elective: Data Communication and Computer Networks Credit (L: T: P = 6: 0: 2)

1. Program for Identifying valid Internet Ports
2. Program for Data Retrieval from Remote Database
3. Program for Simulating HTTP Client
4. Program for Simulating Telnet Client
5. Program for Simple file transfer between two systems, Cwithout using Ftp
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 (Fewer Nos) IC Ask user for it
13. Network address with automatic subnet address generation

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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: Determine the classification and characteristics of 2D Graphics

CO4: Understand the characteristics of 3D Graphics

CO5: Determine the details of Transformation and Viewing Techniques

CO6: Learn the details of Illumination and Colour 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: Basic 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. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

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V SEMESTER

DSE 1B: Elective: Computer Graphics Lab
Credit (L: T: P = 0: 0: 2)

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]

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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 its features with examples Text, Images, Sound and Videos

CO3. Learn in depth Animation Techniques

CO4. Understand the details of Multimedia in Internet

CO5. Synthesize 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, indexed 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", Tata, Eighth edition
2. Ralf Steinmetz and Klara Nahrstedt, "Multimedia: Computing, Communications Applications", Pearson
3. Khalid, "Multimedia Handbook", TMH
4. K. Andleigh and K. Thakkar, "Multimedia System Design", PHI

SUBJECT

V SEMESTER

DSE 1(C) Elective: Multimedia Systems and Applications Lab

Credit (L: T: P = 0: 0: 2)

Practical exercises based on concepts learnt in theory using Programming tools in offli
assessment tool: LOHP Boards / Audacity/ Assessment Tools/ Image Editors/ Video Edi

Implement the following using Director –

1. Create an animation using the tools panel and the properties panel to create the follo
   - Line, pie, oval, circle, rectangle, square, pencil, brush and eraser 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 selecting the centre dot
4. Create an animation using layers having following features: Insert layer, Delete l
   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 line-out text in which both starts from the same point an
   over the text.
7. Create an animation to which text fields are connected into Good Bye m
   motion-shape tweening)
8. Create an animation having five images having fade in fade-out effect.
9. Create an scene to show the motion (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 s
    into another.
12. Create an animation for bouncing ball (you may use motion guide layer).

OR

Project:

Design a minimum 10-pages interactive website using Joomla or WordPress.

[illegible]

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 details Developing Simple Web Applications 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, List 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, Button Controls, 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 Themes: ASP.NET Website Themes, 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 Views, Wizard Control, Summary

Reference Books:

1. Matthew MacDonald, ASP.Net The Complete Reference, Mcgraw-Hill, 2002.

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V SEMESTER

BSE 2A: Elective: ASP.Net Lab
Credit (L: T: P = 0: 0: 2)

LAB MANUAL:

1. Write a Program to generate the fractional sequence.
2. Write a Program to perform Binary 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 Text view operation.
8. Write a Program to display the picture list 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.

[illegible]

V SEMESTER

18SE 2B: Elective: Visual Programming
Credit (L: T: P = 4: 0:0)

(Note: [illegible] with Python Assignments [illegible] with [illegible])

Course Outcomes:

After successful completion of the course, the student is able to:
[illegible]. Learn in details with examples Basic concept of IDE/Environment
[illegible]. Different the details of GUI Controls
[illegible]. Learn in details with examples Data types and Operations in Visual Programming
[illegible]. Learn in details with examples Control statements in Visual Programming
[illegible]. Write down in details with examples Modular Programming
[illegible]. Learn in details of Events Handling in Visual Programming
[illegible]. Understand in depth Database Connectivity in Visual Programming

Unit - I **15 Hours**

[illegible] Environment: Introduction to graphical user interface (GUI) programming language [illegible] Object oriented event driven, the GUI environment compiling, debugging, and testing the program

Controls: Introduction to controls: textboxes, frames, check boxes, option buttons, images, [illegible] forms and styles, the shape control, the line control, working with multiple controls and their properties, designing the user interface, keyboard access, tab controls, default & [illegible] property, coding for controls

Operations: Data types, constants, named & intrinsic, declaring variables, scope of variables [illegible] functions, arithmetic operations, forecasting data.

Unit - 2: **15 Hours**

Decision Making: If statement, comparing strings, compound conditions (and, or, not), [illegible] of statements, user interface using if statements with option buttons & check boxes, displaying messages in message box, testing whether input is valid or not

Modular programming: Using sub-procedures and sub-functions, dividing [illegible] creating and modifying a menu, using common dialog box, executing a new sub-procedure, passing arguments to procedures, passing arguments by value or by reference, writing a function procedure.

Unit - 3 **15 Hours**

Forms Handling: Multiple forms, creating, adding, removing forms in projects, hide, show methods, load, unload statements, my keyword, referring to objects on a different forms

Exception Handling: On Error, Err and Exit, using Err.Raise statement, using error Function, Library and Grouped Data Controls: arrays – [illegible] arrays, initializing an array, using [illegible] with arrays, user-defined data types, accessing information with user-defined data types, using [illegible] with arrays, two dimensional arrays

Unit - 4 15 Hr

Ems, loops and printing list boxes & combo boxes. Using the list index property and add item method, clear method, list box properties, removing an item from a list, list count, two dimensional.

Database Connectivity: Database connectivity of forms with back end tool like mysql inserting data in text boxes, list boxes etc, searching of data in database using forms, updating/ retrieving data based on a criterion.

Reference Books:

1 References: Programming in Visual Basic 6.0 by Julia Case Bradley, Anita C. Millspaugh (Tata Mcgraw hill Edition 2000 Incorporation Reprint (2004))

ECEP5101

V SEMESTER

DSE 2B: Elective: Visual ProgrammingLab
Credit (L: T: P = 0: 0: 2)

1. Print a table of numbers from 1 to 10 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 the numbers.
5. A person deposits Rs. 1000 in a fixed account yielding 9% interest. Compute 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 zeros 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 table with the following mentioned fields:

UCE2x001

V SEMESTER

DSE2C: PHP Programming with MySQL

Credit (L: T: P = 4: 0: 0)

Course Outcome:

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

CO1: Learn in depth Elements of PHP

CO2: Learn in depth Interaction Methods Between HTML and PHP

CO3: Understand in depth PHP Services

CO4: Understand in depth String Manipulations

CO5: Learn the characteristics of Regular Expressions

CO6: Learn the details of Developing PHP Web Applications

Unit - 1 **15 Hours**

Introduction, Basic PHP Development, Control Structure, Introduction to arrays, History, understanding client/server, editor, 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, Assessing 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 Cloning, Exceptions

Using Cookies: What are Cookies? – Setting Cookies – Using Cookie variables – Session Basics: What is a session? – Understanding Session variables – Managing User preferences – Security Issues – Graphics: Drawing functions

Unit - 4

INTRODUCTION TO DATABASE: What is RDBMS technology, Introduction to MySQL, creating a database, adding data to a table, displaying data, Web pages, Finding the number of rows, Inserting, Deleting, Getting metadata, Encoding multiple queries, Understanding Primary and Foreign Key, Database Normalization, Dealing with Date and Time

Reference Books:

1. Complete Beginner's Guide to Web Programming & Web Development, Author: JQ Software 2015
2. PHP and MySQL Web Development by Luke Thomas and Laid Welling
3. PHP Application Programming by Jim Keogh and Mario Lurig
4. PHP 6: A Beginner's Guide by Vikram Vaswani
5. Judy Adams and Matt Telles, PHP 6, Course Technology, 2010(All learning units)
6. Steve Holzner, PHP: The Complete Reference, Tata McGraw Hill Publication, 2008.
7. Steve Tilkins, Peter Armstrong and Deepak Vohra, Pro JSP 2nd Edition, Apress, 2003

ECE26R01

V SEMESTER

DSECC: 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 print the multiplication table for a given number using PHP.
6. Design a web page that would compare 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 'Welcome' date and time message in 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 Bezier 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.

SCS17DSE1

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 Creation of Algorithms

CO2. Learn in details with examples Algorithm Design Techniques

CO3. Get Exposure to Apply Sorting Techniques

CO4. Get Exposure to Apply of Searching Techniques

CO5. Identify in details with examples Analysis of Graph Algorithms

CO6. Learn the details of Dynamic Programming Methods

Unit – 1 **18 Hours**

Introduction: Notion of Algorithm, Review of Asymptotic Notations, Mathematical analysis of Non-Recursive and Recursive Algorithms, Correctness of Algorithm

Algorithm Design Techniques: Iterative technique, Divide and conquer, greedy algorithm

Sorting Techniques: Selection sort, bubble sort, Insertion sort, shell sorting techniques, merge sort, heap sort, Radix sort.

Unit – 2: **18 Hours**

The Greedy Method: General Method – Container Loading – Knapsack Problem – Tree Vertex Splitting

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, Searching a Graph, Biconnected Graph problem.

Unit – 3 **18 Hours**

Dynamic Programming: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths, Single-Source Shortest Paths: The Traveling Salesperson problem

Unit – 4 **18 Hours**

Flow Shop Scheduling – 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 Algorithms Padma Reddy
2. A.V. Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Ig 2006.
3. S. Dasgupta and U. Vazirani, Algorithms Design, Pearson Education, 2006.
4. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Com Algorithms, Universities Press, Second Edition, Reprint 2008.
5. A.A.Puntambekar, Analysis and Design Of Algorithms, Technical Publications,

EDE2P101

V SEMESTER

DSE 3A: Elective: Analysis and Design of Algorithms Lo

(4 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 Kruskal's Algorithm
12. Implement Travelling Salesperson problem
13. Implement Floyd's Algorithm
14. Implement Depth First Search
15. Implement Binary Search tree

BCE20001

V SEMESTER

DSE 1B: 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 **25 Hours**

Event Driven Programming: UI event loop, Threading for background tasks, Define a custom delegation notification, Model View Controller (MVC) design pattern.
Mobile application issues: Limited resources (memory, display, network, file system), Input (Apps touch-based and gestured, sensors (camera, compass, accelerometer, GPS)

Unit - 2 **25 Hours**

Development tools: Apple OS X toolchain (Objective-C, Xcode III, Interface Builder, Cocoa classes).
Frameworks: Objective-C and Foundation Frameworks, Cocoa Touch, UI Kit, Others: User Notifications, 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 Layouts.
Data Persistence: Marshaling data between application invocations, File system, Property lists, SQLite, User Defaults.

Unit - 4 **15 Hours**

Remote Data Storage and Communication: 'Back End' / server side of applications, SOAP/xml programming, HTTP get, post, put, delete, stateless design, server side JavaScript / JSON.
Code signing: security, Keychain, Developers and App Store License Agreement.

References:

1. Rajiv Ramnath, Roger Crawfis, and Paride Dalfonzo, Android SDK 3.x for Dummies, Wiley, 2011.
2. Wei-Meng Lee, Beginning Android Application Development and Deployment, Wrox, 2012.
3. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009.
4. Professional Android Application Development, Wrox, 2009.
5. Christian Crumlish and Erik Meyer, Designing Social Interfaces, O'Reilly Media, 2009.
6. Robert F. Smith, Raul Raja, "Android Recipes", Manning Publications, 2011.

ECE38101

V SEMESTER

DSE 3th: 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 about User Interfaces
7. Sample Application about Animations
8. Create a Project based on above topic
9. Sample Application about Android Store
10. Sample Application about SQLite I
11. Sample Application about SQLite II
12. Project Presentation

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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: Understand the details of Concepts of Machine Learning
CO2: Learn to classify with examples for Machine Learning Software
CO3: Specify the details of Linear Algebra
CO4: Differentiate 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 **18 Hours**

Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical learning, Bayesian Methods, The Naive Bayes Classifier.

Unit – 2 **18 Hours**

Software's for Machine learning and Linear Algebra Overview: Plotting of Data, Vectorization, Matrices and vectors, addition, multiplication, Transpose and inverse using available tool/ work on MATLAB.

Unit – 3 **18 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 **18 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 Regression, 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. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

ECE29101

V SEMESTER

DSE 3C: Elective: Machine Learning Lab

Credits (L: T: P = 0: 0: 2)

For practical Labs for Machine Learning, students may use software like MATLAB/Octave or Python. For Data analytics, students can choose any tool of their choice or software from online repositories like UCI Machine Learning Repository

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, Ex-OR, Ex-NOR, NOT, NAND, NOR.
3. Create variables and display simple variables and simple strings and use simple formatting for variables
4. Create Octave/MATLAB single dimension, multi-dimension arrays and arrays with specific values like array of all zeros, all ones, array with random values within a range, array of Special matrix.
5. Use command to compute the size of a matrix, size/length of a particular row/column, load data from a text file, save matrix data to a text file, finding any variables and its features in the current scope.
6. Perform basic operations on matrices like addition, subtraction, multiplication and also another specific one on elements of the matrix.
7. Perform other matrix operations like converting matrix data to absolute values, taking the negative of matrix values, adding/multiplying rows/columns from a matrix, finding the transpose of individual values in a matrix or an entire matrix, and finding the maximum of some or all elements in a matrix.
8. Create various type of plots/charts like histograms, plot based on one/multiple functions based on data from a matrix, Put labels and 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 examples.
11. Perform advanced implementation of simple matrix operations like finding the transpose of a matrix, adding, subtracting or multiplying two matrices.
12. Implement Linear Regression problem. For example, based on a dataset containing existing set of prices and area size of the houses, predict the estimated price of a given house.
13. Based on available features suitable perform Linear Regression. For example, based on a number of additional features like number of bedrooms, number of bathrooms, number of floors 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' past records, whether a student is suitable for a particular activity or not. Based on the available dataset, a student can also implement another classification problem like checking whether an email is spam or not.
15. Implement functions for regularization of dataset based on problems 14.
16. Implement neural networks like Backpropagation Algorithm on backpropagation – algorithm to predict the value of a variable based on the dataset in problem 14.

B.C.A. (2019)

V SEMESTER

(Shifted from I Semester)

SEC 1A: Elective: Mathematics

Credit (L: T: P = 2: 0: 0)

Course Outcome:

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

CO 1. Understand in details with examples trigonometry

CO 2. Understand the classification and characteristics of Analytic geometry

CO 3. Facilitate in details with examples straight lines

CO 4. Specify in details with examples pair of lines

CO 5. Specify the classification and characteristics of circles

Unit – I **15 Hours**

Trigonometry (6h)

Addition Trigonometric functions and identities Allied angles Trigonometric functions of compound angles and multiple angles Transformation formulae.

Unit – 2 **15 Hours**

Analytical Geometry

Circle Equation of a circle in various forms area of a triangle

Equation of Pair Equation of circle with its

Reference Books:

1. Theory and Problems in Mathematics – I by BOSCO Publications 2004.
2. Theory and Problems in Mathematics – II by BOSCO Publications 2004.
3. Engineering Mathematics Volumes I-IV by S Chandrasekhar.

BCE30201

V SEMESTER
(Shifted from II Semester)
SEC III: Elective: Business Mathematics

Credit (L: T: P = 2: 0: 0)

Course Outcome:

After successful completion of the course, the student is able to
CO 1. Specify the characteristics of matrices and determinants
CO 2. Write down to deals with complex numbers and determinants
CO 3. Delineate the characteristics of algebra
CO 4. Learn the classification and characteristics of permutation and combination
CO 5. Get known to deals with examples mathematical induction

Unit - I

Matrices and Determinants: Various types of matrices-Addition and subtraction of ma... and multiplication of a matrix by a scalar-Product of matrices. Evaluation of determi... order two and three-Properties of determinants (statement only)-Cramer's rule-Singu... non-singular matrix-Inverse of a non-singular matrix-Product of two determinants.

Unit - II

Algebra: Partial fractions-Proper and improper fractions-Permutation-Circular Permu... Combination-Standard deviation. Mathematical induction-Examples of sums using ... $\sum n^2$ and $\sum n^3$-Binomial theorem for a positive integral index-Binomial coefficients.

Reference Books:

1. Mathematics for Economics and Business by P.A. Bhardwaj
2. Business Mathematics by Parimalsenchaudhary
3. Business Mathematics by D.C. Sancheti and V.K. Kapoor
4. Mathematical Economics by Dowling, E. Edward
5. Mathematical Analysis for Economics by Allen, R.G.D.
6. Algebra by Vasishtha, Shanmugavelu Prasad and Ganapathy

BCCE38405

V SEMESTER

(Shifted from 6 Semester)

SEC II: Elective: Accountancy & Financial Management

Credit (L: T: P = 2: 0: 0)

Course Outcome:

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

CO 1: Delineate the details of Basic Accounting Concepts

CO 2: Specify in depth Examples of Accounting

CO 3: Understand the detail Concepts of Costing

CO 4: Learn to debate with numerous Budgetary Control

Unit - I **15 Hours**

ACCOUNTING:

Introduction: Principles, concepts and conventions, double entry system of accounting, ledger balancing.

Subsidiary books with special reference to simple cash book and three columns cash book. Trial balance and final accounts of sole trader: Preparation trial balance adjusting entries, including revenue for bad debts, provision for discount on debtors and creditors, preparation of final accounts.

Unit - II **15 Hours**

COSTING & BUDGETARY CONTROL:

Funds flow statement: Meaning and concepts of funds, preparation of fund flow statement. Cost accounting: Preparation of cost sheet and tender price statement.

Marginal costing: Concepts, Marginal cost equations, P/V ratio, B.E.P., Margin of safety. Ratio to earn a desired profit. Problems on the above.

Reference Books:

1. Accountancy Vol. I by B.S. Raman
2. Accountancy Vol. II by B.S. Raman
3. Management Accounting by S.K. Sharma and Gupta
4. Financial Management by I.M. Pandey

ECE30601

V SEMESTER
(Guided from II Semester)
SEC 1B: Elective: Entrepreneurship Development
Credit (L: T: P = 2: 0: 0)

Course Outcome:

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

CO1. Specify the characteristics of Entrepreneurship
CO2. Determine the details of identification of opportunities
CO3. Understand in depth Feasibility and financial management of the Project
CO4. Write down the details of Project Report
CO5. Learn the characteristics of SWOT Techniques
CO6. Learn the details of Enterprise Rules and regulations

Unit – 1 8h

Need – scope and characteristics of entrepreneurship: special schemes for e.g. entrepreneur EDP.

Identification of opportunities: Exposure to Personal traits, Resource based, Inventions orientation and export promotion schemes. Market survey techniques. Need scope and approaches for the project formulation. Criteria for the principles for selection and development. Structure of the project report. Choice of technology: Plant equipment. Institutions financing procedure and financial assistance. Financial ratios their significance.

Unit – 2 8h

Books of accounts, financial statements and funds flow analysis. Resource management: machine and material. Planning tools for establishing SSI

a. CREATIVITY AND INNOVATION
b. BUSINESS ORGANIZATION APPROACH
c. STRENGTH AND WEAKNESS OPPORTUNITY AND THREAT ANALYSIS

Various economics feasibility of the project. Plan layout and process planning for SSI. Quality control / quality assurance and testing of the products. Costing and pricing. Management of self and understanding human behavior. Guidance to small scale industries and their remedial measures.

Reference Books:

1. Entrepreneurship Development – Kuriakose
2. Entrepreneurship Development – Vasanthdesai

BCAEM501

V SEMESTER

SEC 2A: Elective: Object Oriented Modeling& Design with UML
Credit (L: T: P = 0: 0: 2)

Course Outcome:

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

CO1. Understand 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 assigned by him or she OO analysis & design for the project problem, and develop use case model, analysis model and design model for it, using UML.

Practical assignment:

Three assignments, one on each of the diagrams used 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 Hard-ware Object Oriented systems with UML – Charles Wallace
4. Object Oriented Analysis & Design- Satir singh Bedi, Shri P Thomas
5. Object Oriented Modeling and Design – James Rumbaugh
6. Teach Yourself UML in 24 Hours - Joseph Schmuller

BCE16B04

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. Develop programs to handle with examples JQuery

CO2. Explain the details of JQuery Demo apps

CO3. Specify the details of Ways For Implementation of JQuery

CO4. Explore the details of Design and use of JQuery

JQuery Lab

a. Test if jQuery is loaded

b. Scroll to the top of the page with jQuery

c. Disable right click events on html page using jquery

d. Block form using jQuery

e. Create a Zebra Stripes table effect

f. Print a page using jQuery

g. Limit character input in the text area including counts

h. Create a div using jQuery with style tag

i. Move one DIV element inside another using jQuery.

j. Add a list element within an unordered list element

k. Remove all the options of a select box and then add one option and select it

l. How to get the value of a textbox using jQuery?

m. Remove style added with css() function using jQuery

n. Distinguish between left and right mouse click with jQuery

o. Check if an object is a jQuery object

p. How to detect whether the user has pressed 'home key' using jQuery

q. How to get textarea text using jQuery

r. Access form input fields using jQuery

s. Convert a jQuery object into a string

t. How to detect if textbox's content has changed using jQuery?

u. Remove a specific value from an array using jQuery

v. Add options to a drop-down list using jQuery

w. Delete all table rows except First one using jQuery

x. Count Child elements using jQuery

y. Restrict "question" only input for textboxes including decimal points

z. Set value in input text using jQuery

aa. Set a value in a span using jQuery

bb. Find the class of the clicked element

cc. Set html attribute in runtime using jquery

dd. Find the total width of an element (including width, padding, and border) in jQuery

ee. Change options of select using JQuery

ff. Append HTML from database using JQuery

V CBM501

V SEMESTER

SEC 2B: Elective: MongoDB

Credit (L: T: P = 4: 0: 2)

Course Outcome:

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

CO1: Understand 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

a. Write a MongoDB query to display all the documents in the collection restaurants.

b. Write a MongoDB query to display the fields restaurant_id, name, borough and cuisine for all the documents in the collection restaurant.

c. 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.

d. 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.

e. Write a MongoDB query to display all the restaurants which is in the borough Bronx.

f. Write a MongoDB query to display the first 5 restaurants which is in the borough Bronx.

g. Write a MongoDB query to display the next 3 restaurants after skipping first 5 which are in the borough Bronx.

h. Write a MongoDB query to find the restaurants who achieved a score more than 90.

i. Write a MongoDB query to find the restaurants that achieved a score, more than 80 but less than 100.

j. Write a MongoDB query to find the restaurants which locates in latitude value less than -95.754168.

k. 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.

l. 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.

m. 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.

n. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which cuisine 'Wil' as first three letters for its name.

o. Write a MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which cuisine not as last three letters for its name.

p. 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.

q. Write a MongoDB query to find the restaurants which belong to the borough Bronx and prepared either American or Chinese dish.

i. 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.

ii. 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.

iii. 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

iv. Write a MongoDB query to find the restaurant id, name, borough and cuisine for those restaurants which prepared dish except 'American' and 'Chinese' or restaurant's name begins with letter 'Wil'.

v. 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 ISO Date "2014-08-11T00:00:00Z" among many of survey dates.

vi. 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 ISO Date "2014-08-11T00:00:00Z".

vii. 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.

viii. Write a MongoDB query to arrange the name of the restaurants in ascending order along with all the columns.

ix. Write a MongoDB query to arrange the name of the restaurants in descending along with all the columns.

x. 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.

xi. Write a MongoDB query to know whether all the addresses contains the street or not.

xii. Write a MongoDB query which will select all documents in the restaurants collection where the coord field value is Double.

xiii. 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.

xiv. 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.

xv. Write a MongoDB query to find the restaurant name, borough, longitude and latitude and cuisine for those restaurants which contains 'Mad' as first three letters of its name.

22323003

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: Deal themselves in depth Transportation Problems

CO4: Deal themselves in depth Assignment Problem

CO5: Identify the details with examples Network Analysis

CO6: Learn in depth Applications of Operation Research

Unit – 1 **15 Hours**

Linear Programming Problem: Origin and development of operations research, formulation of Linear Programming problem, Graphical solution.

Theory of simplex method, Use of artificial variables and their solutions.

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 PERT/CPT Evaluation and Review Technique, Algorithm and flow chart for CPM and PERT.

Reference Books:

1) Taha, "Operations Research", 9th edition, Pearson Education, 2007.
2) Sharma J. K. (2014), "Introduction to Operations Research", Pinnacle Publishing House, Delhi, 1979.
3) Gupta Prem Kumar "Operations Research", Delhi Mac Millan, 1983.

ECP23101

VI SEMESTER

DSE 4A: Elective: Operation Research Lab
Credit (L: T: P = 0: 0:3)

Lab based on Operation Research

1. LPP
2. Simplex
3. Dual Simplex
4. Big – M
5. Vogel's
6. Maximin and Minimax
7. North West corner
8. Sequencing Problems
9. Modi Method
10. Hungarian Method
11. Assignment Problem

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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. Understand 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. Understand the details of ERP Modules
CO6. Identify 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, PeopleSoft, JD Edwards World Solutions Company, System Software Associates.

Reference Books:

1. C.S. V.Murthy Enterprise Resource Planning
2. V.K. Sahni – Enterprise Resource Planning – ABS
3. Alexis Leon, Leon Publishers, Enterprise Resource Planning
4. Ivan deraspelchi, Scott Cleaper, Pearson Education, "Managing Business Process Flows"
5. Jawadekar, PHI, Enterprise Resource Planning
6. Tata McGraw Hill Publishers, Enterprise Resource Planning
7. V. Sreedhar and Suman Garg prints, Jaico Publishers, PHI, Enterprise Resource Planning
8. Introduction to ERP, an Overview of SD, MM, PP, FICO, Modules of SAP, SI, Developments, Enterprise Resource Planning

ECE3218i

VI SEMESTER

DSE 4B: Elective: Enterprise Resource Planning Lab
Credit (L: T: P = 0: 0: 2)

Students should be prepare ERP Solution Report for the / her Case Study which the supervision of Teacher/ Lecturer

(CE13004)

VI SEMESTER

DSE 4C: Elective: E-Commerce Technologies

Credit (L: T: P = 4: 0: 0)

Course Outcomes:

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 to develop with examples Concepts of Electronic Data Exchange and applications

CO5: Learn to develop 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, e-Commerce, Commerce and Electronic Commerce (EC), (EC), (EC), (EC), B2B, B2C, P2P, B2A, C2A, B2B, B2C)

The Internet and WWW: Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .net, .gov, .mil, etc.), Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of domain in IIUI Application, building your website, Uses, Uses, Search Engine, Working of Domain Name: Web promotion, Target email, Internet Exchange, Shopping Sites

Unit - 2 **15 Hours**

Internet Security: Internet Security Issues Overview, Computer Security Classifications, Intellectual Property Issues, 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 fraud/ privacy, Computer Crime Issues, Types of Criminal 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 Cryptography, RSA, Authentication and Authorization, Firewall, Digital Signature (How it Works)

Unit - 3 **15 Hours**

Electronic Data Exchange: Introduction, Concepts of EDI and Limitations, 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 modes: Payment cards (credit/debit cards, smart cards, online and offline Cards, Advantages and disadvantages of electronic cash (e-cash), e-commerce security: Why need it? E-mail security (pretty good privacy (PGP), secured socket layer, secure electronic transaction (SET), symmetric and asymmetric cryptography, digital signatures, public key infrastructure (PKI), Firewalls.

Unit - 4 **15 Hours**

Planning for Electronic Commerce: Planning Electronic Commerce systems, linking objectives to business strategies, measuring cost objectives, comparing benefits to Cost, Strategies for developing electronic commerce web sites.

Internet Marketing: The PROS and CONS of online shopping, the costs of online shopping, Costly on Internet business, Internet marketing techniques, The Levels 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.

References Books:

1. [illegible] E-Commerce Concepts, Models, Strategies – [illegible] Publishing House, 2011
2. [illegible] & Ruiz and [illegible], E-Commerce, 2004
3. Gary P. Schneider, Electronic commerce, International Student Edition, 2011.
4. [illegible] Electronic Commerce – Framework Technologies & Applications, [illegible] Edition, Wiley Student Edition, 2011

ECP21101

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

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VI SEMESTER

DSE 8A: 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. Identify 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 Applications of Cloud Computing

Unit – 1 **18 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 **18 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 Documents – 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 **18 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. (with forward) "Cloud Computing" Wiley India Edition 2010
2. John Rittinghouse& James Ransome, "Cloud Computing implementation Management and Strategy", CRC Press, 2010
3. Anthony 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, 2005

Online Reading/Supporting Material

1. Neeraj Sharma "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing", Applications and Data Centers in the Cloud with SLAs, Version 1(e-version), July 2009
2. Wallpapers style on Pinterest - 伪装, [Viva 假日]Summer%20Cruise by sydney.mendlock.org
3. www.cloudbus.org/meeting/ http://www.manjrasoft.com/
4. hadoop.apache.org
5. http://hadoop.apache.org/docs/r1.0.4/hdfs_design.html
6. http://www.google.com/search?client=safari&rls=en&q=Amazon+S3+Service+Level+Agreement&ie=UTF-8&oe=UTF-8

EC2410I

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) Managed data
   c) Manage your calendar, to-do lists
   d) A document editing suite
4. Exploring Open source cloud (Any one)

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VI SEMESTER

DSE 5E: Elective: Data Mining and Data Warehousing

Credit (L: T: P = 6: 0: 0)

Course Outcomes:

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

CO1 : Understand the characteristics of Data Warehousing

CO2 : Understand the issues in Data Warehousing maintenance

CO3 : Be Conversant in basic Data Mining

CO4 : Learn to associate with examples Association Rule Mining

CO5 : Identify the issues in Classification and Prediction Techniques

CO6 : Learn to apply Clustering Methods

CO7 : Write down on latest Applications of Data Mining

Unit – 1 **15 Hours**

Data Warehousing: Introduction- Definitions and descriptions used for data warehousing- Need for strategic information- Failures of past decision support systems- OLTP v/s DWSB- OLAP- Operational models of DWH- Applications of DWH.

Data Warehousing Architecture: Reference architecture- Components of reference architecture - Data warehouse building blocks- implementation phases- design process and DWH implementation phases.

Unit - 2 **15 Hours**

Data Warehouse Data Model- Data Warehouse Architecture

Data Mining: Data mining- need- Data mining vs OLTP- Issues in data mining- Data Mining techniques- 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 database - Mining multi dimensional association rules.

Classification and Prediction: Classification Techniques - Issues regarding classification and prediction - decision tree - Bayesian classification - Classification accuracy.

Unit – 4 **15 Hours**

Clustering: Clustering - Methods - Outlier analysis

Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms- Data mining- Web mining.

Reference Books:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]

[illegible]

6 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: Practicals are to be done using Weka, and a report prepared as per the format. The operations are to be performed on built-in datasets (data sets of weka and/or to downloadable datasets mentioned in references below. Also wherever applicable, the parameter values are to be varied (upto 3 distinct values). The Visualizer tab is to be explored with each operation.

1. Pre-processing: Apply the following filters :
   a. weka.filters.supervised.instance.[illegible] AddClassification, AttributeSelection, Discretize, NominalToBinary
   b. weka.filters.supervised.instance.[illegible] StratifiedRemoveFolds, Resample
   c. weka.filters.unsupervised.attribute.[illegible] AddExpression, AddNoise, Center, Discretize, MathExpression, Merge2Values, NominalToBinary, NormalizeMissingValues, NumericToNominal, Normalize, Standardize, PrincipalComponents, RandomSubset, Remove, RemoveType, ReplaceMissingValues, Standardize
   d. weka.filters.unsupervised.instance.[illegible] Randomize, Resample, RemoveFrequentValues, RemoveWithValues, Normalize, SubsetByExpression
2. Explore the select attribute as follows
   weka.attributeSelection.[illegible] InfoGainAttributeEval, WrapperSubsetEval
3. Association mining
   weka.associations.[illegible] Apriori, PRIncremental
4. Classification**
   weka.classifiers.[illegible] bayes, weka.classifiers.lazy.[illegible] IBk, IBkupdateClassifier, KStar, LWL, RandomTree, J48
5. Clustering**
   weka.clusters.[illegible] SimpleKMeans, FarthestFirst algorithm, HierarchicalClusterer

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VI SEMESTER

DSE 9C) 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. Define/state in details with examples Artificial intelligence (AI)

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, Constraint 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 systems, Frame based system. Inference – Backward chaining, Forward chaining, Rule based approach, Frame reasoning - Common Sense, Bayesian Theory-Bayesian Network-Dempster -Shafer theory

Unit - 3 **15 Hours**

PLANNING AND MACHINE LEARNING: Basic plan generation systems - Strips -Advanced plan generation systems - Klutpi -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, XCON: Expert systems shells.

Reference Books:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

[illegible]

VI SEMESTER

[illegible]: Elective: Artificial Intelligence and Expert Systems Lab

Credits (L: T: P = 0: 0: 2)

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]

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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 an 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 Quality of Project Work

- This option is to be offered only to 6th Semester.
- The students will be allowed to work on any project based on the concepts studied in
- Course/course 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.

ECF30001

VI SEMESTER

SEC 3A: Elective: AJAX
Credit (L: T: P = 6: 0: 2)

Course Outcome:

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

CO1. Understand in details with examples AJAX

CO2. Learn the details of AJAX Framework

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. Deitel and Deitel, Ajax, Rich Internet Web Pages with Asynchronous JavaScript and XML", Pearson Education, inc.
3. Thomas A. Powell, "Ajax: The Complete Reference", McGraw-Hill Companies

ECF30101

VI SEMESTER

SEC 3B: Elective: Angular JS
Credit (L: T: P = 6: 0: 2)

Course Outcome:

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

CO1. Understand in details with examples Angular JS

CO2. Learn the details of Angular JS Overview

CO3. Specify the details of Steps for Implementation of AngularJS

CO4. Learn the details of Design and use of Angular JS

Term work: Design & Develop Small web application using AngularJS

Reference Books:

1. Yashavant Kanetkar, Shrirang Kulkarni, "Professional AngularJS", WROX
2. Jeffrey Cameron, Pawel Kozlowski, "Learn Single Page Web Application Development Using AngularJS", Pearson Education India, First edition.

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VI SEMESTER

SEC 3C: Elective: Wordpress
Credit (L: T: P = 6: 0: 2)

Course Outcomes:

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

CO1: Differentiate details with examples Word press

CO2: Understand 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. [illegible]
2. [illegible]

ECE33501

VI SEMESTER

SEC 4A: Elective: Python Programming
Credit (L: T: P = 4: 0: 2)

Course Outcome:

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

CO1. Learn the details of Python Programming Structure
CO2. Differentiate the characteristics of Python Programming
CO3. Understand in detail's with examples - Python Programming Languages
CO4. Specialty 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 >=80
   - Grade B: Percentage>=70 and <80
   - Grade C: Percentage>=60 and <70
   - Grade D: Percentage>=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! - ..... 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 a integers and display them as a histogram.

a) to display one, two, three, polynomial and exponential curves.

b) to plot a graph of velocity with pulse rate y vs height h. The values of p and h are to be entered by the user.

c) to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula $m = m_0 e^{-rt}$, where r is the rate of decay. Sketch a graph for $r = 0.5$, where $t = 0$.

d) A population of 1000 bacteria is introduced into a nutrient medium. The population grows as follows:

```
Hours | Population
```

Where the time t is measured in hours. Write a program to determine the size of the population at given times t and plot a graph for $0 \le t \le 8$ for the specified time interval.

e) Newton's motion laws of velocities and accelerations and plot the following graphs depicting relationship of motion:

i) Velocity with time ($v - u = at$)

ii) Distance with time ($s = ut + \frac{1}{2}at^2$)

iii) Distance with velocity ($v^2 = u^2 + 2as$)

Reference Books

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]

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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. Understand the characteristics of R Programming
CO3. Understand in details with examples R Programming Language

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. W.Khan N. Knowles and David M. Smith, An Introduction to R, 2nd Edition, Vertmark Tutor Limited 2009
2. Norman Matloff, the Art of R Programming - A Tour of Statistical Software Design, No Starch Press 2011

UCE18901

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. Understand the Features of CodeIgniter

Team work: Design & Develop Small web application using CodeIgniter framework

Reference Books:

[illegible]
[illegible]

SEMESTER II

Course code: BSHDSC102

DSC 1B: Computer Science-II

Problem Solving Using Computer

Credits: Theory – 04 60 Hours

COURSE OUTCOMES:

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

CO1: Learn the details of Problem Solving Techniques

CO2: Understand the characteristics of Programming Languages

CO3: Understand in details with examples – Python Programming Language

CO4: Identify in depth OOPs, Event Driven and GUI features in Python

Unit – 1 15 Hours

Programming Languages: Introduction, Types and its characteristics

Techniques of Problem Solving: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation, Flowcharting, pseudo codes, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

Unit – 2 15 Hours

Overview of Programming: Structure of a Python Program, Elements of Python.

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation, Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment Operator, Ternary operator, Bit wise operator, Increment or Decrement operator), Input and Output Statements, Control statements (Looping: while Loop, for Loop, Loop Control)

Unit – 3 15 Hours

Creating Python Programs: Conditional Statements (if, elif, else), Difference between break, continue and pass.

Data types: Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules, Defining Functions, Exit function, default arguments.

Unit – 4 15Hours

Introduction to Advanced Python: Objects and Classes, Inheritance, Regular Expressions, Event Driven Programming, GUI Programming.

Reference:
1. P. K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications, 2007.
2. Mr. Ankit Goel, Computer Fundamentals, Pearson Education, 2010.
3. T. Budd, Exploring Python, TMH, 1st Ed, 2011.
4. Python Tutorial/Documentation www.python.or (2015)
5. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist learning with Python, Freely available online,2012

SEMESTER II

Course code: BMMSE103

(GE III: Computer Science-II

Problem Solving Using Computer

Credits: Practical – 02 **60 Hours**

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 five subjects are to be input by the user. Assign grades according to the following criteria:
   - Grade A: Percentage >=80
   - Grade B: Percentage>=70 and <80
   - Grade C: Percentage>=60 and <70
   - Grade D: Percentage>=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! – ……. upto
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 and rotate/scale 2D objects
   I. Square
   II. Sphere
   III. Cone
   IV. Arrow
   V. Ring
   VI. Cylinder
2. WAP to find 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) decomposes according to the formula $m = 50(0.5)^t$, where t is the time in hours. Sketch a graph for t vs m. (Hint: t=0:8:0.1)
6. A population of 10000 bacteria is introduced into a nutrient medium. The population p grows as follows:
   $P(t) = (25000)/(1+(1.5)^{-t})$
   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 and time ($v = u + at$)
II. Distance and time ($s = ut + \frac{1}{2}at^2$)
III. Distance and velocity ($v^2 = u^2 + 2as$)

SEMESTER V

Course code: DSE15602

DSE 6A: Elective: Computer Science – V

Database Management System

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: Understand the details of types of database languages with examples
CO3: Learn the details of ER Diagrams and Relationship
CO4: Understand in depth basic concepts of Relational Model
CO5: Learn in details with examples MYSQL Commands
CO6: Learn in details with examples in PL/SQL

Unit – 1 15 Hours

Introduction to Database Management System: Definition of Data, Information, DBMS, Data base system application, Purpose of database systems, Characteristics of DB – Self describing nature, Insulation between programs, data and data Abstraction (data Independence), support of multiple views of the data, sharing of data and multiples transaction processing, Storage management, Database language – DDL, DML, DCL.
File processing system v/s DBMS, Data models, Levels of Abstraction in a DBMS, Three Schema architecture, Characteristics of database approach, data models, DBMS architecture and data independence.

Unit – 2 15 Hours

Entity Relationship and Enhanced ER Modeling: Entity types, Entity Sets, Attributes and Keys, Relationships, Relationship Types, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions. SDL99, Schema Definition, constraints, and object modeling.

Unit – 3 15 Hours

Relational Data Model: Basic concepts, Relational Constraints and Relational Database Schemas, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations.
Database design: ER and EER to relational mapping, functional dependencies, normal forms first normal form, second normal forms, third normal form(BCNF

Unit – 4 15 Hours

MYSQL ORACLE/PL-SQL: SQL VS. SQL * PLUS. SQL COMMANDS, VARIOUS TYPES OPERATORS AND EXPRESSIONS. INTRODUCTION TO SQL * PLUS.

MANAGING TABLES AND DATA:
• CREATING AND ALTERING TABLES (DEFAULT, CONSTRAINTS)
• DATA MANIPULATION COMMANDS (LIKE INSERT, UPDATE, DELETE)
• SELECT STATEMENT WITH WHERE, GROUP BY AND HAVING, ORDER BY, DISTINCT, SPECIAL OPERATOR LIKE, IN, ANY, ALL, BETWEEN, EXISTS, LIKE
• ASK, BUILT IN FUNCTIONS, OTHER DATABASE OBJECTS
• VIEW (CREATING VIEWS, INDEX, TRANSACTION CONTROL STATEMENTS
• COMMIT, ROLLBACK, SAVEPOINT, INTRODUCTION TO PL/SQL
• SQL VS PL/SQL, PL/SQL BLOCK STRUCTURE
• LANGUAGE CONSTRUCT OF PL/SQL (VARIABLES, BASIC AND COMPOSITE DATA TYPE, CONDITIONS LOOPING ETC.)
• %TYPE AND %ROWTYPE
• USING CURSOR (IMPLICIT, EXPLICIT)

References:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010
2. R. Ramakrishnan, J. Gehrke, Database Management Systems, 3rd Edition, WCB/mcgraw-hill, 2007
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw-Hill, 2010
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education,2013

SEMESTER V

Course code: DMEC251[]

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 must be introduced to the students
Note: MS Access/MySQL may be used.
DDL Commands
- Create table, alter table, drop table

DML Commands
- Select, update, delete, and insert statements
- Condition specification using Boolean and comparison operators (and, or, not, [illegible])
- Arithmetic operators and aggregate functions(Example: min, avg, Min, Max)
- Multiple table queries (join on different and same tables) • Nested select statements

(iii) Increase the salary of all employees working on the 'Printer X' project by 10%. Retrieve employee name and increased salary of these employees.

17. Retrieve a list of employees and the project names each works in (sorted by the employee's department, and within each department ordered alphabetically by employee first name).

18. Select the names of employees whose salary does not match with salary of any employee in department 5.

19. Retrieve the name of each employee who has a dependent with the same first name and same sex as the employee.

20. Retrieve the employee numbers of all employees who work on project located in Bellaire (Location or Dlocation).

21. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary (Number 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 5.

24. For each department, retrieve the department number, the number of employees in the department, and their average salary.

25. For each project, retrieve the project number, the project name, and the number of employees who work on that project.

26. Change the location and controlling department number for all projects having more than 5 employees to 'Bellaire' and 5 respectively.

27. For each department having more than 10 employees, retrieve the department no. no. of employees drawing more than 40,000 as salary.

28. Insert a record in Project table which violates referential integrity constraints with respect to Department number. Now remove the violation by making necessary insertion in the Department table.

29. Delete all dependents of employee whose ssn is '123456789'.

30. Delete an employee from Employee table with ssn = '12345' (make sure that this employee has some dependents, is working on some project, is a manager of some department and is supervising some employees). Check and display the cascading effect on Dependent and Works on table. In Department table MGRSSN should be set to default value and in Employee table SUPERSSN should be set to NULL.

31. Perform a query using alias concept to retrieve full name and address of Employee table.

SEMESTER V

Course code: DSEC5D02

18SCAB: Elective: Computer Science - V

Computer Networks

Credits: Theory – 04 **60 Hours**

Course Outcomes:

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

CO1	Understand the Elements of Data Communications and network Systems
CO2	Learn in depth Transmission Media
CO3	Understand in details with examples Network Models
CO4	Understanding the various error features and characteristics of Protocols
CO5	Learn in depth Error Detection and Correction Algorithms
CO6	Learn in detail of Network Security

Unit - 1 **15 Hours**

Basic concepts: Components of data communication, standards and organizations. Network Classification, Network Topologies, network protocol, layered network architecture, overview of OSI reference model, overview of TCP/IP protocol suite.

Unit - 2 **15 Hours**

Physical Layer: Cabling, Network Interface Card, Transmission Media Devices: Repeater, Hub Bridge, Switch, Router, Gateway

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

Unit - 3 **15 Hours**

Network Layer: Virtual Circuit and Datagram approach, IP addressing methods – Subnetting, Routing Algorithms (adaptive and non-adaptive)

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

Unit - 4 **15 Hours**

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

Network Security: Common Terms, Firewalls, Virtual Private Networks

References:

1. B.A. Forouzan, Data Communication and Networking, 4th Edition, Tata McGraw Hill, 2007
2. D.E. Comer, Internetworking with TCP/IP, Vol. 1, Prentice Hall of India, 1998
3. W. Stallings, Data & Computer Communication, 8th edition, Prentice Hall of India, 2006
4. D. Bertsekas, R. Gallager, Data Networks, 2nd edition, Prentice Hall of India, 1992.

SEMESTER V

Course code: DSE(5A)

DSC(elt): Elective: Computer Science – V

Computer Networks

Credits: Practicals – 02 60 Hours

Software Lab based on Computer Networks

Students has to analyze of Computer Networks such as:

1. Simulate Checksum Algorithm
2. Simulate CRC Algorithm
3. Simulate Stop & wait Protocol
4. Simulate Go-Back-N Protocol
5. Simulate Selective Repeat Protocol

and so on.....

SEMESTER VI

Course code: 19MB2S02

19SE6A: Elective: Computer Science - VI
Programming in JAVA

Credits: Theory – 04, **60 Hours**

Course Outcomes:

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

CO1: Difference in depth java programming fundamental

CO2: Specify in details with examples Basic java OOPs Concepts

CO3: Understand in depth OOPs Concepts

CO4: Understand in depth java Interface and packages

CO5: Difference the details of Exception handling in java

CO6: Difference the details of Multithreading & I/O operations in java

CO7: Identify the classification 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, JDK Environment, Object Oriented Programming Concept Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA, JDK Environment.

Java Programming Fundamental: Structure of java program, Data types, Declaration of variables, scope of variables, Keywords, operators, expressions, Decision Making statements, Input and Output statements, Declaring constants, Access statements, Looping statements, type conversions and casting.

Unit – 2 **15 Hours**

Classes and Objects: Defining a Class, Field Declaration, Methods Declarations, Creating an Object, Accessing class members, Assigning Object Reference Variables, Access specifier, Constructor, Type of Constructor, this keyword purpose variable hiding, Garbage Collection, Finalize method, method overloading, overloading Constructor, Understanding Static, Introducing final, Parameters.

Inheritance: Definition, Types of Inheritance, Member Access, Uses of Super, Method Overriding, Dynamic Method Dispatch, Abstract class and Methods, Uses final, Object Class, Nested and Inner classes

Arrays and Strings: Arrays, Creating an array, Types of Arrays, arrays accessing, methods operations String class Methods, String Buffer methods.

Unit – 3 **15 Hours**

Abstract Class, Interface and Packages: Modifiers and Access Control, Abstract classes and methods, Interfaces, Packages Concept- definition, JAVA API packages, naming conventions,

creating packages, accessing Packages using packages, adding a class to a package, listing the class Import

Interfaces: Introduction, Defining Interfaces, implementing Interfaces, Nested Interfaces, Extending Interfaces, accessing interface variables

Exception handling: Introduction, Types of Errors, Exceptions, System of Exception handling, try and catch statement, multiple catch Statements, Nested try Statements, throw, throwing exceptions, finally statement, java built in exceptions, throws

Unit - 6 **15 Hours**

Multithreading: Introduction, Creating threads, Extending the thread Classes, implementing runnable interface, Declaring the Class, implementing the run () Method, starting new thread, stopping and blocking threads, thread life cycle, thread Priority

Input and Output: Concept of Streams, Stream Classes, Byte Stream classes, Character Stream classes, reading Console input, Writing Console Output, wrapper Classes.

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

Reference Books:

1. Ivan Bayross, Web Enabled Commercial Application Development Using Java [Third] provectga, Prof Gp., BPB Publications, 2009
2. Cay Horstmann, BIG Java, WIley Publications, 2nd Edition., 2009
3. Herbert Schildt , Java 7, The Complete Reference., 8th Edition, 2009.
4. E Balagurusamy , Programming with JAVA, TMH, 2007

SEMESTER VI

Course code: 19MP25102

19MBA: Elective: Computer Science - VI

Programming in JAVA Lab

Credits: Practical – 02 **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 largest of three numbers using ternary operator
3. Write a java program to find the roots of the quadratic Equation
4. Write a java program to check whether given data is valid or not
5. Write a java program to implement ATM Transaction Using Switch statement

6. Write a java program to generate the following pattern

```
                A
            A   B   A
        A   B   C   B   A
    A   B   C   D   C   B   A
```

7. Write a java program to find sum of all digits of a given number until given number becomes a single digit
8. Write a program to create an array of 10 integers. Accept values from the user to this 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.
9. Write a java program to sort the given elements using selection sort.
10. Write a java program to find the rows and cols 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 Method 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 Overriding
7. Write a java program to that reads two integer numbers for the variables a and b. If any other character except number (1-9) is entered then the error is caught by NumberFormatException object. After that we get Message () prints the information about the error occurring causes
8. Write a java program to Demonstrate multiple Inheritance using Interface
9. Write a java program to Demonstrate multithreading
10. Write a applet program to generate the following pattern

SEMESTER IV / V / VI

Course code: 18UDSE## / 18UDSE## / 18UEL###

SEC 3A: Elective: Computer Application (Practical)
Office Automation

Credits: Practical – 02 60 Hours

Course Outcomes:

On successful completion of the course, the students will be able to

CO1: Understand the basics of Data processing in Computers

CO2: Learn in depth MsOffice and Software

CO3: Learn the basics of Computer Peripherals

CO4: Understand the basics of Programming Languages

CO5: Software is used with examples office automation Tools

CO6: Software is used Operating System and the User Interface

CO7: Understand the various of Qualities and its usages

Practical List for WORD:

1. Create a **telephone directory**.
   - The heading should be Unicode, bold Font, in bold
   - The size of the document should use Unicode font size
   - Other headings should use Unicode Courier New Font
   - The format should show the page number as well as the date last updated.
2. Design a Curriculum Vitae for your college.
   - The first line should mention the name of the college in Unicode, Arial, Font, and should be bold.
   - The second line should give the author name teacher's name and the department in Unicode font.
   - Leave a gap of 2 lines.
   - The rest of the document should use Unicode Times New Roman font.
   - The format should include your specifications as the designer and date of creation.
3. Create the following document. A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.

Practical List for EXCEL:

1. Open a new workbook containing the numbers names and city names. Open a worksheet. Print and insert the excel worksheet using

[illegible]

[illegible]

Practical List for Power Point:

1. Create five Power point slides. Each slide should support different format. In these slides
2. [illegible] areas of applications of IT. Make slide transitions time as 10 seconds.
3. Create five Power Point slides to give advantages disadvantages of computer, applications
4. [illegible] and logical structure of computer.
5. Create five Power Point slides including the process of internal conversions. It should be a self-running demo.

SEMESTER IV / V / VI

Course code: D[illegible] / DM[illegible] / DM[illegible]

SEC 1B: Elective: Computer Application (Practical)

Elective: XML Programming

Credits: Practical – 02 [illegible]

Course Outcome:

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

- CO1. Understand the details of Elements of XML Programming
- CO2. Write down in details with examples DTD
- CO3. Deliberate in details with examples XML Schemas
- CO4. Deliberate the characteristics of CSS
- CO5. Learn in details with application CSS
- CO6. Deliberate in details with examples XSL
- CO7. Learn the details of XML Security
- CO8. Learn in details with examples XML and JAVA
- CO9. Learn in details with examples XML and ASP.Net

Software Lab Based on XML:

Exercise #1 - Information Structure

In this exercise, student will practice identifying the structure of an information object. For the sample document provided below:

Label the information structures you see, including containing structures.

(2). Draw a tree representation of the structure.

Exercise 2# Deconstructing an XML Document

In this exercise, student will practice identifying the explicit structure within an XML document. In a sense, this is the reverse of what you did in Exercise #1. For the sample XML markup below, create a tree-structure representation [illegible] within the XML tags.

<book>
<preface>
<title>The XML Handbook</title>
<author>Charles F. Goldfarb</author>
<author>Paul Prescod</author>
<edition>Second</edition>
<description>The definitive XML resource, updated and redesigned. Revised and expanded — over 600 new pages.</description>
</preface>
<chapter>
</book>

Exercise #7 – Creating XML Markup

In this exercise, create some XML markup based on the text representation from Exercise #1 above, and the sample document.

Exercise #8 – Well-Formedness

This exercise checks your understanding of the constraints for well-formedness. Are the following documents well-formed? Explain any NO answers.

<doc><dog>The Cat is fat</title><date>4th June</cat>

<quote id type="text">Knowledge is power</author name</quote>

<para>Nothing is old in a <emphasis>relatively</emph> easy walk as long as the cat is willing.</para>

<title>How to Bathe a Cat</author><title>Marlin Bennenbaum</title>

Exercise #9 – Well-Formedness

This exercise is a bit more challenging than the previous examples. Here is a fragment of an XML document (novel) all the pieces where it fails to match the constraints for well-formedness.

<PROCEDURE><TITLE>How to Bathe a Cat</TITLE>

<OVERVIEW>This procedure tells you how to bathe a cat. <WARNING><OVERVIEW>Cats don't like to take baths. You could get hurt doing this. Be sure to obtain all the required products prior before you start. <WARNING><EQUIPMENT><ITEM>Bathtub Mask <ITEM>Paddle Tub brush Kevlar Armor <ITEM></ITEM>Oak bath oil scrub water<ITEM></ITEM>Towels </ITEM> <ITEM>Hand Aid kit<ITEM></ITEM>Cat Shampoo</ITEM></EQUIPMENT> <DISTRACTIONS><STEP> Locate the cat, who by now is hiding under the bed.</STEP> <STEP>Place the cat in the tub of water.</STEP></ITEM>Using the First Aid kit, repair the damage to your hand and arms.</STEP></STEP>Place the cat back on the rug and towel it down.</STEP></STEP>Wash it really fast, then make an effort to dry it with the towels.</STEP></STEP>Decide not to do this again. </STEP></PROCEDURE>

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

SEMESTER VI

Course code: 19UCS301

SEC 4B3 (CA): Elective: Web Programming (Practical's)

Credits (L: T: P = 0: 0: 2)

Total Hours: 64 60 Hours

Course Outcome:

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

CO 1: Learn the details of HTML tags.
CO 2: Understand the details of Basic CSS and its properties.
CO 3: Understand the details of Basic Concepts of Java Scripts.
CO 4: Write down in details with application and Usage of Java Scripts.
CO 5: Understand in details with examples Document Object Model.
CO 6: Implement in-depth Books of XML.

Web programming Lab

1. Program for Animating text.
2. Creating a Webpage having Hyperlink.
3. Creating Types of Lists (Ordered, Unordered, Definition)
4. Creating a Nested List.
5. Creating a Time Table.
6. Creating a HTML document having vertical frames
7. Creating Student Application Form.
8. Program to insert audio & video files
9. Creating External & Internal Style Sheets
10. Program to Merge & Fielding
11. Program to create a Greeting card
12. Program to Image Transparency
13. Program to generate Fibonacci series in Javascript
14. Program to display Rainbow Colors in Javascript.
15. Program to create Pop Up Boxes
16. Program to generate multiplication table.
17. Program to find even and odd numbers
18. Program to add 3 numbers.
19. Program to find factorial of a numbers.
20. Program to generate 3 different patterns.
21. Program to change background color after 5 sec of page load.
22. Display reverse of a given number
23. Program to generate random numbers
24. Program to find the sum of individual numbers.
25. Program to display Bank information in XML.

SEMESTER VI

Course code: CMP23701

SEC4B: Elective: Computer Science - VII
PHP Programming

Credits: Practical – 01 60 Hours

Course Outcomes:

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

CO1. Learn in depth Features of PHP

CO2. Learn in depth Interaction Methods Between HTML and PHP

CO3. Understand in depth PHP functions

CO4. Understand in depth String Manipulations

CO5. Learn the characteristics of Regular Expressions

CO6. Learn the details of Developing PHP Web Applications

PHP Programming Lab

Software Lab Based on PHP:

1. Create a PHP page using functions for comparing three integers and print the largest number.
2. Write a function to calculate the factorial of a number (non-negative integer). The function accepts the number as an argument.
3. Write a PHP 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 passed string is palindrome or not? (A palindrome is word, phrase, or sequence that reads the same backward as forward, e.g., madam or nurses run.)
7. Write a PHP to sort an array.
8. Write a PHP script that removes the whitespaces from a string.
   Sample string: "The quick " brown fox"
   Expected Output: "The quick""brown fox"
9. Write a PHP script that finds out the sum of first n odd numbers.
10. Create a login page having user name and password. On clicking submit, a welcome message should be displayed if the user is already registered (i.e name is present in the database) otherwise error message should be displayed.
11. Write a PHP script that checks if a string contains another string.
12. Create a simple "birthday countdown" script. The script will count the number of days between current day and birthday.
13. Create a script to substitute the following pattern, using normal text string:
    *

```
    * *
    * * *
    * * * *
    * * * * *
```

10. Write a simple PHP program to check that numbers are valid.
11. Write a PHP program to create a cookie.
12. Explain the concept of "generic" in PHP.

Write a PHP script which will display the values in the following order:

1
1 2
1 2 3
1 2 3 4
1 2 3 4 5

13. Create a simple web page and use JavaScript to display a "Hello!" message depending on the language selected in dropdown list.
14. Write a PHP program to create a three-dimensional array using associative.
15. Write a PHP script to replace the first 'the' of the following string with 'That'.

Example: 'the quick brown fox jumps over the lazy dog.'

Expected Result: That quick brown fox jumps over the lazy dog.

References:

1. Rajeev Kumaresh, Rajesh Gunasundaram, and Pradeep Devaram, Android 9 DEV Essentials, Wiley, 2019.
2. Christian Lee, Nicholas Sakhnenko, and Sherlock Sokolyk, Mobile Application Architecture Design and Development, Prentice Hall, 2004.
3. Rajesh Gupta, Mobile Design and Development, O'Reilly Media, 2009, Newsletter.
4. Common Programming for Mobile Web, O'Reilly Media, 2010.
5. Brendan Lawrence and Dan Maynes, Designing Social Interfaces, O'Reilly Media, 2009.

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

2019-20

I SEMESTER ZOOLOGY

PRACTICAL –I

ANIMAL DIVERSITY

PRACTICAL **CREDITS 2**

1. **PROTOZOA-** Culture preparation and observation of different protozoans. Paramecium, Euglena, Amoeba and mounting of Foraminiferans
2. **PORIFERA-** Sycon, Hyalonema, , Gemmule, Monaxon spicules.
3. **COELETERATA**- Obelia, Physalia, Aurelia, Ephyra larva, Metridium
4. **HELMINTHES**- Taenia solium, Planaria, Fasciola, Ascaris male and female,
5. **ANNELIDA:** Pheretima, Nereis, Leech

   Onychophora: Peripatus
6. **ARTHROPODA**: Palaemon, Palamnaeus, Scolopendra, Spirostreptus

   study of mouth parts of cockroach/ honey bee/mosquito/house fly.
7. **MOLLUSCA**: Chiton, Unio, Aplysia, Sepia, Octopus.
8. **ECHINODERMATA**: Asteropecten, Ophiothrix, Sea urchin, Holothuria, Antedon, Pedicellariae of Seaurchin.
9. **PROTOCHORDATA**: Balanoglossus, Herdmania, Amphioxus, Myxine, Petromyzon, Ammocoetes larva.
10. **PISCES:** Pristis, Torpedo, Labeo, Exocoetus.
11. **AMPHIBIA**: Salamandra, Rana tigrina, Ichthyophis.
12. **REPTILES**: Chamaeleon, Draco, Vipera, Naja, Chelone.

    Bungarus, Enhydrina.
13. **AVES:** Koel, Kite, Duck.

    MAMMALS: Bat, Loris, Guinea pig.
14. Study of animal dissection through digi frog software.(digestive and reproductive system of Leech and Rat)
15. Preparation of animal album containing photographs, cut outs, with appropriate write up the above mentioned taxa. Different taxa/topics may be given to different sets of students.**(Invertebrates-05, Vertebrates-05)**

II SEMESTER ZOOLOGY

PRACTICAL –II

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

PRACTICAL **(CREDITS 2)**

1. Skeleton of [Pigeon] and [Rabbit].
2. Carapace and plastron of turtle /tortoise.
3. Mammalian skulls: Herbivorous (Rabbit/ Horse) and Carnivorous (Dog/Cat).
4. Skull of Frog, Pigeon.
5. Vertebrae of Frog (Atlas, Pro, Amphi and Acoelous), Pigeon (Heterocoelous Vertebra, Synsacrum) Rabbit (Atlas, Axis, Thoracic vertebrae).
6. Pectoral and Pelvic girdles of Frog, Pigeon and Rabbit.
7. Fore and hind limb skeletons of Frog, pigeon and Rabbit.
8. Study of development of hen's egg – Window technique.
9. Frog - cleavage stages.
10. Blastula, gastrula, neurula stage (whole mount) .
11. Chick embryo stages-18hrs, 24hrs, 36 hrs, 48hrs. (whole mount).
12. Study of the different types of placenta- Sheep, Rat placenta.
13. Identification of various family planning devices .
14. Study of skeletal system through software.

III SEMESTER ZOOLOGY

PRACTICAL –III

PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL **(CREDITS 2)**

1. Qualitative test for carbohydrate test-Molisch's test, Iodine test, Fehling's test and picric acid test.
2. Qualitative test for proteins- Biuret test, Ninhydrin test, Millon's test and Xanthoproteic test.
3. Qualitative test for lipids-Acrolein Test, Leiberman-Burchard test, Salkowasky test
4. Identification of vitamins presents in the food materials with their physiological role and their disorders.
5. Salivary amylase activity on starch.
6. Dehydrogenase activity in milk.
7. Preparation of hematin crystals.
8. Blood typing –ABO type and Rh factors.
9. Detection of nitrogenous wastes – Ammonia (Nessler's test), Urea (Urease test), Uric acid (Folin's U test).
10. Study of permanent histological sections of mammalian pituitary, thyroid, parathyroid.
11. Study of permanent histological sections of mammalian Pancreas, adrenal gland, testis and ovary.
12. Study of permanent slides of liver, lung and kidney.
13. Study of permanent slides of spinal cord, bone marrow and T.S of cartilage.
14. **Field Study:** Visit to a Pathology lab / Hospital to know about different techniques of biochemical analysis and submission of the report.

IV SEMESTER ZOOLOGY

PRACTICAL –IV

GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL **(CREDITS 2)**

1. Genetic problems- Monohybrid and Dihybrid cross.

2. Complementary genes: Flower color in sweet pea.
   Supplementary genes: Comb patterns in Fowls.

3. Epistatic genes: Plumage colors in Fowls and Multiple genes: Skin color in man.

4. Multiple alleles: ABO blood group in human. And Sex linked inheritance: Drosophila(red and white eye colour) and human(Haemophilia and Colourblindness).

5. Study of Human Karyotypes (normal) and abnormal- (Turner, Klinefelter, Down's and Cri-du-chat syndrome (abnormal).

6. General morphology of *Drosophila melanogaster* (male and female).

7. Mounting of sex comb and wing of Drosophila

8. Identification of mutants of white eye, bar eye, sepia eye, vestigial wing and ebony body of Drosophila

9. Preparation of media and maintenance and breeding of Drosophila – (Demonstration)

10. Study of homology – vertebrate forelimbs and analogy-wing of bird & limb skeleton from suitable specimens/ pictures.

11. Study of aquatic adaptations: Shark & Turtle.
    Study of arboreal adaptations: Chamaeleon, Loris.

12. Study of Volant adaptations : Exocoetus Fish, Bat, Pigeon, Draco.

13. Submission of report on- a. Evolution of Horse
    b. Evolution of Camel
    c. Evolution of Elephant
    d. Evolution of Man
14. Experiment on genetic drift-Sampling error and population size.

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, Phithirus 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

2019-20

I SEMESTER ZOOLOGY

PRACTICAL –I

ANIMAL DIVERSITY

PRACTICAL **CREDITS 2**

1. **PROTOZOA-** Culture preparation and observation of different protozoans. Paramecium, Euglena, Amoeba and mounting of Foraminiferans
2. **PORIFERA-** Sycon, Hyalonema, , Gemmule, Monaxon spicules.
3. **COELETERATA**- Obelia, Physalia, Aurelia, Ephyra larva, Metridium
4. **HELMINTHES**- Taenia solium, Planaria, Fasciola, Ascaris male and female,
5. **ANNELIDA:** Pheretima, Nereis, Leech

   Onychophora: Peripatus
6. **ARTHROPODA**: Palaemon, Palamnaeus, Scolopendra, Spirostreptus

   study of mouth parts of cockroach/ honey bee/mosquito/house fly.
7. **MOLLUSCA**: Chiton, Unio, Aplysia, Sepia, Octopus.
8. **ECHINODERMATA**: Asteropecten, Ophiothrix, Sea urchin, Holothuria, Antedon, Pedicellariae of Seaurchin.
9. **PROTOCHORDATA**: Balanoglossus, Herdmania, Amphioxus, Myxine, Petromyzon, Ammocoetes larva.
10. **PISCES:** Pristis, Torpedo, Labeo, Exocoetus.
11. **AMPHIBIA**: Salamandra, Rana tigrina, Ichthyophis.
12. **REPTILES**: Chamaeleon, Draco, Vipera, Naja, Chelone.

    Bungarus, Enhydrina.
13. **AVES:** Koel, Kite, Duck.

    MAMMALS: Bat, Loris, Guinea pig.
14. Study of animal dissection through digi frog software.(digestive and reproductive system of Leech and Rat)
15. Preparation of animal album containing photographs, cut outs, with appropriate write up the above mentioned taxa. Different taxa/topics may be given to different sets of students.**(Invertebrates-05, Vertebrates-05)**

II SEMESTER ZOOLOGY

PRACTICAL –II

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

PRACTICAL **(CREDITS 2)**

1. Skeleton of [Pigeon] and [Rabbit].
2. Carapace and plastron of turtle /tortoise.
3. Mammalian skulls: Herbivorous (Rabbit/ Horse) and Carnivorous (Dog/Cat).
4. Skull of Frog, Pigeon.
5. Vertebrae of Frog (Atlas, Pro, Amphi and Acoelous), Pigeon (Heterocoelous Vertebra, Synsacrum) Rabbit (Atlas, Axis, Thoracic vertebrae).
6. Pectoral and Pelvic girdles of Frog, Pigeon and Rabbit.
7. Fore and hind limb skeletons of Frog, pigeon and Rabbit.
8. Study of development of hen's egg – Window technique.
9. Frog - cleavage stages.
10. Blastula, gastrula, neurula stage (whole mount) .
11. Chick embryo stages-18hrs, 24hrs, 36 hrs, 48hrs. (whole mount).
12. Study of the different types of placenta- Sheep, Rat placenta.
13. Identification of various family planning devices .
14. Study of skeletal system through software.

III SEMESTER ZOOLOGY

PRACTICAL –III

PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL **(CREDITS 2)**

1. Qualitative test for carbohydrate test-Molisch's test, Iodine test, Fehling's test and picric acid test.
2. Qualitative test for proteins- Biuret test, Ninhydrin test, Millon's test and Xanthoproteic test.
3. Qualitative test for lipids-Acrolein Test, Leiberman-Burchard test, Salkowasky test
4. Identification of vitamins presents in the food materials with their physiological role and their disorders.
5. Salivary amylase activity on starch.
6. Dehydrogenase activity in milk.
7. Preparation of hematin crystals.
8. Blood typing –ABO type and Rh factors.
9. Detection of nitrogenous wastes – Ammonia (Nessler's test), Urea (Urease test), Uric acid (Folin's U test).
10. Study of permanent histological sections of mammalian pituitary, thyroid, parathyroid.
11. Study of permanent histological sections of mammalian Pancreas, adrenal gland, testis and ovary.
12. Study of permanent slides of liver, lung and kidney.
13. Study of permanent slides of spinal cord, bone marrow and T.S of cartilage.
14. **Field Study:** Visit to a Pathology lab / Hospital to know about different techniques of biochemical analysis and submission of the report.

IV SEMESTER ZOOLOGY

PRACTICAL –IV

GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL **(CREDITS 2)**

1. Genetic problems- Monohybrid and Dihybrid cross.

2. Complementary genes: Flower color in sweet pea.
   Supplementary genes: Comb patterns in Fowls.

3. Epistatic genes: Plumage colors in Fowls and Multiple genes: Skin color in man.

4. Multiple alleles: ABO blood group in human. And Sex linked inheritance: Drosophila(red and white eye colour) and human(Haemophilia and Colourblindness).

5. Study of Human Karyotypes (normal) and abnormal- (Turner, Klinefelter, Down's and Cri-du-chat syndrome (abnormal).

6. General morphology of *Drosophila melanogaster* (male and female).

7. Mounting of sex comb and wing of Drosophila

8. Identification of mutants of white eye, bar eye, sepia eye, vestigial wing and ebony body of Drosophila

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13. Submission of report on- a. Evolution of Horse
    b. Evolution of Camel
    c. Evolution of Elephant
    d. Evolution of Man
14. Experiment on genetic drift-Sampling error and population size.

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.
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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
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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.

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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.

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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

B BA- Employability/ Entrpreneurship-2020-2021

Name of the Course	Course Code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill Development
Business Decisions	DDA 210	Self Employment
Statistics For Business	DDB 210	Skill enhancement
Cost & Management Accounting	DDB220	Self Employment and Employability in Industries
OrganisationalBehaviour	DDB230	Employability in Organisation and corporate Sector
Investment Analysis And Portfolio Management	DDE210	Self employment and Employability in Corporate Sector
Investment Banking & Financial Services	DDE230	Self employment and Employability in Corporate Sector
Financial Management	DDF 410	Self Employment
Human Resource Management	DDF 480	Employability in Organisation and corporate Sector

UG_BBA_**BUSINESS DECISIONS**

Unit 1: **Market Dynamics**:

Individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply : Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply; Theory of consumer behaviour: cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and Giffen goods), revealed preference theory.

Unit 2: **Producer and optimal production choice:**

Optimizing behaviour in short run (geometryof product curves, law of diminishing margin productivity, three stages of production),optimizing behaviour in long run (isoquants, iso-cost line, optimal combination of resources) Costs and scale: traditional theory of cost (short run and long run, geometry of cost curves,envelope curves), modern theory of cost (short run and long run), economies of scale,economies of scope.

Unit 3: **Theory of firm and market organization** :

Perfect competition (basic features, shortrun equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes indemand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison withperfect competition, welfare cost of monopoly), price discrimination, multiplant monopoly ;monopolistic competition (basic features, demand and cost, short run equilibrium, long runequilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model,dominant price leadership model, prisoner's dilemma

Unit 4: **Factor Market**:

Demand for a factor by a firm under marginal productivity theory(perfect competition in the product market, monopoly in the product market), market demandfor a factor, supply of labour, market supply of labour, factor market equilibrium.

UG_BBA_ STATISTICS FOR BUSINESS

Unit 1: **Measures of Central Value:**

Meaning, Need for measuring central value.Characteristics of an ideal measure of central value. Types of averages - mean, median, mode, harmonic mean and geometric mean. Merits, Limitations and Suitability of averages.Relationship between averages. Measures of Dispersion: Meaning and Significance. Absolute and Relative measures of dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation, Moments, Skewness.

Unit 2: **Correlation Analysis:**

Meaning and significance.Types of correlation.Methods of studying simple correlation - Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient. Regression Analysis: Meaning and significance, Regression vs. Correlation. Linear Regression, Regression lines (X on Y and Y on X) and Standard error of estimate.

Unit 3:Analysis of Time Seriesand Probability

Analysis of Time Series: Meaning and significance. Utility, Components of time series, Models (Additive and Multiplicative), Measurement of trend: Method of least squares, parabolic trend and logarithmic trend.

Probability: Meaning and need. Theorems of addition and multiplication.Conditional probability.Bayes' theorem, Random Variable- discrete and continuous. Probability Distribution: Meaning, characteristics (Expectation and variance) of Binomial, Poisson, and Normal distribution. s

Unit 4:Introduction to testing of Hypothesis:

Concept; Level of Significance; Process of testing; Test of hypothesis concerning Mean; Test of hypothesis concerning Proportion. Z -test, t – test for single mean and difference of means and ANNOVA – one way and two way.

UG_BBA_COST & MANAGEMENT ACCOUNTING

Unit 1: Cost concepts:

Meaning, Scope, Objectives, and Importance of Cost Accounting, Cost, Costing, Cost Control, and Cost Reduction. Elements of Cost, Components of total Cost, Cost sheet.

Classification of costs: Fixed, Variable, Semi-variable, and Step costs; Product, and Period costs; Direct, and Indirect costs; Relevant, and Irrelevant costs; Shut-down, and Sunk costs; Controllable, and Uncontrollable costs; Avoidable, and Unavoidable costs; Imputed / Hypothetical costs; Out-of-pocket costs; Opportunity costs; Expired, and Unexpired costs; Conversion cost. Cost Ascertainment: Cost Unit, Cost Center, Profit Center, Cost Allocation and Cost

Apportionment; Cost Reduction and Cost Control.

Unit 2: **Cost-Volume-Profit Analysis**:

Contribution, PV Ratio, Breakeven-point, Margin of safety, cost break-even-point, cash break-even-point, Composite break-even-point, Key Factor, Break-even Analysis. Relevant Costs and Decision Making: Pricing, Product Profitability, Make or Buy, Exploring new markets, Shut down or continue.

Process costing: Process losses and wastage, Abnormal effectives.

Unit 3: **Budgets and Budgetary Control**:

Meaning, Types of Budgets (sales, production, purchase raw material consumption, cash budget). Steps in Budgetary Control, Fixed and Flexible Budgeting, Responsibility Accounting.

Unit 4: **Standard Costing and Variance Analysis**:

Material, Labour& Overhead variances.

UG_BBA_ ORGANISATIONAL BEHAVIOUR

Unit 1: Introduction to OrganisationalBehaviour:

Organisation- Concept, features and types. OrganisationalBehaviour – concept, meaning, scope, characteristics and role. Evolution , challenges and opportunities for O.B.

Unit 2: Personality:

Personality – Meaning, characteristics and determinants. Theories – Psychoanalytical Theory. Erikson stages, CheisArgyeis's immateriality – Maturity Theory, Traits Theory and Self theory. Personality traits.

Unit 3: Perception, Attitude and Learning:

Perception – concept, nature, process and factors influencing perceptual set.

Attitudes – Meaning, definition, nature, components and sources.

Learning – concept, nature, theories of learning, principles and determinants of learning

Unit 4: Groups and Teams:

Groups – Definitions, types, reasons for group formation. Groups Dynamics – Definition and features. Teams – Meaning , Groups v/s Teams, features, importance and types.

UG_BBA_INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT

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, yieldto call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve andtheories regarding shape of yield curve. Unsystematic risk and non-risk factors that influenceyields.Duration and modified duration, immunization of a bond portfolio. Fundamental analysis: EIC framework; Economic analysis: Leading lagging & coincident macro-economicindicators, Expected direction of movement of stock prices with macroeconomic variables inthe Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOTanalysis, financial analysis of an industry; Company analysis.

Unit 2: **Share valuation**:

Dividend discount models- no growth, constant growth, two stagegrowth model, multiple stages; Relative valuation models using P/E ratio, book value tomarket value. Technical analysis: meaning, assumptions, difference between technical andfundamental analysis; Price indicators- Dow theory, advances and declines, new highs andlows- 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, Threeforms of EMH and implications for investment decisions. (No numerical in EMH andtechnical 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 riskyand risk free assets. Assumptions of single period classical CAPM model. Characteristic line,Capital Market Line, Security market Line. Expected return, required return, overvalued andundervalued assets. Mutual Funds :Introduction, calculation of Net Asset Value (NAV) of aFund, classification of mutual fund schemes by structure and objective, advantages anddisadvantages of investing through mutual funds. Performance Evaluation using Sharpe'sTreynor's and Jensen's measures and Fama's Decomposition.

UG_BBA_INVESTMENT BANKING & FINANCIAL SERVICES

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 & operatinglease, direct lease and sales & lease back, advantages and limitations of leasing, Lease rentaldetermination; 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 regulatorynorms, operation of General Insurance, Health Insurance, Life Insurance.

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

Securitization: Concept, securitization as a funding mechanism, Traditional and nontraditional mortgages, Graduated-payment mortgages (GPMs), Pledged-Account Mortgages(PAMs),

Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets,Securitization in India

UG_BBA_FINANCIAL MANAGEMENT

Unit 1: Working Capital Management

Meaning, Features, types of working capital, factors influencing working capital, level of current assets, operating cycle and cash cycle, current assets financing policy

Unit 2: CashManagement

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

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.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(AUTONOMOUS INSTITUTION)

(AFFILIATED TO UNIVERSITY OF MYSORE & REACCREDITED BY NAAC WITH A GRADE)

MYSORE-570025

GRADUATE COURSE – SEMESTER SCHEME

2018-19

SYLLABUS

Programmes BSc in Botany, Biochemistry, Microbiology

BSc in Biochemistry, Microbiology, Biotechnology

BIOCHEMISTRY DEPARTMENT

CMF21207

SEMESTER VI

Paper VIII

CLINICAL BIOCHEMISTRY

UNIT –I **6hrs**

Introduction: Definition, scope, units, collection & preservation of biological fluids.

Urine: Normal composition of urine – volume, pH, colour, specific gravity. Normal constituents & clinical significance of their variation– urea, uric acid, creatinine, bile pigments. Abnormal constituents and their clinical significance – glucose, albumin, ketone bodies. Urea clearance test.

UNIT –II **6hrs**

Blood: Normal constituents of blood & their variation in abnormal conditions – urea, uric acid, creatinine, glucose, bilirubin, total protein, albumin/globulin ratio.

Lipid profile - Cholesterol, triglycerides, lipoproteins, HDL, LDL & VLDL and clinical significance of their variation

UNIT – VI **6hrs**

Hematology: Hb%, WBC count- total and differential counting, erythrocyte count, ESR, & platelet counting and their clinical significance.

Cardiac injury profile- CKMB and LDH.

UNIT – VII

Gastric function test: Introduction, tests of gastric function – one test and its clinical significance

Pancreatic Function test: Tests for serum amylase and lipase and their clinical significance.

Kidney function test: Clearance tests- Creatinine clearance test and its clinical significance .

PRACTICAL- CLINICAL BIOCHEMISTRY

1. Qualitative analysis of abnormal constituents of urine – Glucose, albumin, bile pigments, bile salts & ketone bodies.
2. Determination of titrable acidity of urine.
3. Estimation of Urea in urine by DAMO method.
4. Estimation of uric acid in urine
5. Estimation of SGOT
6. Estimation of SGPT
7. Estimation of Bilirubin by direct bilirubin method

CME21007

SEMESTER – V

DSE -1: NUTRITIONAL BIOCHEMISTRY (THEORY)

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, GTT and glycosylated Hb, Differential diagnosis of B12 and folate.

Unit: 8 FOOD & DRUG INTERACTIONS & NUTRICEUTICALS: Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions, Appetite changes with drug intakes and malnutrition. Food as medicine.

PRACTICALS

1. Bioassay for vitamin B12/B1.
2. Homocystiene estimation.
3. Serum/ urine MMA estimation.
4. Anthropometric identifications for Kwashiorkor, Marasmus and Obesity.
5. Determination of oxidative stress: TBARS, antioxidant enzymes in hemolysate.
6. Vitamin A/E estimation in serum.
7. Bone densitometry /bone ultrasound test demonstration (visit to a nearby clinic)
8. Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate (by difference) (3 practicals)
9. Detection of adulterants in food.
10. Estimation of Calcium in ragi.
11. Estimation of Vitamin – C in lemon or gooseberries by DPPH method
12. Estimation of Lactose in milk by Benedict's method
13. Estimation of Vitamin – E by alpha- alpha bipyiridyl method in a given sample (Cod liver oil)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(AUTONOMOUS INSTITUTION)

(AFFILIATED TO UNIVERSITY OF MYSORE & REACCREDITED BY NAAC WITH A GRADE)

MYSORE-570025

GRADUATE COURSE – SEMESTER SCHEME

2018-19

SYLLABUS

Programmes BSc in Botany, Biochemistry, Microbiology

BSc in Biochemistry, Microbiology, Biotechnology

BIOCHEMISTRY DEPARTMENT

CMF21207

SEMESTER VI

Paper VIII

CLINICAL BIOCHEMISTRY

UNIT –I **6hrs**

Introduction: Definition, scope, units, collection & preservation of biological fluids.

Urine: Normal composition of urine – volume, pH, colour, specific gravity. Normal constituents & clinical significance of their variation– urea, uric acid, creatinine, bile pigments. Abnormal constituents and their clinical significance – glucose, albumin, ketone bodies. Urea clearance test.

UNIT –II **6hrs**

Blood: Normal constituents of blood & their variation in abnormal conditions – urea, uric acid, creatinine, glucose, bilirubin, total protein, albumin/globulin ratio.

Lipid profile - Cholesterol, triglycerides, lipoproteins, HDL, LDL & VLDL and clinical significance of their variation

UNIT – VI **6hrs**

Hematology: Hb%, WBC count- total and differential counting, erythrocyte count, ESR, & platelet counting and their clinical significance.

Cardiac injury profile- CKMB and LDH.

UNIT – VII

Gastric function test: Introduction, tests of gastric function – one test and its clinical significance

Pancreatic Function test: Tests for serum amylase and lipase and their clinical significance.

Kidney function test: Clearance tests- Creatinine clearance test and its clinical significance .

PRACTICAL- CLINICAL BIOCHEMISTRY

1. Qualitative analysis of abnormal constituents of urine – Glucose, albumin, bile pigments, bile salts & ketone bodies.
2. Determination of titrable acidity of urine.
3. Estimation of Urea in urine by DAMO method.
4. Estimation of uric acid in urine
5. Estimation of SGOT
6. Estimation of SGPT
7. Estimation of Bilirubin by direct bilirubin method

CME21007

SEMESTER – V

DSE -1: NUTRITIONAL BIOCHEMISTRY (THEORY)

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, GTT and glycosylated Hb, Differential diagnosis of B12 and folate.

Unit: 8 FOOD & DRUG INTERACTIONS & NUTRICEUTICALS: Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Antidepressants, psychoactive drugs and nutrient interactions, Appetite changes with drug intakes and malnutrition. Food as medicine.

PRACTICALS

1. Bioassay for vitamin B12/B1.
2. Homocystiene estimation.
3. Serum/ urine MMA estimation.
4. Anthropometric identifications for Kwashiorkor, Marasmus and Obesity.
5. Determination of oxidative stress: TBARS, antioxidant enzymes in hemolysate.
6. Vitamin A/E estimation in serum.
7. Bone densitometry /bone ultrasound test demonstration (visit to a nearby clinic)
8. Proximate analysis of food samples- Moisture, fibre, protein fat and carbohydrate (by difference) (3 practicals)
9. Detection of adulterants in food.
10. Estimation of Calcium in ragi.
11. Estimation of Vitamin – C in lemon or gooseberries by DPPH method
12. Estimation of Lactose in milk by Benedict's method
13. Estimation of Vitamin – E by alpha- alpha bipyiridyl method in a given sample (Cod liver oil)

CME22005/CME22006

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 EdwardJenner and Louis Pasture.
Antigens: Definition, hatpins, epitops, 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, Heamagglutination, ELISA, immunofluroscent, 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 (HBV).
Enzymes in diagnosis: Enzymes used for diagnosis, immobilized enzymes as diagnostic tools, proteins in diagnosis.
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.

UNIT IV **15**

Hormone therapy: List of hormones and their therapeutic applications, 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, one example

each, principle and applications.
Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 Determination of blood group
a) ABO blood grouping
b) Rh blood grouping.2
Immuno diffusion :
a) ODD
b) RID.
3 Separation of serum from blood
4 Demonstration of ELISA
5Demonstration of Western blotting
6 MIC assay
7 Isolation of antibiotic resistant strains using gradient plate method
8 Estimation of urea by BAMO method
9 Qualitative analysis of normal and abnormal constituents of urine
10 Photographic demonstration of transgenic animals and plants for production of biopharmaceutical

REFERENCES

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.

2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

4. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology. 7th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell

SEC

MICROBIAL TECHNIQUES (2 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Understand and demonstrate basic sterilization techniques.
CO2. Analyze the anatomy of prokaryotic cell and structural detail of eukaryotic cell.
CO3. Acquire the knowledge of Culture media and their applications.
CO4. Assess the growth measurement and pattern of microorganism.

MICROBIAL TECHNIQUES **NO. HOURS**

UNIT I **07**
General introduction. Concept of Prokaryotes and Eukaryotes. General account on Structure, Classification & Reproduction of Bacteria, Fungi & Viruses.

UNIT II **08**
Microbial Techniques: Sterilization: Principles and applications of
a. Physical Methods: Autoclave, Hot air oven, Laminar airflow, Seitz filter, Sintered glass Filter, membrane filter.
b. Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents.
c. Radiation Methods: UV rays and Gamma rays.

UNIT III **08**
Microscopy: working principle and applications of Light microscopy, phase contrast microscopy and electron microscopy.
Staining-Types, Simple and differential (Gram's and acid fast)

UNIT IV **07**
Microbial nutrition and growth: nutritional classes of microorganisms, culture media, pure culture, microbial growth pattern and methods of growth measurements, method of maintenance and preservation of cultures.
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REFERENCES

1 Prescott L.M. Harley J.P and Klein D.A (Microbiology 5th Edition)

2. Pelzar Jr, M.J. Chan, E.C.S. and Krieig N.R (Microbiology)
3. Salle. A.J Fundamental Principles of Bacteriology .
4. Caldmell, D.R. Microbial Physiology and metabolism

CMD22005/ CODECMD22006

SEMESTER IV

PLANT TISSUE & ANIMAL CELL CULTURE (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Develop concept of plant tissue and animal cell culture techniques and their application in biotechnology.
CO2. Comprehend the knowledge of transgenic plants in industrial and agricultural applications.
CO3. Establish and maintain various cell lines used in tissue culture.

PLANT CELL CULTURE NO. HOURS

UNIT I **15**

Plant tissue culture introduction: History and development, Importance of plant tissue culture. Laboratory organization and culture techniques: general requirements and aseptic conditions. Media preparation, culture media, sterilization, and pre-treatment to explants. Principles of tissue culture: Callus culture- Definition of callus, initiation, maintenance, sub culture and organogenesis .Factors affecting organogenesis .organ culture- culture protocols and importance of root and meristem culture.

UNIT- II **15**

Micropropagation in plants: stages of micropropagation, methods, advantages, applications. Somaclonal variation for disease resistance and agronomic traits.
Somatic embryogenesis: Embryoid and embryogenesis. Protocol and importance of somatic embryogenesis, Synthetic seeds and its applications, germplasm conservation and preservation.
Suspension culture: Batch and continuous cell suspension culture. Importance of suspension culture in production of secondary metabolites. Protoplast culture and fusion: Definition of protoplast, isolation principle, culture protocol, action of enzymes, regeneration of plants, protoplast fusion, somatic cell hybridization and its application.

ANIMAL TISSUE CULTURE

UNIT - III **15**

Introduction: History, developments and importance of animal cell culture. Characteristics of animal cell growth, Advantages and disadvantages of tissue culture methods and laboratory facilities (Essential Equipment, Washing facilities, beneficial equipment's, Consumable items).
Animal tissue culture media: Culture media containing naturally occurring ingredients, blood plasma, blood serum, serum-free media, tissue extracts, complex natural media, chemically defined media, and basal salt solution –HBSS.

UNIT – IV **15**

Primary culture, cell lines and cloning: Preparation of primary culture –mechanical and enzymatic method. Primary and established cell lines, somatic cell fusion. Tissue cultures- cover slip method, watch glass method and use of agar.
Whole embryo culture. (e.g. Chick embryo).
Hybridoma technology: Production of monoclonal antibodies.
Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Gene transfer. Animal propagation –Artificial insemination, superovulation, embryo transfer, in-vitro fertilization, embryo splitting. Genetic modification in Medicine -vectors in gene therapy

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Media preparation and sterilization techniques.
2. Callus cultures: choice of explants, preparation of explants, callus induction, subculture and maintenance.
3. Regeneration of plants from growth hormones.
4. Meristem culture for pathogen free plants.
5. Preparation synthetic seed
6. Suspension culture – initiation of suspension culture from callus.
7. Plant protoplast Isolation.
8 . Cell viability test by tryphan blue method.
9. Preparation of HSS and glasswares of cell culture experiments
10.Isolation of PMN leucocytes from human peripheral blood sample and staining and identification.(lishman stain).
11. Demonstration of dissegration of cells by mechanical and enzymatic methods.
12. Photographic Demonstration of Animal Cell culture Lab equipments

REFERENCES

1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.

2. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

3. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.

4. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientificpublishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology-Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.

5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and OrganCulture. Narosa Publishing House.

CMB22005/ CMB22006

SEMESTER II

BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Understand the properties, mechanisms and biological importance of Bio-molecules .
CO2. Comphrend the mechanism of enzyme action, factors affecting it and its applications.
CO3. Understand and able to relate the principles underlying various instruments in the field of Biology.
CO4. Compare and contrast the role of bio -molecules and enzymes.

BIOMOLECULES **NO. HOURS**

UNIT I: **15**

Carbohydrates: Structure (Fischer and Haworth structure), function and properties of Monosaccharide's (Glucose, Fructose), disaccharides (Sucrose, Maltose and Lactose) and Heteropolysaccharide's- hyaluronic acid and heparin. Reducing and Non reducing Sugars, Stereochemistry- Epimers, Enantiomers, Anomers and Isomers.
Proteins: Amino acids- Zwitter ionic structure, classification based on polarity, pka value. D and L amino acids, optical activity. Peptide bond, primary, secondary, tertiary and quaternary structural organization of proteins. Globular and fibrous proteins with special reference to structure of haemoglobin and collagen.

UNIT II: **15**

Lipids: Classification of lipids with examples. Simple and compound lipids, unsaturated and saturated fatty acids, physical and chemical properties of fats and oils. Structure and biological importance of phospholipids and cholesterol.
Nucleic acids: Structure of bases, nucleosides, nucleotides and secondary structure of DNA and different forms of DNA. Types and functions of RNA, cloverleaf structure of tRNA.

UNIT III: **15**

General characteristics of enzymes, nomenclature and classification of enzymes. Mechanism of enzyme action: active site, enzyme substrate complex formation-lock and key and induced fit theory. Concept of co-enzymes and cofactors with an example. Factors influencing enzyme activity: pH, temperature, substrate concentration, metal ion, inhibitors (allosteric) and activators, energy of activation. Isozymes, multienzyme complex and multifunctional enzymes with an example to each

BIO-ANALYTICAL TECHNIQUES

UNIT IV: **15**

Bio-analytical Techniques: Lambert-Beer Law, working principles of UV-Visible spectrophotometry and colorimetry.
Centrifugation: Basic principle of centrifugation, ultracentrifuge and its application.
Chromatography: Principles of chromatography, Types- Partition chromatography- paper and thin layer chromatography & Adsorption chromatography - column chromatography, ion exchange& molecular sieve (principle &application).
Isotopes: Their importance in biological studies, measure of radioactivity, GM counters

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Qualitative analysis of Carbohydrates.
2. Qualitative analysis of Lipids.
3. Estimation of reducing sugar by DNS method.
4. Estimation of Protein by Biuret method.
5. Estimation of amino acid by ninhydrin method /formal titration
6. Determination of activity and specific activity of enzyme-Salivary amylase.
7. Effect of pH on enzyme activity
8.. Effect of temperature on enzyme activity.
9. Effect of metal ions on enzyme activity.
10. Preparation of buffer solution.
11. Identification of amino acids by circular paper chromatography.

REFERENCES

1. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.

2. Biochemistry, LubertStryer, 6th Edition, WH Freeman, 2006.

3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.

4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.

5. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cenage Learning,2005.

6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

7. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004

8. Practical Enzymology Hans Bisswanger Wiley–VCH 2004

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SEMESTER II

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CO4. Compare and contrast the role of bio -molecules and enzymes.

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Isotopes: Their importance in biological studies, measure of radioactivity, GM counters

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

8. Qualitative analysis of Carbohydrates.
9. Qualitative analysis of Lipids.
10. Estimation of reducing sugar by DNS method.
11. Estimation of Protein by Biuret method.
12. Estimation of amino acid by ninhydrin method /formal titration
13. Determination of activity and specific activity of enzyme-Salivary amylase.
14. Effect of pH on enzyme activity

8.. Effect of temperature on enzyme activity.

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15. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004

16. Practical Enzymology Hans Bisswanger Wiley–VCH 2004

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SEMESTER VI

DSE: ENVIRONMENTAL BIOTECHNOLOGY AND BIOSTATISTICS (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Gain an understanding of the causes, types and control methods for Environmental Pollution.
CO2. Differentiate the application of different life forms in Environmental Remediation.
CO3. Apply Statistical Tools for Analysis of Biological Data.

ENVIRONMENTAL BIOTECHNOLOGY NO. HOURS

UNIT I **15**

Introduction: Major issues in environment pollution. Role of Biotechnology to solve the problems.
Biotechnological methods of pollution detection: General bioassay, cell biological methods, immunoassay, DNA based methods, use of biosensor.
Biotechnological methods in pollution abatement: reduction of CO2 emission, Waste water treatment – conventional waste treatment, Use of Algae, Eutrophication, Use of Cell Immobilization.

UNIT II **15**

Biotechnology and biodegradation: Degradation of Xenobiotic compounds-organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides and surfactants.
Biohydrometallurgy and Biomining: Bioleaching, biosorption, oil degradation and creation of super bugs.
Treatment of Industrial wastes: Pulp, Dye, leather and solid waste management. Genetically engineered microbes for waste treatment.
Ecofriendly bioproducts: Biomass resources, biogas, and alcohol as a fuel, biological hydrogen generation and biodegradable plastics.

BIOSTATISTICS

UNIT III **15**

Introduction, Basic concepts- population, data, sample and variable. Types of data-primary and secondary, methods of data collection- direct personal interview, indirect oral interview, through correspondence, questionnaire and census. Classification of data- qualitative, quantitative and simple classification. Sampling methods- random and non-random. Tabulation of data- structure of a table, simple and complex table.

UNIT IV **15**

Graphical and diagrammatic representation of data- histogram, bar graph and pie diagram. Frequency of distribution- without class intervals, with class intervals and cumulative frequency distribution. Measures of central tendency- mean, median and mode. Measure of dispersion- range, mean deviation, co-efficient of deviation and standard deviation.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 & 2. Analysis of sewage water for BOD & COD.
3 Estimation of Hydrogen sulphides in the sewage water.
b. Estimation of chloride in sewage water sample.
c. Estimation of residual chloride in sewage water sample.
d. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
5 . Estimation of percentage of alcohol by specific gravity bottle method
6 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
b. Photographic demonstration of creation of superbug.
c. Photographic demonstration of genetically modified microbes.
d. Photographic demonstration of genetically modified plants.
e. Photographic demonstration of genetically modified animals.

Biostatistics problems
7 Problems on graphical and diagrammatic representation of data
(histogram, bar graph and pie chart)
8 Calculation of mean, median, mode, standard deviation

REFERENCES

1. Environmental Science, S.C. Santra

2. Environmental Biotechnology, Pradipta Kumar Mohapatra

3. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter

4. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA

5. Glaser AN (2001) High YieldTM Biostatistics. Lippincott Williams and Wilkins, USA

6. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.

7. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and SonsInc.

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j. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
13. Estimation of percentage of alcohol by specific gravity bottle method
14 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
j. Photographic demonstration of creation of superbug.
k. Photographic demonstration of genetically modified microbes.
l. Photographic demonstration of genetically modified plants.
m. Photographic demonstration of genetically modified animals.

Biostatistics problems
15 Problems on graphical and diagrammatic
representation of data(histogram, bar graph and pie chart)
16 Calculation of mean, median, mode, standard deviation

REFERENCES

15. Environmental Science, S.C. Santra

16. Environmental Biotechnology, Pradipta Kumar Mohapatra

17. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter

18. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA

19. Glaser AN (2001) High YieldTM Biostatistics. Lippincott Williams and Wilkins, USA

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CME23206

V SEMESTER

BT 5.2: Immunology and Medical Biotechnology **48 hours**

PART-A

Immunology:

Unit-I

Historical account and chronological events of Edward Jenner and Louis Pasture. 6 Hrs

Types of immunity – Innate- mechanism of innate immunity. Adaptive immunity – active and passive and adoptive immunity. Antigens: Definition, hatpins, epitopes, antigenicity, blood group antigens. Antibodies: Definition, types, structure of IgG.

Unit-II 6

HrsCells involved in immune system – T- cells, B-cells, antigen presentation and macrophages, their role in antigen recognition, clonal selection, and immunological memory.

Organs of immune system: Primary and secondary lymphoid organs –structure and functions. Immuno techniques: Precipitation reaction, immuno diffusion-ODD and RID, RIA, Heamagglutination, ELISA, immunofluroscent, Western blotting.

Unit-III 6

HrsImmunological aspects of viral (HIV), bacterial and parasitic infection (one example each)

Immunization: Passive and active, primary and secondary responses, adjuvant.

Immunedisorders: Hypersensitivity, auto immune disorders- organ specific and systemic specific Grave's diseases, Hashimoto's disease, systemic lupus erythematosus.

Unit-IV 6 Hrs

Major histocompatibility complex: Defnition, H2complex, HLA, functions of MHC.Complement proteins: role of classical complement pathway in immune response. Transplantationimmunology: Types of grafts, graft acceptance, graft rejection, host vs graft rejection

PART-B

Medical biotechnology

Unit-I 6 Hrs

Vaccine production: Introduction, new developments, types of vaccines – Inactivate Attenuated and Recombinant Vaccines-Peptide and DNA, production of vaccines using genetically engineered

microorganisms (HBV). Enzymes in diagnosis: Enzymes used for diagnosis, immobilized enzymes as diagnostic tools, diagnostic proteins eg: AIDS diagnosis.

Unit-II 6 Hrs

Nucleic acid analysis: Features of DNA probes and its applications in diagnosis, diagnosis infectious diseases, identification of *Mycobacterium tuberculosis* in clinical samples using PCR.
Antibiotics: Introduction, strain development and improvement, production of penicillin using genetically engineered organisms.
Enzymes in therapy: List of enzymes and their therapeutic applications.

Unit-III 6 Hrs

Monoclonal antibodies: Introduction, production ofmonoclonal antibodies, Monoclonal antibodies in therapy-for infectious disease and cancer.
Human gene therapy: Definition, differences between somatic and germ line gene therapy, one example each, principle and applications. Antisense technology: Principle and applications

Unit-IV 6 Hrs

Hormone therapy: List of hormones and their therapeutic applications, production of humulin by recombinant DNA technology.
Therapeutic proteins: Cytokines as therapeutic proteins, production of interferon by recombinant DNA technology.
Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

V Semester

Practical BT-5.4: Immunology and Medical biotechnology

1.Blood typing :
a) ABO blood grouping
b) Rh blood grouping.
2.Immuno diffusion :
a) ODD
b) RID.
3. Demonstration of ELISA
4.Western blotting
5**.** MIC assay.
6. Serum analysis: SGPT and SGOT.
7. Separation of Serum from blood & precipitation of immunoglobulin.

CME22005/CME22006

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 EdwardJenner and Louis Pasture.
Antigens: Definition, hatpins, epitops, 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, Heamagglutination, ELISA, immunofluroscent, 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 (HBV).
Enzymes in diagnosis: Enzymes used for diagnosis, immobilized enzymes as diagnostic tools, proteins in diagnosis.
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.

UNIT IV **15**

Hormone therapy: List of hormones and their therapeutic applications, 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, one example

each, principle and applications.
Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 Determination of blood group
a) ABO blood grouping
b) Rh blood grouping.2
Immuno diffusion :
a) ODD
b) RID.
3 Separation of serum from blood
4 Demonstration of ELISA
5Demonstration of Western blotting
6 MIC assay
7 Isolation of antibiotic resistant strains using gradient plate method
8 Estimation of urea by BAMO method
9 Qualitative analysis of normal and abnormal constituents of urine
10 Photographic demonstration of transgenic animals and plants for production of biopharmaceutical

REFERENCES

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.

2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

4. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology. 7th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell

SEC

MICROBIAL TECHNIQUES (2 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Understand and demonstrate basic sterilization techniques.
CO2. Analyze the anatomy of prokaryotic cell and structural detail of eukaryotic cell.
CO3. Acquire the knowledge of Culture media and their applications.
CO4. Assess the growth measurement and pattern of microorganism.

MICROBIAL TECHNIQUES **NO. HOURS**

UNIT I **07**
General introduction. Concept of Prokaryotes and Eukaryotes. General account on Structure, Classification & Reproduction of Bacteria, Fungi & Viruses.

UNIT II **08**
Microbial Techniques: Sterilization: Principles and applications of
a. Physical Methods: Autoclave, Hot air oven, Laminar airflow, Seitz filter, Sintered glass Filter, membrane filter.
b. Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents.
c. Radiation Methods: UV rays and Gamma rays.

UNIT III **08**
Microscopy: working principle and applications of Light microscopy, phase contrast microscopy and electron microscopy.
Staining-Types, Simple and differential (Gram's and acid fast)

UNIT IV **07**
Microbial nutrition and growth: nutritional classes of microorganisms, culture media, pure culture, microbial growth pattern and methods of growth measurements, method of maintenance and preservation of cultures.
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REFERENCES

1 Prescott L.M. Harley J.P and Klein D.A (Microbiology 5th Edition)

2. Pelzar Jr, M.J. Chan, E.C.S. and Krieig N.R (Microbiology)
3. Salle. A.J Fundamental Principles of Bacteriology .
4. Caldmell, D.R. Microbial Physiology and metabolism

CMD22005/ CODECMD22006

SEMESTER IV

PLANT TISSUE & ANIMAL CELL CULTURE (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Develop concept of plant tissue and animal cell culture techniques and their application in biotechnology.
CO2. Comprehend the knowledge of transgenic plants in industrial and agricultural applications.
CO3. Establish and maintain various cell lines used in tissue culture.

PLANT CELL CULTURE NO. HOURS

UNIT I **15**

Plant tissue culture introduction: History and development, Importance of plant tissue culture. Laboratory organization and culture techniques: general requirements and aseptic conditions. Media preparation, culture media, sterilization, and pre-treatment to explants. Principles of tissue culture: Callus culture- Definition of callus, initiation, maintenance, sub culture and organogenesis .Factors affecting organogenesis .organ culture- culture protocols and importance of root and meristem culture.

UNIT- II **15**

Micropropagation in plants: stages of micropropagation, methods, advantages, applications. Somaclonal variation for disease resistance and agronomic traits.
Somatic embryogenesis: Embryoid and embryogenesis. Protocol and importance of somatic embryogenesis, Synthetic seeds and its applications, germplasm conservation and preservation.
Suspension culture: Batch and continuous cell suspension culture. Importance of suspension culture in production of secondary metabolites. Protoplast culture and fusion: Definition of protoplast, isolation principle, culture protocol, action of enzymes, regeneration of plants, protoplast fusion, somatic cell hybridization and its application.

ANIMAL TISSUE CULTURE

UNIT - III **15**

Introduction: History, developments and importance of animal cell culture. Characteristics of animal cell growth, Advantages and disadvantages of tissue culture methods and laboratory facilities (Essential Equipment, Washing facilities, beneficial equipment's, Consumable items).
Animal tissue culture media: Culture media containing naturally occurring ingredients, blood plasma, blood serum, serum-free media, tissue extracts, complex natural media, chemically defined media, and basal salt solution –HBSS.

UNIT – IV **15**

Primary culture, cell lines and cloning: Preparation of primary culture –mechanical and enzymatic method. Primary and established cell lines, somatic cell fusion. Tissue cultures- cover slip method, watch glass method and use of agar.
Whole embryo culture. (e.g. Chick embryo).
Hybridoma technology: Production of monoclonal antibodies.
Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Gene transfer. Animal propagation –Artificial insemination, superovulation, embryo transfer, in-vitro fertilization, embryo splitting. Genetic modification in Medicine -vectors in gene therapy

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Media preparation and sterilization techniques.
2. Callus cultures: choice of explants, preparation of explants, callus induction, subculture and maintenance.
3. Regeneration of plants from growth hormones.
4. Meristem culture for pathogen free plants.
5. Preparation synthetic seed
6. Suspension culture – initiation of suspension culture from callus.
7. Plant protoplast Isolation.
8 . Cell viability test by tryphan blue method.
9. Preparation of HSS and glasswares of cell culture experiments
10.Isolation of PMN leucocytes from human peripheral blood sample and staining and identification.(lishman stain).
11. Demonstration of dissegration of cells by mechanical and enzymatic methods.
12. Photographic Demonstration of Animal Cell culture Lab equipments

REFERENCES

1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.

2. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

3. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.

4. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientificpublishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology-Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.

5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and OrganCulture. Narosa Publishing House.

CMB22005/ CMB22006

SEMESTER II

BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Understand the properties, mechanisms and biological importance of Bio-molecules .
CO2. Comphrend the mechanism of enzyme action, factors affecting it and its applications.
CO3. Understand and able to relate the principles underlying various instruments in the field of Biology.
CO4. Compare and contrast the role of bio -molecules and enzymes.

BIOMOLECULES **NO. HOURS**

UNIT I: **15**

Carbohydrates: Structure (Fischer and Haworth structure), function and properties of Monosaccharide's (Glucose, Fructose), disaccharides (Sucrose, Maltose and Lactose) and Heteropolysaccharide's- hyaluronic acid and heparin. Reducing and Non reducing Sugars, Stereochemistry- Epimers, Enantiomers, Anomers and Isomers.
Proteins: Amino acids- Zwitter ionic structure, classification based on polarity, pka value. D and L amino acids, optical activity. Peptide bond, primary, secondary, tertiary and quaternary structural organization of proteins. Globular and fibrous proteins with special reference to structure of haemoglobin and collagen.

UNIT II: **15**

Lipids: Classification of lipids with examples. Simple and compound lipids, unsaturated and saturated fatty acids, physical and chemical properties of fats and oils. Structure and biological importance of phospholipids and cholesterol.
Nucleic acids: Structure of bases, nucleosides, nucleotides and secondary structure of DNA and different forms of DNA. Types and functions of RNA, cloverleaf structure of tRNA.

UNIT III: **15**

General characteristics of enzymes, nomenclature and classification of enzymes. Mechanism of enzyme action: active site, enzyme substrate complex formation-lock and key and induced fit theory. Concept of co-enzymes and cofactors with an example. Factors influencing enzyme activity: pH, temperature, substrate concentration, metal ion, inhibitors (allosteric) and activators, energy of activation. Isozymes, multienzyme complex and multifunctional enzymes with an example to each

BIO-ANALYTICAL TECHNIQUES

UNIT IV: **15**

Bio-analytical Techniques: Lambert-Beer Law, working principles of UV-Visible spectrophotometry and colorimetry.
Centrifugation: Basic principle of centrifugation, ultracentrifuge and its application.
Chromatography: Principles of chromatography, Types- Partition chromatography- paper and thin layer chromatography & Adsorption chromatography - column chromatography, ion exchange& molecular sieve (principle &application).
Isotopes: Their importance in biological studies, measure of radioactivity, GM counters

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Qualitative analysis of Carbohydrates.
2. Qualitative analysis of Lipids.
3. Estimation of reducing sugar by DNS method.
4. Estimation of Protein by Biuret method.
5. Estimation of amino acid by ninhydrin method /formal titration
6. Determination of activity and specific activity of enzyme-Salivary amylase.
7. Effect of pH on enzyme activity
8.. Effect of temperature on enzyme activity.
9. Effect of metal ions on enzyme activity.
10. Preparation of buffer solution.
11. Identification of amino acids by circular paper chromatography.

REFERENCES

1. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.

2. Biochemistry, LubertStryer, 6th Edition, WH Freeman, 2006.

3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.

4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.

5. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cenage Learning,2005.

6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

7. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004

8. Practical Enzymology Hans Bisswanger Wiley–VCH 2004

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SEMESTER II

BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Understand the properties, mechanisms and biological importance of Bio-molecules .
CO2. Comphrend the mechanism of enzyme action, factors affecting it and its applications.
CO3. Understand and able to relate the principles underlying various instruments in the field of Biology.
CO4. Compare and contrast the role of bio -molecules and enzymes.

BIOMOLECULES **NO. HOURS**

UNIT I: **15**

Carbohydrates: Structure (Fischer and Haworth structure), function and properties of Monosaccharide's (Glucose, Fructose), disaccharides (Sucrose, Maltose and Lactose) and Heteropolysaccharide's- hyaluronic acid and heparin. Reducing and Non reducing Sugars, Stereochemistry- Epimers, Enantiomers, Anomers and Isomers.
Proteins: Amino acids- Zwitter ionic structure, classification based on polarity, pka value. D and L amino acids, optical activity. Peptide bond, primary, secondary, tertiary and quaternary structural organization of proteins. Globular and fibrous proteins with special reference to structure of haemoglobin and collagen.

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Lipids: Classification of lipids with examples. Simple and compound lipids, unsaturated and saturated fatty acids, physical and chemical properties of fats and oils. Structure and biological importance of phospholipids and cholesterol.
Nucleic acids: Structure of bases, nucleosides, nucleotides and secondary structure of DNA and different forms of DNA. Types and functions of RNA, cloverleaf structure of tRNA.

UNIT III: **15**

General characteristics of enzymes, nomenclature and classification of enzymes. Mechanism of enzyme action: active site, enzyme substrate complex formation-lock and key and induced fit theory. Concept of co-enzymes and cofactors with an example. Factors influencing enzyme activity: pH, temperature, substrate concentration, metal ion, inhibitors (allosteric) and activators, energy of activation. Isozymes, multienzyme complex and multifunctional enzymes with an example to each

BIO-ANALYTICAL TECHNIQUES

UNIT IV: **15**

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Centrifugation: Basic principle of centrifugation, ultracentrifuge and its application.
Chromatography: Principles of chromatography, Types- Partition chromatography- paper and thin layer chromatography & Adsorption chromatography - column chromatography, ion exchange& molecular sieve (principle &application).
Isotopes: Their importance in biological studies, measure of radioactivity, GM counters

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

8. Qualitative analysis of Carbohydrates.
9. Qualitative analysis of Lipids.
10. Estimation of reducing sugar by DNS method.
11. Estimation of Protein by Biuret method.
12. Estimation of amino acid by ninhydrin method /formal titration
13. Determination of activity and specific activity of enzyme-Salivary amylase.
14. Effect of pH on enzyme activity

8.. Effect of temperature on enzyme activity.

12. Effect of metal ions on enzyme activity.

13. Preparation of buffer solution.

14. Identification of amino acids by circular paper chromatography.

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15. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004

16. Practical Enzymology Hans Bisswanger Wiley–VCH 2004

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SEMESTER VI

DSE: ENVIRONMENTAL BIOTECHNOLOGY AND BIOSTATISTICS (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Gain an understanding of the causes, types and control methods for Environmental Pollution.
CO2. Differentiate the application of different life forms in Environmental Remediation.
CO3. Apply Statistical Tools for Analysis of Biological Data.

ENVIRONMENTAL BIOTECHNOLOGY NO. HOURS

UNIT I **15**

Introduction: Major issues in environment pollution. Role of Biotechnology to solve the problems.
Biotechnological methods of pollution detection: General bioassay, cell biological methods, immunoassay, DNA based methods, use of biosensor.
Biotechnological methods in pollution abatement: reduction of CO2 emission, Waste water treatment – conventional waste treatment, Use of Algae, Eutrophication, Use of Cell Immobilization.

UNIT II **15**

Biotechnology and biodegradation: Degradation of Xenobiotic compounds-organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides and surfactants.
Biohydrometallurgy and Biomining: Bioleaching, biosorption, oil degradation and creation of super bugs.
Treatment of Industrial wastes: Pulp, Dye, leather and solid waste management. Genetically engineered microbes for waste treatment.
Ecofriendly bioproducts: Biomass resources, biogas, and alcohol as a fuel, biological hydrogen generation and biodegradable plastics.

BIOSTATISTICS

UNIT III **15**

Introduction, Basic concepts- population, data, sample and variable. Types of data-primary and secondary, methods of data collection- direct personal interview, indirect oral interview, through correspondence, questionnaire and census. Classification of data- qualitative, quantitative and simple classification. Sampling methods- random and non-random. Tabulation of data- structure of a table, simple and complex table.

UNIT IV **15**

Graphical and diagrammatic representation of data- histogram, bar graph and pie diagram. Frequency of distribution- without class intervals, with class intervals and cumulative frequency distribution. Measures of central tendency- mean, median and mode. Measure of dispersion- range, mean deviation, co-efficient of deviation and standard deviation.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 & 2. Analysis of sewage water for BOD & COD.
3 Estimation of Hydrogen sulphides in the sewage water.
b. Estimation of chloride in sewage water sample.
c. Estimation of residual chloride in sewage water sample.
d. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
5 . Estimation of percentage of alcohol by specific gravity bottle method
6 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
b. Photographic demonstration of creation of superbug.
c. Photographic demonstration of genetically modified microbes.
d. Photographic demonstration of genetically modified plants.
e. Photographic demonstration of genetically modified animals.

Biostatistics problems
7 Problems on graphical and diagrammatic representation of data
(histogram, bar graph and pie chart)
8 Calculation of mean, median, mode, standard deviation

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1. Environmental Science, S.C. Santra

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SEMESTER VI

DSE: ENVIRONMENTAL BIOTECHNOLOGY AND BIOSTATISTICS (4 CREDITS)

Course Outcomes:

After completing the course students are able to:
CO1. Gain an understanding of the causes, types and control methods for Environmental Pollution.
CO2. Differentiate the application of different life forms in Environmental Remediation.
CO3. Apply Statistical Tools for Analysis of Biological Data.

ENVIRONMENTAL BIOTECHNOLOGY NO. HOURS

UNIT I **15**

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UNIT II **15**

Biotechnology and biodegradation: Degradation of Xenobiotic compounds-organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides and surfactants.
Biohydrometallurgy and Biomining: Bioleaching, biosorption, oil degradation and creation of super bugs.
Treatment of Industrial wastes: Pulp, Dye, leather and solid waste management. Genetically engineered microbes for waste treatment.
Ecofriendly bioproducts: Biomass resources, biogas, and alcohol as a fuel, biological hydrogen generation and biodegradable plastics.

BIOSTATISTICS

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PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

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Biostatistics problems
11 Problems on graphical and diagrammatic representation of data(histogram, bar graph and pie chart)
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SEMESTER VI

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Course Outcomes:

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CO1. Gain an understanding of the causes, types and control methods for Environmental Pollution.
CO2. Differentiate the application of different life forms in Environmental Remediation.
CO3. Apply Statistical Tools for Analysis of Biological Data.

ENVIRONMENTAL BIOTECHNOLOGY NO. HOURS

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BIOSTATISTICS

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PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 & 2. Analysis of sewage water for BOD & COD.
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j. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
13. Estimation of percentage of alcohol by specific gravity bottle method
14 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
j. Photographic demonstration of creation of superbug.
k. Photographic demonstration of genetically modified microbes.
l. Photographic demonstration of genetically modified plants.
m. Photographic demonstration of genetically modified animals.

Biostatistics problems
15 Problems on graphical and diagrammatic
representation of data(histogram, bar graph and pie chart)
16 Calculation of mean, median, mode, standard deviation

REFERENCES

15. Environmental Science, S.C. Santra

16. Environmental Biotechnology, Pradipta Kumar Mohapatra

17. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter

18. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA

19. Glaser AN (2001) High YieldTM Biostatistics. Lippincott Williams and Wilkins, USA

20. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.

21. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and SonsInc.

CME23206

V SEMESTER

BT 5.2: Immunology and Medical Biotechnology **48 hours**

PART-A

Immunology:

Unit-I

Historical account and chronological events of Edward Jenner and Louis Pasture. 6 Hrs

Types of immunity – Innate- mechanism of innate immunity. Adaptive immunity – active and passive and adoptive immunity. Antigens: Definition, hatpins, epitopes, antigenicity, blood group antigens. Antibodies: Definition, types, structure of IgG.

Unit-II 6

HrsCells involved in immune system – T- cells, B-cells, antigen presentation and macrophages, their role in antigen recognition, clonal selection, and immunological memory.

Organs of immune system: Primary and secondary lymphoid organs –structure and functions. Immuno techniques: Precipitation reaction, immuno diffusion-ODD and RID, RIA, Heamagglutination, ELISA, immunofluroscent, Western blotting.

Unit-III 6

HrsImmunological aspects of viral (HIV), bacterial and parasitic infection (one example each)

Immunization: Passive and active, primary and secondary responses, adjuvant.

Immunedisorders: Hypersensitivity, auto immune disorders- organ specific and systemic specific Grave's diseases, Hashimoto's disease, systemic lupus erythematosus.

Unit-IV 6 Hrs

Major histocompatibility complex: Defnition, H2complex, HLA, functions of MHC.Complement proteins: role of classical complement pathway in immune response. Transplantationimmunology: Types of grafts, graft acceptance, graft rejection, host vs graft rejection

PART-B

Medical biotechnology

Unit-I 6 Hrs

Vaccine production: Introduction, new developments, types of vaccines – Inactivate Attenuated and Recombinant Vaccines-Peptide and DNA, production of vaccines using genetically engineered

microorganisms (HBV). Enzymes in diagnosis: Enzymes used for diagnosis, immobilized enzymes as diagnostic tools, diagnostic proteins eg: AIDS diagnosis.

Unit-II 6 Hrs

Nucleic acid analysis: Features of DNA probes and its applications in diagnosis, diagnosis infectious diseases, identification of *Mycobacterium tuberculosis* in clinical samples using PCR.
Antibiotics: Introduction, strain development and improvement, production of penicillin using genetically engineered organisms.
Enzymes in therapy: List of enzymes and their therapeutic applications.

Unit-III 6 Hrs

Monoclonal antibodies: Introduction, production ofmonoclonal antibodies, Monoclonal antibodies in therapy-for infectious disease and cancer.
Human gene therapy: Definition, differences between somatic and germ line gene therapy, one example each, principle and applications. Antisense technology: Principle and applications

Unit-IV 6 Hrs

Hormone therapy: List of hormones and their therapeutic applications, production of humulin by recombinant DNA technology.
Therapeutic proteins: Cytokines as therapeutic proteins, production of interferon by recombinant DNA technology.
Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

V Semester

Practical BT-5.4: Immunology and Medical biotechnology

1.Blood typing :
a) ABO blood grouping
b) Rh blood grouping.
2.Immuno diffusion :
a) ODD
b) RID.
3. Demonstration of ELISA
4.Western blotting
5**.** MIC assay.
6. Serum analysis: SGPT and SGOT.
7. Separation of Serum from blood & precipitation of immunoglobulin.

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Syllabus

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Chemistry, Botany, Zoology

Botany, Biochemistry, Microbiology

2018-19

CMF23607

V SEMESTER

Credits 2 **Theory: 30Lectures**

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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

SEC-1: Floriculture

Unit 1: Introduction: History of gardening; **(2 Lectures)**

Importance and scope of floriculture and landscape gardening

Unit 2: Nursery Management and Routine Garden Operations: **(8 Lectures)**

Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators

Unit 3: Ornamental Plants: **(4 Lectures)**

Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and *Selaginellas*; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit 4: Principles of Garden Designs: **(4Lectures)**

English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden Some Famous gardens of India.

Unit 5: Landscaping Places of Public Importance: **(4 Lectures)**

Landscaping highways and Educational institutions

Unit 6: Commercial Floriculture: **(6 Lectures)**

Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchids).

Unit 7: Diseases and Pests of Ornamental Plants. (2 Lectures

References

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India Allied Publishers

2018-19

BMF25208

BOTANY THEORY

III B.Sc. SEMESTER VI: PAPER VIII

Molecular Biology, Genetic Engineering, Plant Biotechnology,Plant Breeding & Plant Propagation

Duration : 3 Hours/Week **Max. Marks : 100**

Total : 48 Hours **[Theory Exam : 80 + IA : 20 (Based on the tests conducted)]**

UNIT 1 : MOLECULAR BIOLOGY

1. Definition and Scope
2. DNA: Chemistry, Structure and functions, DNA replication.(Eukaryotic)
   RNA : Chemistry, Structure, types and functions
3. Nucleic Acids as genetic material : Avery *et al's* experiment, Frankel Conrat's experiment.
4. Gene concept : Cistron, Recon and Muton – Prokaryotic & Eukaryotic gene structure.
5. Central Dogma of Molecular biology, Genetic code : Features, Wobble concept, Protein synthesis : Transcription , Splicing & Translation..
6. Gene regulation in Prokaryotes (Lac Operon concept) & Eukaryotes (Britten- Davidson's model).

14 hours

UNIT 2 : GENETIC ENGINEERING

1. Introduction : Definition and Scope
2. Tools of Genetic engineering
   i) Donor DNA
   ii) Vectors – Plasmids, Viruses, Cosmid, Artificial chromosomes.
   iii) Enzymes – RENs and Ligases.
   iv) Host cells – *E.coli*/Yeast.
   v) Bioreactor (Fermenter)

3. Steps involved in Recombinant DNA technology

4. Induction of recombinant DNA into host cells; Microprojectile, Electroporation, *Agrobacterium* mediated gene transfer.

5. Polymerase Chain Reaction (PCR) and its applications.

6. A brief account of Blotting Techniques.

7. Genomics :

   i) DNA finger printing

   ii) Gene therapy

8. Hazards and safe guards of Genetic Engineering **12 hours**

UNIT 3: PLANT BIOTECHNOLOGY

1. Introduction and scope.
2. Tissue culture-Technique, differentiation, dedifferentiation, redifferention and totipotency.
3. Application in Agriculture and Horticulture.
4. Organogenesis,isolation and culturing of protoplast.
5. Somatic hybridization, somatic embryos and synthetic seeds.
6. Anther culture –haploid production and its significance.
7. Transgenic plants ,production of enzymes. **14hours**
8. A brief account of IPR.

UNIT 4 : PLANT PROPAGATION AND PLANT BREEDING

A. Plant propagation :

1. Methods of vegetative propagation – Stem cutting, Grafting, Trenching, Layering-types & Significance

2. Basic Nursery methods and Green house technique.

B. Plant Breeding :

1. Aims and Objectives, Techniques in Plant breeding, Hybridization (Intraspecific, Interspecific and Intergeneric), Hybrid vigour and Hybrid seed production. Germplasm maintenance, pollen banks and quarantine
2. Plant Breeding centers in India – a general account.

08 hours

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

DEPARTMENT OF CHEMISTRY

VI SEMESTER :CHEMISTRY PRACTICAL DSE LAB 6A

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given)
   Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}
2. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate
(ii) tetraamminecopper (II) sulphate
(iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Section B: Volumetric analysis

1. Estimation of iron in the given sample of Hematite by dichromate method
2. Estimation of % of calcium in lime stone 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 tha given sample of copper wire
6. Determination of COD of water.
7. Estimation of available chlorine in bleaching powder
8. Estimation of total hardness of different samples of water using EDTA & ZnSO4.

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

DEPARTMENT OF CHEMISTRY

CHEMISTRY PRACTICAL - DSE LAB 6B

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CMF24008

DSE-1A **SEMESTER-VI**

ORGANOMETALLICS, BIOINORGANIC CHEMISTRY,

POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Theory: 60 Lectures

Course outcome:

After completion of the course the student is able to:

CO1: Learn in depth metallurgy, organometallic compounds and bioinorganic chemistry

CO2: Understand in depth heteronuclear aromatic compounds, active methylene compounds

CO3: Learn in detail with examples spectroscopy

DSE-1A:

Section A: Inorganic Chemistry-4 **(30 Lectures)**

Metallurgy: Terms and principles involved in metallurgy, Ellingam'sdiagram,Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- generall metallurgy followed by Monds process (purification, Manganese from oxides ores- Reduction by the Alumino Thermite process- refininmg by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quartation process.

Electro metallurgy: Extraction of Lithium by fusion method Followed by electrolysis of lithium chloride.

Powder metallurgy: Importance, metal powder production &applications. Production of Tungsten powder.Principles of Electroplationg. **(10 Lectures)**

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene.. Preparation , properties , boding and appliations of alkyle and aryls of Li, Al, Hg,Sn and Ti.

Nature of M-CO bonding in carbonyls. Preparation, properties and structures of mono nuclear and binuclear metal carbonyls-Ni(CO)4, Cr(CO)6, Fe(CO)5, Mn2(CO)10, Co2(CO)8. Applications of EAN rule to mononuclear metalcarbonyls.

Behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies). **(10 Lectures)**

Chemistry of nonmetallics:

Boron : Boron hydrides – Diborane – preparation, properties, uses and structureCarbon: Fullerenes- Production, structure of C60 and C70. Diamond and Graphite-Properties and structure.

Silicon: Structure of silica. Silicates-types of silicates with examples.

Nitrogen: Preparation(any two methods), properties, uses, structure of hydrazine, hydroxyl amine and hydrazoic acid.

Sulphur: Preparation, properties, structures and applications of thionyl chloride, sulphuryl chloride and SF6.

Halogens: Preparation, properties and structure of bleaching powder.

Pseudo halogens: preparation, properties and structure of cyanogens, thiocyanogen, tellurocyanogen and oxucyanogen.(any one method of preparation and any three properties to be discussed). **(5 Lectures)**

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry.Essential and trace elements in biological process. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Ca2+, Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, Enzymatic role of Iron in Hemoglobin and myoglobin, Magnesium in Chlorophyll, Cobalt in Vitamin B12.

Stabilization of protein structures and structural role (bones).

Biological functions and toxicity of Cr, Mn, Co, Ni, I, Hg, Mo, and Se. **(5 Lectures)**

Section B: Organic Chemistry-4 **(30 Lectures)**

Polynuclear and heteronuclear aromatic compounds:

Polynuclear Hydrocarbons: Resonance structures of Naphthalene, anthracene and Phenanthracene.

Structural elucidation of naphthalene. Reactions of naphthalene- oxidation, reduction and electrophilic substitution reactions

HetrocyclicCompounds:Definition, classification with examples, synthesis of Furan, thiophene, pyrrole, pyridine, indole (Fischer method), quinoline (Skrup's synthesis), isoquinoline, pyrimidine (one method each). Aromaticity and basicity of pyrrole and pyridine.Electrophillic substitution reactions of pyrrole and pyridine.

Uric acid- Structure, Synthesis. Conversion of uric to purine and caffeine

Dyes: Colour and Constitution, Witt's theory, Classification of dyes based on structures with examples, synthesis of Methyl orange, Bismark brown, indigo and malachite green, structural elucidation of alizarin and it's synthesis**.**

Drugs: Chemotherapy and chemotherapeutic agents, definition of drugs, types of drugs, antipyretics, analgesics, anaesthetics, sedatives, narcotics, antiseptics, antibacterials, antibiotics, antimalarials and sulpha drugs with examples. Synthesis of paracetamol, sulphanilamide, sulphaguanidine **(13 lectures)**

Active methylene compounds: Definition, Ethyl acetoacetate and diethyl malonatepreparation, Mechanism of Claisen condensation, keto-enoltautomerism and its evidence.Synthetic applications of EAA and DEM:- Synthesis of mono carboxylic acids, dicarboxylic acids-succinic acid, adipic acid, antipyrine,Barbituric acid, acetyl acetone, Crotonic acid and Cinnamic acid**.**

(4 lectures)

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, $\lambda_{max,}$ chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λmax of conjugated dienes

IR-Spectroscopy: Introduction,functional group region and finger print region stretching frequency, Graphical representation of IR spectra of benzoic acid and methyl benzoate . Absorption frequencies of Simple functional groups

NMR Spectroscopy: Basic principles of proton magnetic resonance , nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, magnetic resonance-chemical shift (δ value), use of TMS as reference, nuclear shielding effects, equivalent and non-equivalent protons, spin-spin splitting.

NMR spectra of Simple organic molecules (like ethyl alcohol, ethane, propane, benzene, toluene, acetone, and methyl chloride) to be discussed.. **(13 Lectures)**

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CMF24008

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DEPARTMENT OF CHEMISTRY

I SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2A LAB**
Section A: Inorganic Chemistry – Volumetric Analysis 1. Estimation of sodium hydroxide using HCl and sodium carbonate crystals 2. Estimation of oxalic acid $KmnO_4$.And Mohr's salt. 3. Estimation of Mohr's salt using $KmnO_4$. and oxalic acid crystals 4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator. 5. Estimation of Cu (II) ions iodometrically using NaS_2O_3. 6. Estimation of Hydrogen peroxide using $KMnO_4$ and Sodium oxalate crystals 7. Estimation of oxalic acid and Sulphuric acid present in a given mixture. 8. Estimation of oxalic acid using NaOH solution and PHP crystals.
Section B: Organic Chemistry: 1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements). 2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given) a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography. b) Identify and separate the sugars present in the given mixture by paper chromatography.

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

DEPARTMENT OF CHEMISTRY

II SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2B LAB**

Section A: Physical Chemistry

Conductance

I. Determination of cell constant

II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

III. Perform the following conductometric titrations:

i. Strong acid vs strong base

ii. Weak acid vsstrong base

Potentiometry

Perform the following potentiometric titrations:

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

iii. Potassium dichromate vs. Mohr's salt

Colorimetric estimation of Cu^{2+} /Fe^{3+}

Determination of refractive index of the mixture

Ionic equilibria

pH measurements

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

b) PH titration of strong acid with strong base.

c) Determination of pKa of weak acid by potentiometric titration.

d) Preparation of buffer solutions:

I. Sodium acetate-acetic acid.

II. Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation ofquantitative yields to be done.

(a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.

(d) Preparation of acetanilide from aniline.

(e) Preparation of p-bromo acetanilide

(f) Preparation of benzoic acid from benzaldehyde by oxidation.

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DEPARTMENT OF CHEMISTRY

III SEMESTER :

Section A: Physical Chemistry

Section A: Physical Chemistry
Thermo chemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.

4. Determination of Transition temperature of the given salt hydrate.
5. Determination of enthalpy of hydration of copper sulphate.
6. Determination of CST OF phenol water system
7. Determination of % of NaCl

Section B: Organic Chemistry

I Systematic Qualitative Organic Analysis of Organic Compounds possessingmonofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

II

1. Separation of amino acids by paper chromatography
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. .Differentiation between a reducing and a nonreducing sugar.

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DEPARTMENT OF CHEMISTRY

IV SEMESTER :

CHEMISTRY LAB-DSC 2D LAB:

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:

Cations : NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^+, K^+

Anions : CO_3^{2-} , S^{2-}, SO^{2-}, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, SO_4^{2-}, PO_4^{3-},BO_3^{3-}, C_2O4^{2-}, F^-

1.Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.

1. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
2. Estimation of total hardness of a given sample of water by complexometric titration.

B: Physical Chemistry

I. Surface tension measurement (use of organic solvents excluded).

a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b) Study of the variation of surface tension of a detergent solution with concentration.

II. Viscosity measurement (use of organic solvents excluded)

a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
b. Study of the variation of viscosity of an aqueous solution with concentration of solute.

III Determination molecular weight of the given non volatile solute by Walker Lumbsden method.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
   a. Acid hydrolysis of methyl acetate with hydrochloric acid.
   b. Saponification of ethyl acetate.
   c. Kinetics of rate of decomposition of H_2O_2catalysed by $FeCl_3$

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DEPARTMENT OF CHEMISTRY

V SEMESTER :CHEMISTRY PRACTICAL DSE LAB 5B

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 ($AgNO_3$ and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

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DEPARTMENT OF CHEMISTRY

V SEMESTER :

CHEMISTRY PRACTICAL - DSE LAB:5A

Section A: Gravimetric estimations

1. Gravimetric estimation of Barium as barium sulphate.
2. Gravimetric estimation of Iron as Iron oxide
3. Gravimetric estimation of Copper as Copper thiocyanate
4. Gravimetric estimation of Nickel as nickeldimethylglyoximate
5. Gravimetric estimation of magnesium as Magnesiumhydroxyquenolate
6. Gravimetric estimation of Sulphate as barium sulphate
7. Gravimetric estimation of Manganese from pyrolusite ore

Section B: Volumetric estimations

1. Determination of Iodine value of edible oil
2. Determination saponification value of edible oil
3. Separation of Green leaf pigments by TLC
4. Determination of amount of acetic cid in a given wine sample
5. Determination of total acidity of vineger
6. Determination of vitamin C in orange juice.

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DEPARTMENT OF CHEMISTRY

VI SEMESTER :CHEMISTRY PRACTICAL DSE LAB 6A

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given)
   Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}
2. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate
(ii) tetraamminecopper (II) sulphate
(iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Section B: Volumetric analysis

1. Estimation of iron in the given sample of Hematite by dichromate method
2. Estimation of % of calcium in lime stone 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 tha given sample of copper wire
6. Determination of COD of water.
7. Estimation of available chlorine in bleaching powder
8. Estimation of total hardness of different samples of water using EDTA & ZnSO4.

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DEPARTMENT OF CHEMISTRY

CHEMISTRY PRACTICAL - DSE LAB 6B

Section A: Inorganic Chemistry

3. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given)
   Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}
4. Preparation of any two of the following complexes and measurement of their conductivity:

(iv) tetraamminecarbonatocobalt (III) nitrate
(v) tetraamminecopper (II) sulphate
(vi) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Section B: Volumetric analysis

9. Estimation of iron in the given sample of Hematite by dichromate method
10. Estimation of % of calcium in lime stone by oxalate method
11. Estimation of manganese in the given sample of pyrolusite
12. Estimation of magnesium in the given sample of Dolomite by EDTA method
13. Determination of % purity of copper in tha given sample of copper wire
14. Determination of COD of water.
15. Estimation of available chlorine in bleaching powder
16. Estimation of total hardness of different samples of water using EDTA & ZnSO4.

CMF24008

DSE-1A **SEMESTER-VI**

ORGANOMETALLICS, BIOINORGANIC CHEMISTRY,

POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Theory: 60 Lectures

Course outcome:

After completion of the course the student is able to:

CO1: Learn in depth metallurgy, organometallic compounds and bioinorganic chemistry

CO2: Understand in depth heteronuclear aromatic compounds, active methylene compounds

CO3: Learn in detail with examples spectroscopy

DSE-1A:

Section A: Inorganic Chemistry-4 **(30 Lectures)**

Metallurgy: Terms and principles involved in metallurgy, Ellingam'sdiagram,Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- generall metallurgy followed by Monds process (purification, Manganese from oxides ores- Reduction by the Alumino Thermite process- refininmg by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quartation process.

Electro metallurgy: Extraction of Lithium by fusion method Followed by electrolysis of lithium chloride.

Powder metallurgy: Importance, metal powder production &applications. Production of Tungsten powder.Principles of Electroplationg. **(10 Lectures)**

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene.. Preparation , properties , boding and appliations of alkyle and aryls of Li, Al, Hg,Sn and Ti.

Nature of M-CO bonding in carbonyls. Preparation, properties and structures of mono nuclear and binuclear metal carbonyls-Ni(CO)4, Cr(CO)6, Fe(CO)5, Mn2(CO)10, Co2(CO)8. Applications of EAN rule to mononuclear metalcarbonyls.

Behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies). **(10 Lectures)**

Chemistry of nonmetallics:

Boron : Boron hydrides – Diborane – preparation, properties, uses and structureCarbon: Fullerenes- Production, structure of C60 and C70. Diamond and Graphite-Properties and structure.

Silicon: Structure of silica. Silicates-types of silicates with examples.

Nitrogen: Preparation(any two methods), properties, uses, structure of hydrazine, hydroxyl amine and hydrazoic acid.

Sulphur: Preparation, properties, structures and applications of thionyl chloride, sulphuryl chloride and SF6.

Halogens: Preparation, properties and structure of bleaching powder.

Pseudo halogens: preparation, properties and structure of cyanogens, thiocyanogen, tellurocyanogen and oxucyanogen.(any one method of preparation and any three properties to be discussed). **(5 Lectures)**

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry.Essential and trace elements in biological process. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Ca2+, Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, Enzymatic role of Iron in Hemoglobin and myoglobin, Magnesium in Chlorophyll, Cobalt in Vitamin B12.

Stabilization of protein structures and structural role (bones).

Biological functions and toxicity of Cr, Mn, Co, Ni, I, Hg, Mo, and Se. **(5 Lectures)**

Section B: Organic Chemistry-4 **(30 Lectures)**

Polynuclear and heteronuclear aromatic compounds:

Polynuclear Hydrocarbons: Resonance structures of Naphthalene, anthracene and Phenanthracene.

Structural elucidation of naphthalene. Reactions of naphthalene- oxidation, reduction and electrophilic substitution reactions

HetrocyclicCompounds:Definition, classification with examples, synthesis of Furan, thiophene, pyrrole, pyridine, indole (Fischer method), quinoline (Skrup's synthesis), isoquinoline, pyrimidine (one method each). Aromaticity and basicity of pyrrole and pyridine.Electrophillic substitution reactions of pyrrole and pyridine.

Uric acid- Structure, Synthesis. Conversion of uric to purine and caffeine

Dyes: Colour and Constitution, Witt's theory, Classification of dyes based on structures with examples, synthesis of Methyl orange, Bismark brown, indigo and malachite green, structural elucidation of alizarin and it's synthesis**.**

Drugs: Chemotherapy and chemotherapeutic agents, definition of drugs, types of drugs, antipyretics, analgesics, anaesthetics, sedatives, narcotics, antiseptics, antibacterials, antibiotics, antimalarials and sulpha drugs with examples. Synthesis of paracetamol, sulphanilamide, sulphaguanidine **(13 lectures)**

Active methylene compounds: Definition, Ethyl acetoacetate and diethyl malonatepreparation, Mechanism of Claisen condensation, keto-enoltautomerism and its evidence.Synthetic applications of EAA and DEM:- Synthesis of mono carboxylic acids, dicarboxylic acids-succinic acid, adipic acid, antipyrine,Barbituric acid, acetyl acetone, Crotonic acid and Cinnamic acid**.**

(4 lectures)

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, $\lambda_{max,}$ chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λmax of conjugated dienes

IR-Spectroscopy: Introduction,functional group region and finger print region stretching frequency, Graphical representation of IR spectra of benzoic acid and methyl benzoate . Absorption frequencies of Simple functional groups

NMR Spectroscopy: Basic principles of proton magnetic resonance , nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, magnetic resonance-chemical shift (δ value), use of TMS as reference, nuclear shielding effects, equivalent and non-equivalent protons, spin-spin splitting.

NMR spectra of Simple organic molecules (like ethyl alcohol, ethane, propane, benzene, toluene, acetone, and methyl chloride) to be discussed.. **(13 Lectures)**

Reference:

- James E. Huheey, Ellen Keiter& Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
- G.L. Miessler& Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
- J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
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- John R. Dyer: Applications of Absorption Spectroscopy of OrganicCompounds, Prentice Hall.
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DSE-1A SEMESTER-VI

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Biological functions and toxicity of Cr, Mn, Co, Ni, I, Hg, Mo, and Se. **(5 Lectures)**

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DEPARTMENT OF CHEMISTRY

I SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2A LAB**
Section A: Inorganic Chemistry – Volumetric Analysis 1. Estimation of sodium hydroxide using HCl and sodium carbonate crystals 2. Estimation of oxalic acid $KmnO_4$.And Mohr's salt. 3. Estimation of Mohr's salt using $KmnO_4$. and oxalic acid crystals 4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator. 5. Estimation of Cu (II) ions iodometrically using NaS_2O_3. 6. Estimation of Hydrogen peroxide using $KMnO_4$ and Sodium oxalate crystals 7. Estimation of oxalic acid and Sulphuric acid present in a given mixture. 8. Estimation of oxalic acid using NaOH solution and PHP crystals.
Section B: Organic Chemistry: 1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements). 2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given) a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography. b) Identify and separate the sugars present in the given mixture by paper chromatography.

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DEPARTMENT OF CHEMISTRY

II SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2B LAB**

Section A: Physical Chemistry

Conductance

I. Determination of cell constant

II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

III. Perform the following conductometric titrations:

i. Strong acid vs strong base

ii. Weak acid vsstrong base

Potentiometry

Perform the following potentiometric titrations:

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

iii. Potassium dichromate vs. Mohr's salt

Colorimetric estimation of Cu^{2+} /Fe^{3+}

Determination of refractive index of the mixture

Ionic equilibria

pH measurements

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

b) PH titration of strong acid with strong base.

c) Determination of pKa of weak acid by potentiometric titration.

d) Preparation of buffer solutions:

I. Sodium acetate-acetic acid.

II. Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation ofquantitative yields to be done.

(a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.

(d) Preparation of acetanilide from aniline.

(e) Preparation of p-bromo acetanilide

(f) Preparation of benzoic acid from benzaldehyde by oxidation.

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DEPARTMENT OF CHEMISTRY

III SEMESTER :

Section A: Physical Chemistry

Section A: Physical Chemistry
Thermo chemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.

4. Determination of Transition temperature of the given salt hydrate.
5. Determination of enthalpy of hydration of copper sulphate.
6. Determination of CST OF phenol water system
7. Determination of % of NaCl

Section B: Organic Chemistry

I Systematic Qualitative Organic Analysis of Organic Compounds possessingmonofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

II

1. Separation of amino acids by paper chromatography
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. .Differentiation between a reducing and a nonreducing sugar.

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DEPARTMENT OF CHEMISTRY

IV SEMESTER :

CHEMISTRY LAB-DSC 2D LAB:

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:

Cations : NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^+, K^+

Anions : CO_3^{2-} , S^{2-}, SO^{2-}, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, SO_4^{2-}, PO_4^{3-},BO_3^{3-}, C_2O4^{2-}, F^-

1.Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.

1. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
2. Estimation of total hardness of a given sample of water by complexometric titration.

B: Physical Chemistry

I. Surface tension measurement (use of organic solvents excluded).

a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b) Study of the variation of surface tension of a detergent solution with concentration.

II. Viscosity measurement (use of organic solvents excluded)

a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
b. Study of the variation of viscosity of an aqueous solution with concentration of solute.

III Determination molecular weight of the given non volatile solute by Walker Lumbsden method.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
   a. Acid hydrolysis of methyl acetate with hydrochloric acid.
   b. Saponification of ethyl acetate.
   c. Kinetics of rate of decomposition of H_2O_2catalysed by $FeCl_3$

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

DEPARTMENT OF CHEMISTRY

V SEMESTER :CHEMISTRY PRACTICAL DSE LAB 5B

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 ($AgNO_3$ and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2.
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

V SEMESTER :

CHEMISTRY PRACTICAL - DSE LAB:5A

Section A: Gravimetric estimations

1. Gravimetric estimation of Barium as barium sulphate.
2. Gravimetric estimation of Iron as Iron oxide
3. Gravimetric estimation of Copper as Copper thiocyanate
4. Gravimetric estimation of Nickel as nickeldimethylglyoximate
5. Gravimetric estimation of magnesium as Magnesiumhydroxyquenolate
6. Gravimetric estimation of Sulphate as barium sulphate
7. Gravimetric estimation of Manganese from pyrolusite ore

Section B: Volumetric estimations

1. Determination of Iodine value of edible oil
2. Determination saponification value of edible oil
3. Separation of Green leaf pigments by TLC
4. Determination of amount of acetic cid in a given wine sample
5. Determination of total acidity of vineger
6. Determination of vitamin C in orange juice.

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DEPARTMENT OF CHEMISTRY

VI SEMESTER :CHEMISTRY PRACTICAL DSE LAB 6A

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given)
   Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}
2. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate
(ii) tetraamminecopper (II) sulphate
(iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Section B: Volumetric analysis

1. Estimation of iron in the given sample of Hematite by dichromate method
2. Estimation of % of calcium in lime stone 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 tha given sample of copper wire
6. Determination of COD of water.
7. Estimation of available chlorine in bleaching powder
8. Estimation of total hardness of different samples of water using EDTA & ZnSO4.

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

DEPARTMENT OF CHEMISTRY

CHEMISTRY PRACTICAL - DSE LAB 6B

Section A: Inorganic Chemistry

3. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given)
   Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+} or Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}
4. Preparation of any two of the following complexes and measurement of their conductivity:

(iv) tetraamminecarbonatocobalt (III) nitrate
(v) tetraamminecopper (II) sulphate
(vi) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Section B: Volumetric analysis

9. Estimation of iron in the given sample of Hematite by dichromate method
10. Estimation of % of calcium in lime stone by oxalate method
11. Estimation of manganese in the given sample of pyrolusite
12. Estimation of magnesium in the given sample of Dolomite by EDTA method
13. Determination of % purity of copper in tha given sample of copper wire
14. Determination of COD of water.
15. Estimation of available chlorine in bleaching powder
16. Estimation of total hardness of different samples of water using EDTA & ZnSO4.

CMF24008

DSE-1A **SEMESTER-VI**

ORGANOMETALLICS, BIOINORGANIC CHEMISTRY,

POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Theory: 60 Lectures

Course outcome:

After completion of the course the student is able to:

CO1: Learn in depth metallurgy, organometallic compounds and bioinorganic chemistry

CO2: Understand in depth heteronuclear aromatic compounds, active methylene compounds

CO3: Learn in detail with examples spectroscopy

DSE-1A:

Section A: Inorganic Chemistry-4 **(30 Lectures)**

Metallurgy: Terms and principles involved in metallurgy, Ellingam'sdiagram,Types of metallurgy: Pyro metallurgy- extraction of Nickel by sulphide ore- generall metallurgy followed by Monds process (purification, Manganese from oxides ores- Reduction by the Alumino Thermite process- refininmg by electrolytic process.

Hydro metallurgy: Extraction of Gold from native ore by cyanide process, and refining by quartation process.

Electro metallurgy: Extraction of Lithium by fusion method Followed by electrolysis of lithium chloride.

Powder metallurgy: Importance, metal powder production &applications. Production of Tungsten powder.Principles of Electroplationg. **(10 Lectures)**

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene.. Preparation , properties , boding and appliations of alkyle and aryls of Li, Al, Hg,Sn and Ti.

Nature of M-CO bonding in carbonyls. Preparation, properties and structures of mono nuclear and binuclear metal carbonyls-Ni(CO)4, Cr(CO)6, Fe(CO)5, Mn2(CO)10, Co2(CO)8. Applications of EAN rule to mononuclear metalcarbonyls.

Behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies). **(10 Lectures)**

Chemistry of nonmetallics:

Boron : Boron hydrides – Diborane – preparation, properties, uses and structureCarbon: Fullerenes- Production, structure of C60 and C70. Diamond and Graphite-Properties and structure.

Silicon: Structure of silica. Silicates-types of silicates with examples.

Nitrogen: Preparation(any two methods), properties, uses, structure of hydrazine, hydroxyl amine and hydrazoic acid.

Sulphur: Preparation, properties, structures and applications of thionyl chloride, sulphuryl chloride and SF6.

Halogens: Preparation, properties and structure of bleaching powder.

Pseudo halogens: preparation, properties and structure of cyanogens, thiocyanogen, tellurocyanogen and oxucyanogen.(any one method of preparation and any three properties to be discussed). **(5 Lectures)**

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry.Essential and trace elements in biological process. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Ca2+, Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, Enzymatic role of Iron in Hemoglobin and myoglobin, Magnesium in Chlorophyll, Cobalt in Vitamin B12.

Stabilization of protein structures and structural role (bones).

Biological functions and toxicity of Cr, Mn, Co, Ni, I, Hg, Mo, and Se. **(5 Lectures)**

Section B: Organic Chemistry-4 **(30 Lectures)**

Polynuclear and heteronuclear aromatic compounds:

Polynuclear Hydrocarbons: Resonance structures of Naphthalene, anthracene and Phenanthracene.

Structural elucidation of naphthalene. Reactions of naphthalene- oxidation, reduction and electrophilic substitution reactions

HetrocyclicCompounds:Definition, classification with examples, synthesis of Furan, thiophene, pyrrole, pyridine, indole (Fischer method), quinoline (Skrup's synthesis), isoquinoline, pyrimidine (one method each). Aromaticity and basicity of pyrrole and pyridine.Electrophillic substitution reactions of pyrrole and pyridine.

Uric acid- Structure, Synthesis. Conversion of uric to purine and caffeine

Dyes: Colour and Constitution, Witt's theory, Classification of dyes based on structures with examples, synthesis of Methyl orange, Bismark brown, indigo and malachite green, structural elucidation of alizarin and it's synthesis**.**

Drugs: Chemotherapy and chemotherapeutic agents, definition of drugs, types of drugs, antipyretics, analgesics, anaesthetics, sedatives, narcotics, antiseptics, antibacterials, antibiotics, antimalarials and sulpha drugs with examples. Synthesis of paracetamol, sulphanilamide, sulphaguanidine **(13 lectures)**

Active methylene compounds: Definition, Ethyl acetoacetate and diethyl malonatepreparation, Mechanism of Claisen condensation, keto-enoltautomerism and its evidence.Synthetic applications of EAA and DEM:- Synthesis of mono carboxylic acids, dicarboxylic acids-succinic acid, adipic acid, antipyrine,Barbituric acid, acetyl acetone, Crotonic acid and Cinnamic acid**.**

(4 lectures)

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, $\lambda_{max,}$ chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating λmax of conjugated dienes

IR-Spectroscopy: Introduction,functional group region and finger print region stretching frequency, Graphical representation of IR spectra of benzoic acid and methyl benzoate . Absorption frequencies of Simple functional groups

NMR Spectroscopy: Basic principles of proton magnetic resonance , nuclear magnetic spin quantum number I, influence of the magnetic field on the spin of nuclei, magnetic resonance-chemical shift (δ value), use of TMS as reference, nuclear shielding effects, equivalent and non-equivalent protons, spin-spin splitting.

NMR spectra of Simple organic molecules (like ethyl alcohol, ethane, propane, benzene, toluene, acetone, and methyl chloride) to be discussed.. **(13 Lectures)**

Reference:

- James E. Huheey, Ellen Keiter& Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
- G.L. Miessler& Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
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DSE-1A SEMESTER-VI

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- ArunBahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand

DEPARTMENT OF CHEMISTRY

I SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2A LAB**
Section A: Inorganic Chemistry – Volumetric Analysis 1. Estimation of sodium hydroxide using HCl and sodium carbonate crystals 2. Estimation of oxalic acid $KmnO_4$.And Mohr's salt. 3. Estimation of Mohr's salt using $KmnO_4$. and oxalic acid crystals 4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator. 5. Estimation of Cu (II) ions iodometrically using NaS_2O_3. 6. Estimation of Hydrogen peroxide using $KMnO_4$ and Sodium oxalate crystals 7. Estimation of oxalic acid and Sulphuric acid present in a given mixture. 8. Estimation of oxalic acid using NaOH solution and PHP crystals.
Section B: Organic Chemistry: 1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements). 2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given) a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography. b) Identify and separate the sugars present in the given mixture by paper chromatography.

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DEPARTMENT OF CHEMISTRY

II SEMESTER :

Paper : **CHEMISTRY LAB: DSC 2B LAB**

Section A: Physical Chemistry

Conductance

I. Determination of cell constant

II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

III. Perform the following conductometric titrations:

i. Strong acid vs strong base

ii. Weak acid vsstrong base

Potentiometry

Perform the following potentiometric titrations:

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

iii. Potassium dichromate vs. Mohr's salt

Colorimetric estimation of Cu^{2+} /Fe^{3+}

Determination of refractive index of the mixture

Ionic equilibria

pH measurements

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

b) PH titration of strong acid with strong base.

c) Determination of pKa of weak acid by potentiometric titration.

d) Preparation of buffer solutions:

I. Sodium acetate-acetic acid.

II. Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation ofquantitative yields to be done.

(a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.

(d) Preparation of acetanilide from aniline.

(e) Preparation of p-bromo acetanilide

(f) Preparation of benzoic acid from benzaldehyde by oxidation.

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DEPARTMENT OF CHEMISTRY

III SEMESTER :

Section A: Physical Chemistry

Section A: Physical Chemistry
Thermo chemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.

4. Determination of Transition temperature of the given salt hydrate.
5. Determination of enthalpy of hydration of copper sulphate.
6. Determination of CST OF phenol water system
7. Determination of % of NaCl

Section B: Organic Chemistry

I Systematic Qualitative Organic Analysis of Organic Compounds possessingmonofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

II

1. Separation of amino acids by paper chromatography
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. .Differentiation between a reducing and a nonreducing sugar.

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DEPARTMENT OF CHEMISTRY

IV SEMESTER :

CHEMISTRY LAB-DSC 2D LAB:

Section A: Inorganic Chemistry

Semi-micro qualitative analysis (using H2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:

Cations : NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^+, K^+

Anions : CO_3^{2-} , S^{2-}, SO^{2-}, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, SO_4^{2-}, PO_4^{3-},BO_3^{3-}, C_2O4^{2-}, F^-

1.Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.

1. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
2. Estimation of total hardness of a given sample of water by complexometric titration.

B: Physical Chemistry

I. Surface tension measurement (use of organic solvents excluded).

a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b) Study of the variation of surface tension of a detergent solution with concentration.

II. Viscosity measurement (use of organic solvents excluded)

a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
b. Study of the variation of viscosity of an aqueous solution with concentration of solute.

III Determination molecular weight of the given non volatile solute by Walker Lumbsden method.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
   a. Acid hydrolysis of methyl acetate with hydrochloric acid.
   b. Saponification of ethyl acetate.
   c. Kinetics of rate of decomposition of H_2O_2catalysed by $FeCl_3$

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

DEPARTMENT OF CHEMISTRY

V SEMESTER :CHEMISTRY PRACTICAL DSE LAB 5B

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 ($AgNO_3$ and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2.
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

V SEMESTER :

CHEMISTRY PRACTICAL - DSE LAB:5A

Section A: Gravimetric estimations

1. Gravimetric estimation of Barium as barium sulphate.
2. Gravimetric estimation of Iron as Iron oxide
3. Gravimetric estimation of Copper as Copper thiocyanate
4. Gravimetric estimation of Nickel as nickeldimethylglyoximate
5. Gravimetric estimation of magnesium as Magnesiumhydroxyquenolate
6. Gravimetric estimation of Sulphate as barium sulphate
7. Gravimetric estimation of Manganese from pyrolusite ore

Section B: Volumetric estimations

1. Determination of Iodine value of edible oil
2. Determination saponification value of edible oil
3. Separation of Green leaf pigments by TLC
4. Determination of amount of acetic cid in a given wine sample
5. Determination of total acidity of vineger
6. Determination of vitamin C in orange juice.

UG_BBA_ **BUSINESS DECISIONS**-2018-2019

Unit 1: **Market Dynamics**:

Individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply : Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply; Theory of consumer behaviour: cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and Giffen goods), revealed preference theory.

Unit 2: **Producer and optimal production choice:**

Optimizing behaviour in short run (geometry of product curves, law of diminishing margin productivity, three stages of production), optimizing behaviour in long run (isoquants, iso-cost line, optimal combination of resources) Costs and scale: traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Unit 3: **Theory of firm and market organization** :

Perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination, multiplant monopoly ; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma

Unit 4: **Factor Market**:

Demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.

UG_BBA_ ORGANISATIONAL BEHAVIOUR -2018-2019

Unit 1: Introduction to Organisational Behaviour:

Organisation- Concept, features and types. Organisational Behaviour – concept, meaning, scope, characteristics and role. Evolution , challenges and opportunities for O.B.

Unit 2: Personality:

Personality – Meaning, characteristics and determinants. Theories – Psychoanalytical Theory. Erikson stages, Cheis Argyeis's immateriality – Maturity Theory, Traits Theory and Self theory. Personality traits.

Unit 3: Perception, Attitude and Learning:

Perception – concept, nature, process and factors influencing perceptual set.

Attitudes – Meaning, definition, nature, components and sources.

Learning – concept, nature, theories of learning, principles and determinants of learning

Unit 4: Groups and Teams:

Groups – Definitions, types, reasons for group formation. Groups Dynamics – Definition and features. Teams – Meaning , Groups v/s Teams, features, importance and types.

UG_BBA_ STATISTICS FOR BUSINESS -2018-2019

Unit 1: **Measures of Central Value:**

Meaning, Need for measuring central value. Characteristics of an ideal measure of central value. Types of averages - mean, median, mode, harmonic mean and geometric mean. Merits, Limitations and Suitability of averages. Relationship between averages. Measures of Dispersion: Meaning and Significance. Absolute and Relative measures of dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation, Moments, Skewness.

Unit 2: **Correlation Analysis:**

Meaning and significance. Types of correlation. Methods of studying simple correlation - Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient. Regression Analysis: Meaning and significance, Regression vs. Correlation. Linear Regression, Regression lines (X on Y and Y on X) and Standard error of estimate.

Unit 3: Analysis of Time Series and Probability

Analysis of Time Series: Meaning and significance. Utility, Components of time series, Models (Additive and Multiplicative), Measurement of trend: Method of least squares, parabolic trend and logarithmic trend.

Probability: Meaning and need. Theorems of addition and multiplication. Conditional probability. Bayes' theorem, Random Variable- discrete and continuous. Probability Distribution: Meaning, characteristics (Expectation and variance) of Binomial, Poisson, and Normal distribution. s

Unit 4: Introduction to testing of Hypothesis:

Concept; Level of Significance; Process of testing; Test of hypothesis concerning Mean; Test of hypothesis concerning Proportion. Z -test, t – test for single mean and difference of means and ANNOVA – one way and two way.

BDE24001

SEMESTER V
CORPORATE ANALYSIS AND VALUATION-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs
Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students are able to:

CO1:Learn the details of Analysis of Corporate Financial Statements

CO2:Understand the details of various methods of valuation

CO3: Learn in details with application of Discounted Cash flow valuation method

CO4:Learn the classification of estimating discount rates

CO5: Understand in depth Relative valuation

CO6:Identify the details of Impact of inflation on valuation

Unit 1: Analysis of Corporate Financial Statements:
Income statements and Balance sheetsthrough ratio analysis and analyzing the Chairman's statement, Directors' report,management discussion & analysis, report on corporate governance, auditor's report to evaluate the financial soundness of the company. Understanding financial statements of manufacturing and service organisations. Common size analysis and relevant ratios.

Unit 2: Introduction to Valuation:
Value and price, Balance sheet-based methods, Incomestatement-based methods, Multiples, Goodwill-based methods. Cash flow discounting-based methods. Deciding the appropriate cash flow for discounting. The free cash flow to the firm, free cash flow to equity. Forecasting Cash flows: simple model for forecasting income and cashflows. Earnings, Tax effect, Reinvestment needs, dividend.

Unit 3: **Discounted Cash flow Valuation**:
Valuation of a company with no growth, constant growth, variable growth and infinite life. Estimating discount rates-cost of equity, cost of debt, tax shield, weighted average cost of capital. The estimation of equity risk premium, calculation of beta, instability of beta, adjusted beta, levered and unlevered beta, bottoms up beta.

Unit 4: **Relative Valuation:**
standard multiples, comparable companies, potential pitfalls; estimating multiples using regression. Valuation of brands and intellectual capital. Interest rates and company valuation. Impact of inflation on valuation. Reconciling relative and discounted cash flow valuation. Case studies in valuation.

Reference:

1. Foster, George Financial Statement Analysis, 2nd ed., Pearson Education Pvt Ltd
2. Damodaran, A. (2008). Damodaran on Valuation, Security Analysis for investment and CorporateFinance (2nd ed.). Wiley India Pvt. Ltd.
3. Chandra, P. (2011).Corporate Valuation and Value Creation, (1st ed). TMH
4. Pablo Fernandez, Valuation and Common Sense, free download from ssrn.

Note: Latest edition of the text books should be used

BDF21001 **SEMESTER VI**

CORPORATE RESTRUCTURING – DSC 11

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail the problems faced in joint ventures

CO2:Learn the types and structure of joint venture

CO3: Understand in detail the theories of Mergers and Acquisitions

CO4:Learn the details of legal frame work for mergers and acquisitions

CO5: Understand the methods and factors affecting Valuation

CO6: Understand the details of Post merger evaluation and its impact on sharehloders' wealth

Unit 1: **Joint Ventures**:
Concept & Meaning of Joint Ventures, Need & Types of Joint Ventures, Structures & Problems faced in Joint Ventures, Joint Ventures and Strategic Alliance. Some relevant case study of successful and failed joined ventures.

Unit 2: **Mergers and Acquisitions**:
Introduction to mergers, types of mergers, theories of mergers & acquisitions; Cross-border mergers and acquisitions, issues and challenges in cross border M&A. Analysis of Post-Merger Performance. Demerger, types of demerger, reverse merger, buyback of shares, leverage buy-out strategy, merger strategy - growth, synergy, operating synergy, financial synergy, diversification. Takeover and its types, takeover strategy, takeover bids, legal framework for mergers andacquisitions, leverages and buyouts; Hostile tender offers and various anti-takeover strategies.

Unit 3: **Deal Valuation and Evaluation**:
Factors affecting valuation basics, methods of valuation, cash flow approaches, Economic Value Added (EVA), sensitivity analysis, valuation under takeover regulation, valuation for slump sale, cost-benefit analysis and swap ratio determination.

Unit 4: Post-Merger Evaluation:
Financial Evaluation of Mergers & Acquisitions, Impact on shareholders' Wealth; Methods of payment and financing options in mergers & acquisitions, financing decision, Merger, Acquisition and Competition law 2002, SEBI (Securities & Exchange Board of India) Takeover Code 2011 and criteria for negotiating friendly takeover.

Reference:

1. Weston, Fred; Chung, Kwang S. &Siu, Jon A.: Takeovers, Restructuring and Corporate Governance, (2nd ed.). Pearson Education
2. Gupta, Manju (2010): Contemporary Issues in Mergers and Acquisitions. Himalaya Publishing
3. Sundarsanam (2006); Creating Value from Mergers and Acquisitions, (1st ed.) Pearson Education
4. Ramanujan. S. (1999); Mergers: The New Dimensions for Corporate Restructuring, McGraw Hill
5. Narayankar, Ravi, (2013): Merger and Acquisitions Corporate Restructuring, Strategy and Practices, (2nd ed.). International Book House Pvt. Ltd.

Note: Latest edition of the text books should be used

UG_BBA_COST & MANAGEMENT ACCOUNTING-2018-19

Unit 1: Cost concepts:

Meaning, Scope, Objectives, and Importance of Cost Accounting, Cost, Costing, Cost Control, and Cost Reduction. Elements of Cost, Components of total Cost, Cost sheet.

Classification of costs: Fixed, Variable, Semi-variable, and Step costs; Product, and Period costs; Direct, and Indirect costs; Relevant, and Irrelevant costs; Shut-down, and Sunk costs; Controllable, and Uncontrollable costs; Avoidable, and Unavoidable costs; Imputed / Hypothetical costs; Out-of-pocket costs; Opportunity costs; Expired, and Unexpired costs; Conversion cost. Cost Ascertainment: Cost Unit, Cost Center, Profit Center, Cost Allocation and Cost

Apportionment; Cost Reduction and Cost Control.

Unit 2: **Cost-Volume-Profit Analysis**:

Contribution, PV Ratio, Breakeven-point, Margin of safety, cost break-even-point, cash break-even-point, Composite break-even-point, Key Factor, Break-even Analysis. Relevant Costs and Decision Making: Pricing, Product Profitability, Make or Buy, Exploring new markets, Shut down or continue.

Process costing: Process losses and wastage, Abnormal effectives.

Unit 3: **Budgets and Budgetary Control**:

Meaning, Types of Budgets (sales, production, purchase raw material consumption, cash budget). Steps in Budgetary Control, Fixed and Flexible Budgeting, Responsibility Accounting.

Unit 4: **Standard Costing and Variance Analysis**:

Material, Labour & Overhead variances.

BDA21011

SEMESTER I

ENTREPRENEURSHIP DEVELOPMNET - GE 1

(Credits: Lecture – 03, Tutorial – 01, Practical – 0) Lectures: 48 Hrs
Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1:Learn in depth qualities of an entrepreneur and able to become an entrepreneur
CO2: Write down the details of financial schemes offered by banks and government agencies and able to access them easily
CO3: Learn the details of mobilisation of resources
CO4: Learn in depth the characteristics of customer and able to identify the customer

Unit 1: Entrepreneurial Development Perspective:
Concept of entrepreneurship development and their dynamics.Importance of skill, knowledge and motivation in ED. Entrepreneurial Competition, generation of business, ideas and final selection of an activity. Market survey report and business plan preparation. Pooling of resources, forms enterprise ownership and their details.

Unit 2: Enterprise Management
Logistics and launching formalities, probable pitfalls, managing money, men, machinery, material and marketing. Support organization, entrepreneurial growth, following the law of the land and social obligation. Managing organisation for innovation and creativity. Importance of leadership, business ethics and business skills on good team building

Unit 3: Running A Family Business :
Concept, structure and kinds of family firms.Understanding its reputation and brand.Enhancing the knowledge and skill.Managing family and shareholders relationship. Managing leadership succession and understanding the group dynamics, encouraging family women into business. Identifying the changed customer needs and encouraging growth and change in the family business.

Unit 4: Social Entrepreneurship:
Introduction, Role and Characteristics of Social Entrepreneurs, Starting of a Non-profits Organization innovatively through local resources in a social context, sustainability, Business Strategies and Scaling up.

Unit 5: Role Of Government And Financial Institutions
Role of Central and State Government in promoting entrepreneurship. Types of schemes, loans, incentives, grants and subsidies. Different types of financial institutions, role of commercial banks, types of loans for MSMEs schemes, appraisal, sanctions, repayment.

BDF25001

SEMESTER VI
FINANCIAL DERIVATIVES-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs
Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Learn the classification and characteristics of financial derivatives in India

CO2: Identify and study the relationship between derivatives and other variables

CO3:Learn the characteristics of options and factors affecting option prices

CO4 :Understand the various types of SWAPS

CO5:Understand in depth forward and future contracts and play an important role in dealing with these contract

Unit 1: **Introduction:**
History of derivatives - origin of derivatives in India - the classification of derivatives – the important features of derivatives – Early delivery, extension and cancellation of forward contracts –financial derivatives market in India.

Unit 2:Forward and Future Contracts:
Meaning of forwards and futures – difference between forwards and futures – Clearing house mechanism - Margin requirements: Initial margin, maintenance margin and margin call – Making to Market – pricing of futures (Problems in preparation of Margin Accounts and Pricing of futures) – Valuation of futures contracts.

Unit 3: Options:
Meaning – Types of Option contracts – factors affecting option prices – Distinction between futures and options. Prices – Upper bounds and lower bounds, early exercise, pul-call parity – Time value and Intrinsic value of options – Concept of options In the money, At the money and Out of the money – Computation of Gross pay off and Net pay off from options contracts – Graphical representation of Pay off from options contracts.

Unit 4:Understanding of SWAPS:
Meaning and types – Interest rates swap – Currency Swaps; Credit Derivatives: Credit ratings, Credit Default Swaps.

Reference:
1. Ruey S. Tsay (2005). Analysis of Financial Time Series (2nd ed.). John Wiley.
2. John C. Hull. Options, Futures and Other Derivatives (7th ed.). Pearson Education.
3. JurgenFranke, Wolfgang Hardle and Christian Hafner. Introduction to Statistics of Financial Markets.
4. R. Madhumathi, M. Ranganatham. Derivatives and risk management (1st ed.)

Redhead, K. Financial Derivatives- An introduction to futures, forwards, options, swaps Prentice Hall of India
5. Kotreshwar – Derivative Market

Note: Latest edition of text books may be used

BDE22001

SEMESTER V

GST AND CUSTOMS DUTY – DSC 10

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students are able to:

CO1: Learn in depth the provisions of GST to handle TDS and POS online and off line more efficiently

CO2: Learn the details of computation of GST

CO3: Learn in detail the steps to be followed to determine the assessable value and customs duty

CO4: Understand the details of technology of GST and flow of return filing under GST

CO5: Learn in details and gain knowledge to practice as GST Consultant

Unit 1: **Introduction to GST**- Indirect tax Structure in India, Constitutional requirements, GST Council, Issues in Indirect Tax, Rationale for Transition to GST. GST- Meaning, Definition of GST - Structure of GST -Types of GST- Features of GST, Benefits of GST. Difficulties in implementation of GST.

GSTCompliance requirementdefinitions of Dealer, Manufacturer and Trader. Registration under GST-Persons liable for registration, compulsory registration, Procedure for Registration, Rejection of application for registration, cancellation of Registration,

Unit 2: a) **GST Definitions** - Aggregate Turnover, Agriculturist, Business, Credit note and Debit note, Exempt Supplies, Input, Input service, Input Service Distributor, Intra-state supply of Goods, Job work, Invoice. Composition Levy, Mixed Supply, outward supply, Person, Turnover in State

b) **Levy and Collection of Tax**: Introduction, Supply- meaning and scope of supply, treatment of mixed and composite supply, Liability of tax payable person, Rate and value of tax, transactions without considerations, list of transactions for supply of goods and services and list of transactions for non-supply of goods and services, Reverse charge mechanism,.

Unit 3:**Time of supply and Value of taxable supply**

Time of Supply Introduction, time of supply-forward charge, reverse charge, residuary, special charges Time of supply of service- forward charge, reverse charge, Vouchers, Residuary, Special charges. Problems on determination of time of supply.

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 4 :**Input tax credit and Returns**

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)

Returns-Furnishing details of outward supplies and inward supplies, a brief introduction to GST forms-1 to 8, Steps for filing forms, Levy of late fee.

Unit 5: **Customs Act 1962**

Meaning-Notified Goods-Specified goods-Prohibition of Importation and Exportation under section 11-Types of Customs duty.Computation of Assessable Value and Customs duty.

Suggested Readings:

1. GST and Customs Duty - Singhania

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SEMESTER III

INCOME TAX - DSC 5

(Credits: Lecture – 04, Tutorial – 01, Practical – 01) Lectures: 64 Hrs
Tutorials: 16 Hrs
Practical: 32 Hrs

Course Outcome:

On successful completion of this course the students can:
CO1:Learn in depth the procedure of online filing and able to file online income tax returns
CO2:Understand in depth Income Tax Act of 1961 and can become tax consultant practitioner
CO3:Deliberate in detail with examples and appear before IT tribunal on behalf of clients
CO4:Learn in detail different sections Under IT Act to reduce tax liability
CO5: Identify the different heads of income and able to compute tax liability

Unit 1: **Basic concepts**:
Income, agricultural income, person, asessee, assessment year, previous year, gross total income, total income, maximum marginal rate of tax. Residential status of persons and its effect on tax incidence .Exempted income under section 10(in relation to individuals).

Unit 2: **Computation of income under the heads**:
Salaries, Income from house property

Unit 3: **Computation of income under the heads**:
Profits and gains of business & profession, Capital gain, Income from other sources.

Unit 4: **Computation Total Income and Tax Liability**
Deductions under Chapter VI-A- Computation of total income and tax liability of individuals. Preparationof return of income manually and through software. Provision & Procedures of Compulsory online filing of returns for specified assesses.

Reference:

1. Dr.VinodkSinghaniaandDr.MonicaSinghania; Students guide to income tax, Taxman Publications.
2. GirishAhuja and Ravi Gupta; Systematic Approach to Income Tax: Bharat Law House.
3. Mahesh Chandra, D.C Shukla; Income Tax Law and Practice: Pragati Publications.
4. S.P Goyal; Direct tax planning: SahityaBhawan

5. Finance Act for relevant Assessment Year
6. CBDT Circulars
7. Latest court judgements

Note: Latest edition of the text books should be used.

BDE26001

SEMESTER V

INTERNATIONAL TRADE BLOCKS AND MULTILATERAL AGENCIES-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO 1: Learn the details of Economic theory on international trade

CO2: Understand the characteristics of domestic, foreign, global environment and analyse their impact on international business decision

CO3: Understand the details of regional integration and trade blocks

CO4: Understand the characteristics and types of international investment

CO5: Identify the impact of reform on competitiveness of the Indian firms

CO6: Understand in depth economic institutions

Unit 1: **Review of Economic Theory on International Trade**:
Basis for international trade;gains from trade; distributional issues, policy instruments and their impact, politicaleconomy.Importance, nature and scope of international relation, modes of entry intointernational business, internationalization process and managerial implications; Domestic,foreign and global environments and their impact on international business decision; Growingconcern for green trades.

Unit 2:**International economic & trading environment**:
Regional integration and trade blocks, regionalism v/s. multilateralism, european union, integration of developing countries -BRICS, ASEAN, SAARC, SAFTA, NAFTA, G-20; World trade in goods and services -Major trends and developments; World trade and protectionism - Tariff and non-tariffbarriers ; Counter trade, UNCTAD, WTO, GATT, GATS, TRIM, TRIPS; India's role in facilitating trade relations under BRICS, SAARC, SAFTA, ASEAN and to WTO.

Unit 3: **International investment**:
Types and significance of foreign investments, factors affecting international investment, growth and dispersion of FDI, Cross border mergers and acquisition, foreign investment in India-Impact of reforms on competitiveness of the Indian Firms, EURO/ADR issues, ECBs; current economic crises in US/Europe/Asia and its impact on economic growth in India.

Unit 4: **Economic institutions**:
International Monetary Funds (IMF), World Bank (IBRD,IDA, IFC), Asian Development Bank, BRICS Development Bank, Bilateral funding arrangements with special reference to Japan International Cooperation Agencies (JICA),agencies of USA; Case studies on Bilateral financing

arrangements of Indian projects like Delhi Metro, Dedicated Freight corridor, Nuclear Power Plant etc.

Reference:

1. Hill, W. L. Charles and Jain, A.K. (2008). International Business (6th ed.). India: McGrawHill.
2. Fernando, A.C. (2011) .Corporate Governance: Principles, Policies and Practices. India: Pearson Education.
3. Roger, Bennet (1999). International Business, Financial Times. London: Pitman Publishing.
4. Sharan, Vyuptakesh (2003). International Business (2nd ed.). India: Pearson Education.
5. Krueger, Anne O. (2002). Economic Policy Reforms and the Indian Economy.OUP.

Note: Latest edition of the text books should be used

UG_BBA_INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT -2018-2019

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-2018-2019

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_INVESTMENT BANKING & FINANCIAL SERVICES-2018-2019

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

BDE23001

SEMESTER V
INVESTMENT BANKING & FINANCIAL SERVICES-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs
Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students are able to:

CO1: Learn the characteristics of Investment banking in India

CO2: Learn the details of Public Issue

CO3: Understand the details of types of leasing

CO4: Understand in detail the feature of Hire Purchase

CO5: Understand the classification and characteristics of Insurance

CO6: Learn in detail the history and evolution of venture Capital

CO7: Learn the details of Securitization

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; RightIssue: 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

Reference:

1. M.Y.Khan,-Financial Services' – Tata McGraw –Hill, 3 rd Edition, 2005.
2. Machiraju - Indian Financial System _- Vikas Publishing House, 2 nd Edition, 2002.
3. J.C.Verma - A Manual of Merchant Banking _, Bharath Publishing House, New Delhi,2001.
4. K.Sriram - Hand Book of Leasing, Hire Purchase & Factoring', ICFAI, Hyderabad, 1992.

Note: Latest edition of the text books should be used

BDB23011

SEMESTER II

ORGANISATIONAL BEHAVIOUR - GE 2

(Credits: Lecture – 03, Tutorial – 01, Practical – 0) Lectures: 48 Hrs
Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1: Understand in detail behaviour of employees and able to manage them efficiently

CO2: Identify in details employees performance and able to motivate for effective performance

CO3: Learn in depth and analyse the behaviour of employees

CO4: Understand in details key positions in an organisation and able to occupy them

CO5: Learn in details with examples frame policies and strategies in organisation

Unit 1: Introduction to Organisational Behaviour:
Organisation- Concept, features and types. Organisational Behaviour – concept, meaning, scope, characteristics and role. Evolution , challenges and opportunities for O.B.

Unit 2: Personality:
Personality – Meaning, characteristics and determinants. Theories – Psychoanalytical Theory. Erikson stages, CheisArgyeis's immateriality – Maturity Theory, Traits Theory and Self theory. Personality traits.

Unit 3: Perception, Attitude and Learning:
Perception – concept, nature, process and factors influencing perceptual set.
Attitudes – Meaning, definition, nature, components and sources.
Learning – concept, nature, theories of learning, principles and determinants of learning

Unit 4: Groups and Teams:
Groups – Definitions, types, reasons for group formation. Groups Dynamics – Definition and features. Teams – Meaning , Groups v/s Teams, features, importance and types.

Reference:

1. Koontz & Heinz Weihrich: Essential of management McGraw Hill (1999)
2. Kaul, Vijay kumar, Management- Text & Cases, Vikas Publishing, New Delhi, 2015
3.Stoner&Wankel:Management
4. Stephen P. Robbins and Mary Coulter:Management, Pearson

5. Y.K. Bhushan: Fundamentals of Business Organisation& Management X Edition
6. Richard L. Daft, Principles Of Management, CengageLearning,India
7. Robbins Stephen P. :OrganisationalBehaviour, Pearson Education, 12th Edition

Note: Latest edition of the text books should be used.

BDE25001

SEMESTER V

RESEARCH METHODOLOGY-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs

Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can:

CO1:Understand in details with application of research methodology and become a good researcher

CO2: Learn the characteristics and classification of research Design

CO3:Understand in details with examples Sources of Data Collection

CO4:Learn the characteristics of sampling techniques

CO5: Understand in details with application of methods of analysis

CO6: Understand the details of research report

Unit 1:Business Research:
Meaning - Nature and Scope of Business Research – Role of Business Research in decision making. Applications of Business Research; The Research process – Steps in the research process; the research proposal; Problem Formulation: Management decision problem vs. Business Research problem. Research Design: Exploratory, Descriptive & Causal.

Unit 2: Primary Data Collection:
Survey v/s Observations.Random sample collection methods. Comparison of self-administered, telephone, mail, emails techniques. Qualitative Research
Tools: Depth Interviews focus groups and projective techniques.

Unit 3:Measurement& Scaling:
Primary scales of Measurement-Nominal, Ordinal, and Interval &Ratio. Scaling techniques paired comparison, rank order, constant sum, semantic differential, itemized ratings, Likert Scale; Questionnaire-form & design. Sampling: Sampling techniques, determination of sample size using statistical techniques, Cronbach's Alpha test for reliability(using software).

Unit 4: Data and the Methods of Analysis:
Analysis of Variance (ANOVA) One-Way & Two-Way, Chi square test (goodness of Fit).Multivariate Data Analysis: Factor Analysis (Principal Component Analysis), Discriminant Analysis. Above statistical test also to be explained using statistical software package. Report writing: Contents of a Research Report, Plagiarism in Business Research – Meaning and effects - Plagiarism detection software

Refercnce:

1. Zikmund, W.G., Babin, B.J., Carr, J.C. & Griffin, M. (2013). Business Research Methods (9th ed.). Cengage Learning.
2. Johnson, R.A. &Wichern, D.W. (1997) Business Statistics-Decision Making with Data (1st ed.). John Wiley & Sons.
3. Cooper, D.R. & Schindler, P.S. (2008) Business Research Methods (10th ed.). McGraw Hill Education.
4..Chawla, D, &Sondhi,N. (2011) Research Methodology Concepts and Cases (1st ed.). Vikas Publishing House
5. Malhotra, N & Dash. S (2010) Marketing Research An Applied Orientation (6th ed.). Pearson, Prentice Hall of India.

Note: Latest edition of the text books should be use

BDF23001

SEMESTER VI
STRATEGIC CORPORATE FINANCE-DSE

(Credits: Lecture – 05, Tutorial – 01, Practical – 0) Lectures: 80 Hrs
Tutorials: 16 Hrs

Course Outcome:

On successful completion of this course the students can

CO1: Learn in detail the risk management choices

CO2: Understand the details of value enhancement tools and techniques

CO3: Learn the different types of financial strategy for shareholders wealth maximization of strategic corporate finance

CO4: Understand the significance of strategy in financial decision

CO5: Learn the details of Financial Distress and restructuring

CO6: Learn in depth capital structure and factors affecting the capital structure

Unit 1:Introduction to strategic corporate finance:
Strategy v/s Planning, significance ofstrategy in financial decisions, Different types of financial strategy for Shareholders WealthMaximization, overall corporate value addition and Economic Value Addition.Strategic Cost Management: Traditional costing Vs Strategic Costing, Relevant costs v/sIrrelevant costs, Different types of strategic costing and their relevance- Target Costing,Activity based Costing, Life Cycle Costing, Quality Costing, Zero Based Budgeting, Strategic cost reduction techniques and value chain analysis.Valuing Real assets in the presence of risk: tracking portfolios and Real Asset valuation,DifferentApproaches of Valuing Real Assets, Capital Budgeting and Strategic policy.

Unit 2: **Fundraising**:
Identification of different sources of development capital, determination of capital structure and factors affecting the capital structure, cost of capital and cost saving strategy, production of a business plan and financial forecasts to enable potential funders to assess the proposition. Alternative sources of financing – alternative sources of financing, Different approach to infrastructure projects financing- Public Private Partnership (PPP) and its relevance. Managing credit ratings. Dividend v/s share repurchase policy, problem of too much cash. The issues of stock liquidity and illiquidity.
Financial Distress and restructuring: Meaning of Bankruptcy, Factors leading to bankruptcy, symptoms and predictions of bankruptcy, reorganization of distressed firms, liquidation offirms. Company disposals: retirement sale or the sale of a non-core subsidiary, planned exit,forceful retirement and other disposals. Exit strategy- most appropriate exit route, valuation,timing of sale and tax planning opportunities, identification of potential purchasers, approaching the potential purchaser, negotiate with potential acquirers and selection of apreferredpurchaser.Real options:

Financial and real options compared, various types of real options, applicationof Real options, Drawbacks of Real options

Unit 3: Company Valuation:

An overview of valuation, valuation principles and practices more, the impact of "what if" scenarios, the key financial and commercial factors affecting the business.Value enhancement tools & techniques, the link between valuation and corporate finance Management Buy-outs: Establishing feasibility of the buy-out, Negotiating the main terms of the transaction with the vendor including price and structure, Developing the business plan and financial forecasts in conjunction with the buy-out team for submission to potential funders, negotiations with potential funders so that the most appropriate funding offers are selected. Management Buy-ins: Management Buy-in/Buy-outs ("BIMBOs"), Vendor initiated buy-outs/buy-ins. Due Diligence: financial due diligence for both purchasers and financial institutions.

Unit 4: Strategic risk management:

Strategic risk management, the substitutability of capital structure and risk management choices, such as process control efforts, financial, physical, and operational hedging, value-based management.

Reference:

1.AswathDamodaran: Corporate finance theory and practice; John willey& sons, Inc.
2.AswathDamodaran: Strategic Risk Taking:A Framework for Risk Management ; Prentice Hall
3.IMPandey: Financial Management; Vikas Publishing House
4.Strategic Financial Management: Prasanna Chandra; McGraw Hill Education (India) Private Limited

Note: Latest edition of text books may be used.

B COM - Employability/ Entrpreneurship-2020-21

Name of the Course	Course Code	Activities/Content with a direct bearing on Employability Entrpreneurship/ Skill Development
FinancialAccounting	**DNA21001**	Employability in corporate sector.
Business Organisation and Management	**DNA22001**	Employability in 1rganizations.
Principles of Marketing	**DNB23001**	Employability in Marketing sector
Corporate Accounting	DNC 210	Employability in corporate sector.
Income Tax	DNC220	Self Employment and Corporate sector
Indirect Tax	DND220	Self Employment and Corporate sector
Investment Analysis	DNE 310	Employability in securitiesmarket
Entrepreneurship Development	DNE210	Self Employment
Corporate Tax Planning	DNF 230	Employability in corporate sector.
Business Research Methodology	DNF260	**Skill Enhancement**
Auditing & Corporate Governance	DNF220	Employability in corporate sector.
GST and customs duty	ENF 300	Self Employment

UG_B.Com_FinancialAccounting

1.4 FINANCIAL ACCOUNTING – I

Unit 1:Introduction

Accounting-Meaning And Definitions, Objectives, Functions, Advantages And Limitations Of Accounting, Users Of Financial Accounting Information And Their Needs. Systems Of Book-Keeping – Rules Of Double Entry -Preparation Of Journal, LedgerAnd Trial Balance. Accounting Principles -Accounting Concepts And Conventions. Accounting Standards: Concept, Benefits, Procedure For Issuing Accounting Standards In India. Ifrs – Need And Procedure

Unit 2:Final Accounts

Final Accounts Of Sole Trading Concern- Preparation Of Manufacturing, Trading And Profit And Loss Account And Balance Sheet With Adjustments.

Unit 3:Bills Of Exchange

Meaning – Characteristics – Kinds – Noting, Protest-Discounting, Endorsement, Dishonour – Rebate & Renewals Of Bills. Problems On Trade Bills Only

Unit 4:Branch Account

Meaning And Objectives. Dependent Branches – Concept, Accounting Aspects; Debtors System, Stock And Debtors System, Branch Final Accounts System. Independent Branches: Concept Accounting Treatment.Goods Invoiced By HoAt Cost And Invoice Price.

Unit5: **Departmental Accounts**

Meaning, Objectives, Advantages Of Keeping Departmental Accounts, Basis For Allocation Of Joint Expenses, Internal Transfer Of Goods, Preparation Of Profit And Loss Account And Balance Sheet.

Unit 6: **Computerized Accounting Systems26Practical Lab**

Computerized Accounting Systems: Computerized Accounts By Using Any Popular Accounting Software: Creating A Company; Configure And Features Settings; Creating Accounting Ledgers And Groups; Creating Stock Items And Groups; Vouchers Entry; Generating Reports – Cash Book, Ledger Accounts, Trial Balance, Profit And Loss Account, Balance Sheet, Funds Flow Statement, Cash Flow Statement. Selecting And Shutting A Company; Backup And Restore Data Of A Company.

UG_B.COM_**BUSINESS ORGANISATION AND MANAGEMENT**

Unit 1: Foundation Of Indian Business

Manufacturing And Service Sectors; Small And Medium Enterprises - Problems And Government Policy. Technological Innovations And Skill Development. 'Make In India' Movement. Emerging Opportunities In Business; Franchising, Outsourcing, And E-Commerce.

Unit 2: Business Enterprises

Forms Of Business Organisation: Sole Proprietorship, Joint Hindu Family Firm, Partnership Firm, Joint Stock Company, Cooperative Society; Limited Liability Partnership; Forms Of Public Enterprises. Multinational Corporations.

Unit 3: Management

The Process Of Management: Planning; Decision-Making; Strategy Formulation.Organizing: - Types Of Organisational Structure - Departmentation – Kinds . Delegation And Decentralisation Of Authority – Groups And Teams.

Unit 4:Leadership, Motivation And Control

Leadership: Concept And Styles; Trait And Situational Theory Of Leadership.Motivation: Concept And Importance; Maslow Need Hierarchy Theory; Herzberg Two Factors Theory. Control: Concept And Process.

Unit 5: Functional Areas Of Management

Marketing Management:- Meaning & Definitions, Marketing Concepts, Functions, Elements Of Marketing Mix.

Financial Management: Concept And Objectives – Scope, Finance Manager- Role & Functions. Sources Of Finance, Financial Decisions.

Human Resource Management: Concept And Functions. Role, Status And Competencies Of HR Manager.

UG_B.COM_ PRINCIPLES OF MARKETING

Unit 1: Introduction:

Nature, Scope And Importance Of Marketing; Evolution Of Marketing; Selling V/S Marketing; Marketing Environment: Concept, Importance, And Components (Economic, Demographic, Technological, Natural, Socio-Cultural And Legal).

Unit 2: Consumer Behaviour & Market Segmentation

A. Consumer Behaviour**:** Nature And Importance**,** Consumer Buying Decision Process; Factors Influencing Consumer Buying Behaviour.

B. Market Segmentation: Concept, Importance And Bases; Target Market Selection; Positioning Concept, Product Differentiation Vs. Market Segmentation.

Unit 3: Product

Concept And Importance, Product Classifications; Concept Of Product Mix; Branding, Packaging And Labelling.

Unit 4: Pricing & Place

A. Pricing: Significance. Factors Affecting Price Of A Product. Methods Of Pricing.

B. Physical Distribution: Channels Of Distribution - Meaning And Importance; Types Of Distribution Channels; Functions Of Middle Man; Factors Affecting Choice Of Distribution Channel; Wholesaling And Retailing; Types Of Retailers;

Unit 5: Promotion

A. Promotion:Nature And Importance Of Promotion; Types Of Promotion: Advertising, Personal Selling, Public Relations & Sales Promotion, And Their Distinctive Characteristics; Promotion Mix And Factors Affecting Promotion Mix Decisions;

B. Recent Developments In Marketing:Social Marketing, Online Marketing, Services Marketing, Green Marketing, Rural Marketing; Consumerism.

UG_B.COM_**CORPORATE ACCOUNTING**

Unit 1: Accounting For Share Capital

Meaning And Types Of Shares-Issue Of Shares Over- Subscription And Prorate Allotment-Forfeiture Of Shares-Reissue Of Forfeited Shares-Passing Journal Entries And Preparing Balance Sheet.

Unit 2: Financial Statements Of Limited Companies

Preparation Of Financial Statements As Per Schedule III Of Companies' Act-2013. Provisions Of Companies Act-2013 On Declaration Of Dividends.

Unit 3: Accounting For Redemption Of Preference Shares And Issue Of Bonus Shares

Conditions For Redemption Of Preference Shares, And Accounting Procedure For Redemption; Meaning Of Bonus Shares And Bonus Issue-SEBI Guidelines For Bonus Issue-Accounting Entries For Issue Of Bonus Shares.

Unit 4: Issue AndRedemption Of Debentures
Meaning And Types Of Debentures-Methods Of Redemption Of Debentures-Journal Entries For Issue Of Debentures And Conditions For Redemption- Financing For Redemption Of Debentures.

Unit 5: LiquidationOfCompanies
Meaning And Circumstances Of Liquidation- Preparation Of Liquidator's Final Statement Of Account.
Unit 6: Accounting For Employees Stock Option Plan, Buy-Back Of Securities, Equity Shares With Differential Rights, Under Writing Of Shares And Debentures.

UG_B.COM_**Income Tax**

Unit 1: Introduction

Brief History Of Income Tax Act, Finance Act, Scheme Of Income Tax, Basic Concepts-Income, Assessee, Person, Assessment Year, Previous Year, Gross Total Income, Total Income, Marginal Rate Of Tax—Agricultural Income-Residential Status Of Individual, Incidence Of Tax (Including Problems)- Incomes Which Do Not Form Part Of Total Income U/S 10.

Unit 2: Heads Of Income

Income From Salary -Features Of Salary Income-Allowances,Perquisites, Provident Fund, Computation Of Taxable Salary Income

Unit 3: Income From Salary: Retirement Benefits

Gratuity, Commutation Of Pension, Leave Encashment - Problems

Unit 4: **Income From House Property**

Basis Of Charge -Deemed Ownership-ExemptionsDetermination Of Annual Value-Deductions U/S 24-Computation Of Income From House Property.

UG_B.COM_ **INCOME TAX-II**

Unit 1: Capital Gain

Capital Asset, Transfer, Cost Of Acquisition, Cost Of Improvement, Indexation, Types Of Capital Gain- Exemptions For Individual Assessee U/S 54-54gb-Problmes

Unit 2:Income From Other Sources

Income From Other Sources. Set Off And Carry Forward Of Losses (Theory Only)

Unit 3:Assessment Of Individual

Application Of Deductions U/S 80c-80u, Section 87a Computation Of Tax Liability.(Available Software Package For Computation Of Tax Liability, Computation Using Excel-Work Sheet)

Unit 4:Assessment Of Partnership Firm

Definition Of Firm, Partner U/S 2(23) Residential Status -Conditions U/S 184, Provisions U/S 40(B)-Deductions From 80g80jja- Alternate Minimum Tax(Amt)-Computation Of Tax Liability Of Firms (Use Of Available Software Package For Computation Of Tax Liability, Related Forms And Challans-Computation Using Excel Work- Sheet)

Unit 5:Assessment Of Company

Definition Of Company, Closely-Held Company, Widely-Held Company, Indian Company, Foreign Company-Residential Status Of Company-Applicable Deductions U/S 80g -80jja-

UG_B.COM_**ENTRPRENEURSHIP DEVELOPMENT**

Unit 1: Introduction

Meaning, Definition Of Entrepreneur, Enterprise, Entrpreneurship, Characteristics Of Successful Entrepreneur, Functions, Role Of Entrepreneur In Economic Development, WomenEntrepreneur, Rural Entrepreneur, Agricultural Entrepreneur-Meaning And Challenges.

Unit 2:Entrpreneurship Development Program (Edp)

Meaning, Objective, Importance, Institutions Doing Edp In India, Dic, Cedock, Ssi, Nsic, Edii, Awake, Kvic,Rudset, Industrial Estate-Meaning And Importance.

Unit 3: Financing Of Small Business In India

Institutional And Non Institutional Assistance Sfcs, Banks, Sidbi, Nbfc-Meaning And Schemes; Venture Capital, Bills Discounting, Factoring, State And Central Government Subsidies And Incentives For Ssi (Existing) - Recent Industrial Policy(2011), Pm Mudra Yojana- Meaning, Objectives, Procedures For Obtaining Loan Under Mudra.

Unit 4:Setting Up Of New Business, Forms For Small Business

Small Proprietorship, Partnership, Private Company, Cooperative Society-Meaning And Nature, Project Formulation, Project Report-Meaning, Importance, General Format Of Project Report, Project Appraisal, Financial, Technical, Marketing, Social Feasibility Study, Obtaining License, Clearance Certificate, Registration Procedure.

Unit 5: Business Ethics

Meaning, Ethics In Business, Importance, Various Social Responsibility Of An Entrepreneur Towards Customers, Suppliers, Government And Society, Self- Employment-Recent Trends In The Areas Of Self Employment-Event Management-MeaningAnd Areas Of Business In Event Management (Party Organizing , Catering, Wedding Plan And Corporate Event Plan) Tourism-Meaning, Tourism Products, E-Marketing As Self Employment Opportunity.

UG_B.COM_**CORPORATE TAX PLANNING**

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 AdtAgreements , Unilateral Relief [Sec. 91], Double Taxation Relief In Case Of Specified Associations [Sec. 90a]

UG_B.COM_BUSINESS RESEARCH METHODS

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_**AUDITING AND CORPORATE GOVERNANCE**

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 EdpEnvironment; 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.

ENF30001

UG_B.COM_ GOODS AND SERVICES TAX AND CUSTOM DUTY

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.

DLF21611

VI Semester

Skill Enhancement Course (SEC)-1: DATA ANALYSIS

Course outcome

On completion of the Course, students will:

CO1. Understand the classification and characteristics of Population Census versus Sample Survey.
CO2. Specify the details of Measures of Central Tendency
CO3. Understand in depth Karl Pearson Method
CO4. Learn in details with application, if applicable, Normal Distributions
CO5. Learn the details of Introduction to Probability theory

Course Description:

This course introduces the student to collection and presentation of data. Discusses how data can be summarized and analyzed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use free statistical software to analyze data.

I.	Data: Meaning, Types, Importance of Data, Sources of Data. Population Census versus Sample Survey.	14
II.	Univariate frequency distributions. Measures of Central tendency: Mean, Median and Mode, Measures of Dispersion, Skeweness and kurtosis.	**15**
III.	Bivariate frequency distribution. Correlation, Karl Pearson Method-Spearman's Rank Correlation-Regression- Estimator.	**14**
IV.	Introduction to probability theory- Notions of random experiment , sample space. Event, probability of an event. Conditional probability. Independence of events. Random variables and Probability distributions. Binomial and normal distributions.	**17**

Reference:

P. H. Karmel and M. Polasek (1978), Applied Statistics for Economics
M. R. Spiegel, Theory and Problems of probability And Statistics
Veerachamy –Quantitative methods for Economics-(New Age International)
Anderson, David R, Dennis, Sweeney & Thomas A Williams Statistics for Business & Economics (New Age International)
C. K. Renukarya – Mathematics and Statistics for Economics (Chethana Book house)
Suresh. B. H-Quantitative Techniques (Chethana Book house)

DLE21611

V Semester
Skill Enhancement Course (SEC)-1: Financial Economics

Course outcome

On completion of the Course, students will:
CO1. Learn in depth Basic theory of interest.
CO2. Learn in details with examples Investment decisions under uncertainty.
CO3. Deliberate the classification and characteristics of Portfolios of assets.
CO4. Understand the details of Capital Asset Pricing Model.

Course Description:

This course introduces students to the economics of finance, essential aspects of financial asset valuation. The students are introduced to numerical techniques in finance using spreadsheet programmes such as Microsoft Excel. The course will impart skills that will be useful in a variety of business settings including investment banks, asset management companies and in the field of financial and business journalism.

I Deterministic cash-flow streams : 22

Basic theory of Interest, Investment decisions under uncertainty: Pay back period Method, Net Present Value Method, Internal Rate of return Method, fixed Income securities: Bond, Prices and Yields, Interest rate sensitivity and duration the term structure of Interest rates, spot rates and forward rates.

II. Single-period random cash flows: 21

Random asset returns; portfolios of assets: portfolio mean and variance: feasible combinations of mean and variance: Portfolio analysis: the Markowitz model and Two fund theorems: risk-free assets and the one-fund theorem.

III. Capital Asset Pricing Model(CAPM): 17

The Capital Market: Capital Asset Pricing Model: Securities Market: use of the CAPM model in investment analysis and as a pricing formula.

Reference:

David G. Luenberger. Investment Science - Oxford University Press.USA.1997
Richard A. Brealey and Stewart C. Myers - Principles of Corporate Finance, McGraw-Hill, 7th Edition
Burton G. Malkiel. A Random Walk Down Wall Street, W. W. Norton & Company, 2003
Simon Benninga, Financial Modeling, MIT Press, USA, 1997
L. V. Chandler-Money & Banking (S. Chand & Company)
D. M. Mithani - Money & Banking and Financial System (Himalaya Publishing house)
R. R. Paul-Monetary Economics (kalyani Publishers
B. Gupta-Monetary Economics (S. Chand & Company)

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VI Semester

Skill Enhancement Course (SEC)-1: DATA ANALYSIS

Course outcome

On completion of the Course, students will:

CO1. Understand the classification and characteristics of Population Census versus Sample Survey.
CO2. Specify the details of Measures of Central Tendency
CO3. Understand in depth Karl Pearson Method
CO4. Learn in details with application, if applicable, Normal Distributions
CO5. Learn the details of Introduction to Probability theory

Course Description:

This course introduces the student to collection and presentation of data. Discusses how data can be summarized and analyzed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use free statistical software to analyze data.

I.	Data: Meaning, Types, Importance of Data, Sources of Data. Population Census versus Sample Survey.	14
II.	Univariate frequency distributions. Measures of Central tendency: Mean, Median and Mode, Measures of Dispersion, Skeweness and kurtosis.	**15**
III.	Bivariate frequency distribution. Correlation, Karl Pearson Method-Spearman's Rank Correlation-Regression- Estimator.	**14**
IV.	Introduction to probability theory- Notions of random experiment , sample space. Event, probability of an event. Conditional probability. Independence of events. Random variables and Probability distributions. Binomial and normal distributions.	**17**

Reference:

P. H. Karmel and M. Polasek (1978), Applied Statistics for Economics
M. R. Spiegel, Theory and Problems of probability And Statistics
Veerachamy –Quantitative methods for Economics-(New Age International)
Anderson, David R, Dennis, Sweeney & Thomas A Williams Statistics for Business & Economics (New Age International)
C. K. Renukarya – Mathematics and Statistics for Economics (Chethana Book house)
Suresh. B. H-Quantitative Techniques (Chethana Book house)

DLE21611

V Semester
Skill Enhancement Course (SEC)-1: Financial Economics

Course outcome

On completion of the Course, students will:
CO1. Learn in depth Basic theory of interest.
CO2. Learn in details with examples Investment decisions under uncertainty.
CO3. Deliberate the classification and characteristics of Portfolios of assets.
CO4. Understand the details of Capital Asset Pricing Model.

Course Description:

This course introduces students to the economics of finance, essential aspects of financial asset valuation. The students are introduced to numerical techniques in finance using spreadsheet programmes such as Microsoft Excel. The course will impart skills that will be useful in a variety of business settings including investment banks, asset management companies and in the field of financial and business journalism.

I Deterministic cash-flow streams : 22

Basic theory of Interest, Investment decisions under uncertainty: Pay back period Method, Net Present Value Method, Internal Rate of return Method, fixed Income securities: Bond, Prices and Yields, Interest rate sensitivity and duration the term structure of Interest rates, spot rates and forward rates.

II. Single-period random cash flows: 21

Random asset returns; portfolios of assets: portfolio mean and variance: feasible combinations of mean and variance: Portfolio analysis: the Markowitz model and Two fund theorems: risk-free assets and the one-fund theorem.

III. Capital Asset Pricing Model(CAPM): 17

The Capital Market: Capital Asset Pricing Model: Securities Market: use of the CAPM model in investment analysis and as a pricing formula.

Reference:

David G. Luenberger. Investment Science - Oxford University Press.USA.1997
Richard A. Brealey and Stewart C. Myers - Principles of Corporate Finance, McGraw-Hill, 7th Edition
Burton G. Malkiel. A Random Walk Down Wall Street, W. W. Norton & Company, 2003
Simon Benninga, Financial Modeling, MIT Press, USA, 1997
L. V. Chandler-Money & Banking (S. Chand & Company)
D. M. Mithani - Money & Banking and Financial System (Himalaya Publishing house)
R. R. Paul-Monetary Economics (kalyani Publishers
B. Gupta-Monetary Economics (S. Chand & Company)

DLF21611

VI Semester

Skill Enhancement Course (SEC)-1: DATA ANALYSIS

Course outcome

On completion of the Course, students will:

CO1. Understand the classification and characteristics of Population Census versus Sample Survey.
CO2. Specify the details of Measures of Central Tendency
CO3. Understand in depth Karl Pearson Method
CO4. Learn in details with application, if applicable, Normal Distributions
CO5. Learn the details of Introduction to Probability theory

Course Description:

This course introduces the student to collection and presentation of data. Discusses how data can be summarized and analyzed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use free statistical software to analyze data.

I.	Data: Meaning, Types, Importance of Data, Sources of Data. Population Census versus Sample Survey.	14
II.	Univariate frequency distributions. Measures of Central tendency: Mean, Median and Mode, Measures of Dispersion, Skeweness and kurtosis.	**15**
III.	Bivariate frequency distribution. Correlation, Karl Pearson Method-Spearman's Rank Correlation-Regression- Estimator.	**14**
IV.	Introduction to probability theory- Notions of random experiment , sample space. Event, probability of an event. Conditional probability. Independence of events. Random variables and Probability distributions. Binomial and normal distributions.	**17**

Reference:

P. H. Karmel and M. Polasek (1978), Applied Statistics for Economics
M. R. Spiegel, Theory and Problems of probability And Statistics
Veerachamy –Quantitative methods for Economics-(New Age International)
Anderson, David R, Dennis, Sweeney & Thomas A Williams Statistics for Business & Economics (New Age International)
C. K. Renukarya – Mathematics and Statistics for Economics (Chethana Book house)
Suresh. B. H-Quantitative Techniques (Chethana Book house)

DLE21611

V Semester
Skill Enhancement Course (SEC)-1: Financial Economics

Course outcome

On completion of the Course, students will:
CO1. Learn in depth Basic theory of interest.
CO2. Learn in details with examples Investment decisions under uncertainty.
CO3. Deliberate the classification and characteristics of Portfolios of assets.
CO4. Understand the details of Capital Asset Pricing Model.

Course Description:

This course introduces students to the economics of finance, essential aspects of financial asset valuation. The students are introduced to numerical techniques in finance using spreadsheet programmes such as Microsoft Excel. The course will impart skills that will be useful in a variety of business settings including investment banks, asset management companies and in the field of financial and business journalism.

I Deterministic cash-flow streams : 22

Basic theory of Interest, Investment decisions under uncertainty: Pay back period Method, Net Present Value Method, Internal Rate of return Method, fixed Income securities: Bond, Prices and Yields, Interest rate sensitivity and duration the term structure of Interest rates, spot rates and forward rates.

II. Single-period random cash flows: 21

Random asset returns; portfolios of assets: portfolio mean and variance: feasible combinations of mean and variance: Portfolio analysis: the Markowitz model and Two fund theorems: risk-free assets and the one-fund theorem.

III. Capital Asset Pricing Model(CAPM): 17

The Capital Market: Capital Asset Pricing Model: Securities Market: use of the CAPM model in investment analysis and as a pricing formula.

Reference:

David G. Luenberger. Investment Science - Oxford University Press.USA.1997
Richard A. Brealey and Stewart C. Myers - Principles of Corporate Finance, McGraw-Hill, 7th Edition
Burton G. Malkiel. A Random Walk Down Wall Street, W. W. Norton & Company, 2003
Simon Benninga, Financial Modeling, MIT Press, USA, 1997
L. V. Chandler-Money & Banking (S. Chand & Company)
D. M. Mithani - Money & Banking and Financial System (Himalaya Publishing house)
R. R. Paul-Monetary Economics (kalyani Publishers
B. Gupta-Monetary Economics (S. Chand & Company)

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF ELECTRONICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programme

Physics, Mathematics, Electronics

Syllabus on Skill Development

2019-20 and 2020-21

DMA26104

PRACTICAL 1
NETWORK ANALYSIS AND ANALOG ELECTRONICS

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), Digital Multimeter, Function Generator and Oscilloscope.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of Thevenin's theorem and (b) Norton's theorem.
4. Verification of (a) Superposition Theorem and (b) Reciprocity Theorem
5. Verification of the Maximum Power Transfer Theorem.
6. Study of the I-V Characteristics of (a) p-n junction Diode and (b) Zener diode.
7. Study of (a) Half wave rectifier and (b) Full wave rectifier (FWR) with C filter and without filter
8. Zener diode as voltage regulator (at the output of Full Wave Rectifier)
9. Study of the I-V Characteristics of UJT
10. Study of the output and transfer I-V characteristics of common source JFET.
11. Study of Fixed Bias and Voltage divider bias configuration for CE transistor.
12. Study of Single Stage CE amplifier.
13. Study of the RC Phase Shift Oscillator.
14. Study the Colpitt`s oscillator.

DMB26104

PRACTICAL 2

LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Section – A: Op-Amp. Circuits (Hardware)

1. To design an Inverting & Non-inverting amplifier using Op-amp (741,351) for DC voltage of given gain
2. To design an Inverting amplifier using Op-amp (741) & to study its frequency response(for AC voltage)
3. To design non-inverting amplifier using Op-amp (741) & to study frequency response(for AC voltage)
4. To Add / Subtract two dc voltages using Op-amp in inverting mode.
5. To study the zero-crossing detector and comparator.
6. To investigate the use of an op-amp as an Integrator.
7. To investigate the use of an op-amp as a Differentiator.
8. To study a Wien bridge oscillator using an op-amp.
9. To design an Astable Multivibrator of given specification using IC 555 Timer.
10. To design a Butterworth Low Pass active Filter (1st order) & to study Frequency Response.
11. To design a Butterworth High Pass active Filter (1st order) & to study Frequency Response.
12. R – 2R digital to analog converter (DAC).

Section-B: Digital circuits (Hardware)

1. To simplify the given Boolean expression and to construct logic circuit using basic gates
2. To study NAND & NOR gates as Universal gates
3. Half Adder and Full Adder.
4. Half Subtractor and Full Subtractor.
5. 4 bit binary Adder-Subtractor using Full adder IC.
6. Seven segment decoder.
7. Study of Encoder
8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
9. To build JK Master-slave flip-flop using Flip-Flop ICs.
10. To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.

11. To make a Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.

Section-C: SPICE/MULTISIM simulations for electronic circuits and devices

1. To verify the Thevenin's and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1st order active low pass and high pass filters of given cut-off frequency
6. Design a Wein Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.

DMC26104

PRACTICAL 3

COMMUNICATION ELECTRONICS

1. To study an Amplitude Modulator using Transistor.
2. To study envelope detector for demodulation of AM signal.
3. To study FM – Generator.
4. To study AM Transmitter and Receiver
5. To study FM Transmitter and Receiver
6. To study Time Division Multiplexing (TDM)
7. To study Pulse Amplitude Modulation (PAM).
8. To study Pulse Width Modulation (PWM).
9. To study Pulse Position Modulation (PPM).
10. To study ASK modulators.
11. To study PSK modulators.
12. To study FSK modulators.
13. IF amplifier.
14. RF amplifier.

DMD26104

PRACTICAL IV

MICROPROCESSOR AND MICROCONTROLLER LAB

Section-A: Programs using 8085 Microprocessor

1. Addition and subtraction of numbers using direct addressing mode.
2. Addition and subtraction of numbers using indirect addressing mode.
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Finding Largest among a group of numbers.
6. Finding Smallest among a group of numbers.
7. Arranging in an ascending order of a group of numbers.
8. Arranging in descending order of a group of numbers
9. Other programs (e.g. Parity Check, etc.).

Section-B: Experiments using 8051 microcontroller:

1. Binary addition , subtraction , multiplication and division
2. 8 bits multiplication and division.
3. Fibonacci series.
4. Average of a number.
5. Square and Square root of a number.
6. Palindrome.
7. BCD to Binary conversion.
8. Finding the smallest and largest numbers from the given N binary numbers.
9. To find that the given numbers is prime or not.
10. To find the factorial of a number.
11. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
12. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's. 5. Program to glow the first four LEDs then next four using TIMER application.
13. Program to rotate the contents of the accumulator first right and then left.
14. Program to run a countdown from 9-0 in the seven segment LED display.

15. To interface seven segment LED display with 8051 microcontroller and display ‘HELP’ in the seven segment LED display.
16. To toggle ‘1234’ as ‘1324’ in the seven segment LED display.
17. To generate different types of wave forms using DAC interface
18. Application of embedded systems: Temperature measurement & display on LCD

DME26104

PRACTICAL V

DIGITAL SIGNAL PROCESSING

1. Verification of properties of a system : linear and convolution
2. Finding DFT of a given sequence - direct method
3. Finding IDFT of a given sequence - direct method
4. Linear convolution using DFT
5. Circular convolution using DFT
6. Solution of simple difference equations
7. Verification of sampling theorem
8. Determination of impulse response of a given system
9. Determination of Frequency response of system to any arbitrary input
10. Design of simple IIR filters – Butterworth
11. DFT using FFT
12. IDFT using FFT

DME26304

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.

DMF261

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

DMF26304

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

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)
B.N. ROAD, MYSURU-570025

DEPARTMENT OF GEOGRAPHY

Revised Syllabus for Undergraduate (UG)
CBCS scheme – 2018-19

DLF23011 (A)

VI – Semester
Geography VI: DISASTER MANAGEMENT

Course Outcome:

CO 1. Identify in details with application, if applicable, hazards and disasters concepts

CO 2. Specify the characteristics of flood, landslide, drought are in India

CO 3. Write down in details with examples earthquake tsunami and cyclone are in India

CO 4. Identify the classification and characteristics of human induced disasters

CO 5. Learn in details with examples response and mitigation to disaster

UNIT	No. of Hours
1. Hazards, Risk, Vulnerability and Disasters: Definition and Concepts.	12
2. Disasters in India: (a) Causes, Impact, Distribution and Mapping: Flood, Landslide, Drought.	12
3. Disasters in India: (b) Causes, Impact, Distribution and Mapping: Earthquake, Tsunami and Cyclone.	12
4. Human induced disasters: Causes, Impact, Distribution and Mapping.	12
5. Response and Mitigation to Disasters: Mitigation and Preparedness, NDMA and NIDM; Indigenous Knowledge and Community-Based Disaster Management; Do's and Don'ts during Disasters	12

Reading List

1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
2. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.
3. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
4. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
5. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
6. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
7. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
8. Singh Jagbir (2007) "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India (www.ikbooks.com).

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)
B.N. ROAD, MYSURU-570025

DEPARTMENT OF GEOGRAPHY

Revised Syllabus for Undergraduate (UG)
CBCS scheme – 2018-19

DLF23011 (A)

VI – Semester
Geography VI: DISASTER MANAGEMENT

Course Outcome:

CO 1. Identify in details with application, if applicable, hazards and disasters concepts

CO 2. Specify the characteristics of flood, landslide, drought are in India

CO 3. Write down in details with examples earthquake tsunami and cyclone are in India

CO 4. Identify the classification and characteristics of human induced disasters

CO 5. Learn in details with examples response and mitigation to disaster

UNIT	No. of Hours
1. Hazards, Risk, Vulnerability and Disasters: Definition and Concepts.	12
2. Disasters in India: (a) Causes, Impact, Distribution and Mapping: Flood, Landslide, Drought.	12
3. Disasters in India: (b) Causes, Impact, Distribution and Mapping: Earthquake, Tsunami and Cyclone.	12
4. Human induced disasters: Causes, Impact, Distribution and Mapping.	12
5. Response and Mitigation to Disasters: Mitigation and Preparedness, NDMA and NIDM; Indigenous Knowledge and Community-Based Disaster Management; Do's and Don'ts during Disasters	12

Reading List

1. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
2. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.
3. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
4. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
5. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
6. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
7. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
8. Singh Jagbir (2007) "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India (www.ikbooks.com).

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(AUTONOMOUS)

B.N. ROAD, MYSURU-570025

DEPARTMENT OF JOURNALISM

Revised Syllabus for Undergraduate (UG) Journalism
With CBCS scheme Effective from 2018-19

Semester: 6
Code: DLF27415
Paper: Film Communication and Appreciation

CO1 Learn in depth Introduction to Cinema Language

CO2 Identify the details of nature of scenes

CO3 Understand the details of types of shots

CO4 Identify the characteristics of montage language

CO5 Specify the characteristics of types of sounds

CO6 Understand the details of use of colors

CO7 Specify in depth development of classical Hollywood cinema

CO8 Learn the details of cinema and the nation

CO9 Deliberate the details of globalization and Indian cinema

Unit:1- Cinema Language-visual language-types of shots- nature of scene-continuity editing-montage language- types of sounds- use of colors- stylistic elements- differences between story-plot-screen play

Unit:2- Film form- style of German expression- Film Noir- Italian Neo realism- French new wave genre- the development of classical Hollywood cinema

Unit:3- Visions of 3rd cinema-nonfiction cinema- feminist cinema theory- auteur- film authorship-a special focus on ray/Kurusawa

Unit:4- Hindi cinema1950- cinema and the nation- the Indian new wave- globalization and Indian cinema- the multiplex Era-film culture

References:

1. Andre Bazin-The Ontology of the Photographic Image
2. Sergei Eisenstein- A Dialectic Approach to Film Form
3. Tom Gunning- Non Continuity, Continuity, Dis Continuity: A theory of Genre in early Films.
4. David Bordwell- Classical Hollywood Cinema: Narrational Principles and Procedure
5. Paul Schraeder- Notes on Film Noir
6. Robert Stam- The cult of the Auteur
7. Richard Dyer- Heavens Bodies: Film Stars and Society.
8. Mahadev Prasad- Idealogy of Hindi Film

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF MATHEMATICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

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

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27001	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27001	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27001	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27001	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27001	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27001	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27201	2	0	0	0

PROGRAMME: BSc PMCS, PROGRAMME CODE: BSc-02 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27002	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27002	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27002	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27002	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27002	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27002	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27202	2	0	0	0

PROGRAMME: BSc PMCM, PROGRAMME CODE: BSc-03 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27003	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27003	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27003	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27003	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27003	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27003	5	0	1	6

7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27203	2	0	0	0

PROGRAMME: BSc PME, PROGRAMME CODE: BSc-04 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27004	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27004	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27004	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27004	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27004	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27004	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27204	2	0	0	0

Scheme of Assessment:

Credits L:T:P	Percentage			Maximum marks in the Exam /Assessment			Exam Duration	
	Th	Pr	IA	Th	Pr	IA	Th	Pr
4:0:2	50	20	30	70	70	30	3h	3h
4:0:1	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

SEMESTER -I

Course code: CMA27001/ CMA27002/ CMA27003/ CMA27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

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

CO1. Learn in details with examples curvature
CO2. Learn in depth applications of taylor's theorem
CO3. Understand the details of mean value theorems
CO4. Learn the details of linear approximation theorem
CO5. Understand in details with examples partial derivatives
CO6. Specify in details with examples asymptotes
CO7. Identify the classification and characteristics of envelopes
CO8. Deliberate the details of maxima and minima
C09. Understand in details with examples indeterminate forms

DSC I: Differential Calculus

Unit I : Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit II: Linear Approximation theorem, Tangents and normals, Monotone functions, Maxima and Minima, Curvature, Radius of curvature, Centre of curvature , Evolutes

Unit III : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sinx, cosx, e^x , log(l+x), $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit IV: Asymptotes, Envelopes, Singular points – Multiple points – Cusp, Node and conjugate points, Orthogonal Trajectories, Tracing of curves,

Reference Books:

1. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc. Graw Hill., 2008.
2. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
3. H.Anton,I.Birens and S. Davis,Calculus,John Wiley and Sons, Inc.,2002
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.

5. Lipman Bers – Calculus, Volumes 1 and 2
6. N. Piskunov – Differential and Integral Calculus
7. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
8. Serge Lang – First Course in Calculus
9. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
10. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICAL COMPONENT-1

1. Introduction to Scilab.
2. Operators; trigonometric, inverse trigonometric functions in scilab.
3. Plotting of standard Cartesian curves using Scilab.
4. Plotting of standard polar curves using Scilab.
5. Plotting of standard parametric curves using Scilab.
6. Introduction to Maxima.
7. Creating variables, functions.
8. Creating a Maxima program (simple examples, loops, control sequence).
9. Differentiation and integration using maxima inbuilt functions.
10. Plotting of standard curves- Cartesian, Polar using Maxima.
11. Plotting of standard parametric curves using Maxima.
12. Geometrical meaning of Rolle's theorem of the functions on the given interval.
13. To verify Rolle's theorem , Lagrange's theorem and cauchy's mean value theorem
14. Finding Taylor's theorem for a given function.
15. To illustrate left hand and right hand limits for discontinuous functions.
16. To illustrate continuity of a function.
17. To illustrate differentiability of a function.

SEMESTER-II

Course code: CMB27001/ CMB27002/ CMB27003/ CMB27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

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

CO1. Understand in depth variable separable

CO 2. Specify the characteristics of homogeneous equations

CO3. Identify the details of exact equation

CO4. Learn in depth simultaneous differential equations

CO5. Write down in depth total differential equation

CO6. Identify in depth linear non homogeneous equations

CO7. Write down in depth linear partial differential equation

CO8. Deliberate the characteristics of lagrange's method

DSC II: Differential Equations

Unit I: Linear differential equations of First order, Separation of variables, Equations with homogeneous coefficients, Exact differential equations, Linear differential equations of the form $\frac{dy}{dx} + Py = Q$, Integrating factors, rules to find an integrating factor ,Bernoulli's Equations, Equations with coefficients linear in x and y.

Unit II: First order higher degree equations solvable for x, y, p, Clairaut's form. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order, Simultaneous differential equations and Total differential equations.

Unit III: Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, Exact equations, Inverse Differential operators, The Cauchy-Euler equation.

Unit IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Reference Books:

1. Daniel A Murray – Introductory Course to Differential equations
   Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
2. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
   F.Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010
3. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
4. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
5. G. Stephonson – An introduction to Partial Differential Equations.
6. B. S. Grewal – Higher Engineering Mathematics
   E. Kreyszig – Advanced Engineering Mathematics
7. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
8. D. A Murray – Introductory Course in Differential Equations.
9. G. P. Simmons – Differential Equations
10. F. Ayres – Differential Equations (Schaum Series)
11. Martin Brown – Application of Differential Equations.
12. Shepley L.Ross,Differential Equations, 3rd Ed,John Wiley and Sons,1984.

PRACTICAL COMPONENTS-II

1. Obtaining partial derivatives of some standard functions
2. Solution of Differential equation and plotting the solution-I
3. Solution of Differential equation and plotting the solution-II
4. Solution of Differential equation and plotting the solution-III
5. Solution of Differential equation and plotting the solution-IV
6. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
7. Solving second order linear partial differential equations in two variables with constant coefficient.

8. Solutions to the problems on total and simultaneous differential equations.
9. Solutions to the problems on different types of partial differential equations.
10. Solution of Cauchy problem for first order partial differential equation.
11. Plotting the characteristics for the first order partial differential equation.
12. Plot the integral surfaces of a given first order partial differential equation with initial data.

SEMESTER III

Course code: CMC27001/ CMC27002/ CMC27003/ CMC27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOMES:

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

CO1. Deliberate in details with examples finite and infinite sets

CO2. Identify the details of countable and uncountable sets

CO3. Specify the details of sequence

CO4. Learn the characteristics of infinite series

CO5. Deliberate in details with examples comparison test

CO6. Identify the characteristics of sequence and series of function

CO7. Learn the details of uniform convergence

CO8. Understand in details with examples power series and radius of convergence.

DSC III: **Real Analysis**

Unit I: Finite and infinite sets, examples of countable and uncountable sets.Real line, bounded sets, supremum and infimum, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weistrass theorem.

Unit II: Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence .

Unit III: Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test , Definition and examples of absolute and conditional convergence.

Unit IV: Sequences and series of functions, Point wise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. Murray R Speigel – Laplace Transforms
3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
4. Richard R Goldberg, Methods of Real Analysis, Indian ed.
5. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis
6. E.Kreyszig- Advanced Engineering Mathematics, Wiely India Pvt. Ltd.
7. Raisinghania M. D., Laplace and Fourier Transforms S. Chand publications.

Practical components-III

1. Illustration of convergent, divergent and oscillatory sequences.
2. Plotting of recursive sequences.
3. Study of convergence of sequences through plotting
4. Illustration of convergent, divergent and oscillatory series.
5. To study the convergence and divergence of infinite series by plotting their sequences of partial sums.
6. Using Cauchy's criterion on the sequence of partial sums of the series to determine

convergence of series.

7. Cauchy's root test by plotting n^{th} roots.
8. Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ terms.
9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and it's radius of convergence.

SEMESTER IV

CMD27001/ CMD27002/ CMD27003/ CMD27004

(Credits: Theory-04, Practicals-02) **Theory: 60**

Lectures

COURSE OUTCOMES:

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

CO1. Understand in details with examples abelian group

CO2. Identify in details with examples permutation group

CO3. Learn the details of subgroups

CO4. Identify the classification and characteristics of cosets

CO5. Specify the details of commutative ring

CO6. Write down in depth ideals

CO7. Deliberate the characteristics of integral domains and fields

CO8. Write down in details with examples homomorphism

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity, cyclic group, groups of symmetries ,the permutation group , Group of quarter nion's.

Unit II: Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Unit III: Definition and examples of rings, examples of commutative and non- commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternion's, rings of matrices, polynomial rings, and rings of continuous functions. Sub rings and ideals.

Unit IV: Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homeomorphisms', Isomorphism'.

Reference Books :

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. I. N. Herstien – Topics in Algebra.
3. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. J B Fraleigh – A first course in Abstract Algebra.
6. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
7. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
8. R Balakrishan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
9. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2

Practical component-IV

1. Verifying whether a given operator is binary or not.
2. To find identity element of a group.
3. To find inverse element of a group.
4. Finding all possible subgroups of a finite group.

5. Examples to verify Lagrange's theorem.
6. Illustrating homomorphism and isomorphism of groups.
7. Verification of normality of a given subgroup.
8. Verifying Cayley's theorem and isomorphism theorems.
9. Examples for finding left and right coset and finding the index of a group.
10. Examples on different types of rings.
11. Examples on integral domains and fields.
12. Examples on subrings, ideals and subrings which are not ideals.
13. Homomorphism and isomorphism of rings – illustrative examples.
14. Solving polynomial equations.
15. Findind G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

CME 27001/CME27002/CME27003/CME27004

(Credits: Theory-04, Practicals-02) **Theory: 60**

Lectures

COURSE OUTCOMES:

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

CO1. Understand the details of vector space

CO2. Specify the characteristics of dimension of subspaces

CO3. Write down the characteristics of euclidean vectorspace

CO4. Understand the details of orthogonal projection

CO5. Learn in depth linear transformations

CO6. Understand in details with examples rank and nullity

CO7. Learn in details with examples eigen values and eigen vectors

CO8. Write down the characteristics of isomorphism, automorphism theorems

DSE I: Linear Algebra

Unit I: Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces, Direct sum of two subspaces.

Unit II: Inner Product, Inner Product of any two vectors in V (R), Euclidean Vectorspace, Orthogonal Vectors, Ortho normal Basis, Orthogonal Projection, Orthogonal Compliment.

Unit III: Linear transformations, algebra of linear transformations , matrix representation of a linear transformation, null space, range, rank and nullity of a linear transformation,

Unit IV: Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphism, Auto morphism, theorems, invertibility of non singular linear transformation, change of coordinate matrix.

Reference Books:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. S. Kumaresan – Linear Algebra
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

Practical components –V

Credit :2 Hour: 4 Hour per week

1. Vector space, subspace – illustrative examples.
2. Expressing a vector as a linear combination of given set of vectors.
3. Examples on linear dependence and independence of vectors.

4. Basis and Dimension – illustrative examples.
5. Verifying whether a given transformation is linear.
6. Finding matrix of a linear transformation.
7. Problems on rank and nullity.
8. Find characteristics polynomials.
9. To find Eigen values and their multiplicity.
10. Calculation of Eigen vector.
11. Change of basis.
12. Linear transformations to matrices and vice versa.
13. Matrix with respect to change of basis.
14. Orthogonal and orthonormal sets.
15. Gram- Schmidt orthogonalisation of the columns.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF MATHEMATICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

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

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27001	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27001	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27001	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27001	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27001	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27001	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27201	2	0	0	0

PROGRAMME: BSc PMCS, PROGRAMME CODE: BSc-02 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27002	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27002	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27002	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27002	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27002	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27002	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27202	2	0	0	0

PROGRAMME: BSc PMCM, PROGRAMME CODE: BSc-03 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27003	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27003	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27003	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27003	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27003	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27003	5	0	1	6

7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27203	2	0	0	0

PROGRAMME: BSc PME, PROGRAMME CODE: BSc-04 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27004	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27004	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27004	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27004	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27004	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27004	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27204	2	0	0	0

Scheme of Assessment:

Credits L:T:P	Percentage			Maximum marks in the Exam /Assessment			Exam Duration	
	Th	Pr	IA	Th	Pr	IA	Th	Pr
4:0:2	50	20	30	70	70	30	3h	3h
4:0:1	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

SEMESTER -I

Course code: CMA27001/ CMA27002/ CMA27003/ CMA27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

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

CO1. Learn in details with examples curvature
CO2. Learn in depth applications of taylor's theorem
CO3. Understand the details of mean value theorems
CO4. Learn the details of linear approximation theorem
CO5. Understand in details with examples partial derivatives
CO6. Specify in details with examples asymptotes
CO7. Identify the classification and characteristics of envelopes
CO8. Deliberate the details of maxima and minima
C09. Understand in details with examples indeterminate forms

DSC I: Differential Calculus

Unit I : Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit II: Linear Approximation theorem, Tangents and normals, Monotone functions, Maxima and Minima, Curvature, Radius of curvature, Centre of curvature , Evolutes

Unit III : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sinx, cosx, e^x , log(l+x), $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit IV: Asymptotes, Envelopes, Singular points – Multiple points – Cusp, Node and conjugate points, Orthogonal Trajectories, Tracing of curves,

Reference Books:

1. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc. Graw Hill., 2008.
2. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
3. H.Anton,I.Birens and S. Davis,Calculus,John Wiley and Sons, Inc.,2002
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.

5. Lipman Bers – Calculus, Volumes 1 and 2
6. N. Piskunov – Differential and Integral Calculus
7. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
8. Serge Lang – First Course in Calculus
9. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
10. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICAL COMPONENT-1

1. Introduction to Scilab.
2. Operators; trigonometric, inverse trigonometric functions in scilab.
3. Plotting of standard Cartesian curves using Scilab.
4. Plotting of standard polar curves using Scilab.
5. Plotting of standard parametric curves using Scilab.
6. Introduction to Maxima.
7. Creating variables, functions.
8. Creating a Maxima program (simple examples, loops, control sequence).
9. Differentiation and integration using maxima inbuilt functions.
10. Plotting of standard curves- Cartesian, Polar using Maxima.
11. Plotting of standard parametric curves using Maxima.
12. Geometrical meaning of Rolle's theorem of the functions on the given interval.
13. To verify Rolle's theorem , Lagrange's theorem and cauchy's mean value theorem
14. Finding Taylor's theorem for a given function.
15. To illustrate left hand and right hand limits for discontinuous functions.
16. To illustrate continuity of a function.
17. To illustrate differentiability of a function.

SEMESTER-II

Course code: CMB27001/ CMB27002/ CMB27003/ CMB27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

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

CO1. Understand in depth variable separable

CO 2. Specify the characteristics of homogeneous equations

CO3. Identify the details of exact equation

CO4. Learn in depth simultaneous differential equations

CO5. Write down in depth total differential equation

CO6. Identify in depth linear non homogeneous equations

CO7. Write down in depth linear partial differential equation

CO8. Deliberate the characteristics of lagrange's method

DSC II: Differential Equations

Unit I: Linear differential equations of First order, Separation of variables, Equations with homogeneous coefficients, Exact differential equations, Linear differential equations of the form $\frac{dy}{dx} + Py = Q$, Integrating factors, rules to find an integrating factor ,Bernoulli's Equations, Equations with coefficients linear in x and y.

Unit II: First order higher degree equations solvable for x, y, p, Clairaut's form. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order, Simultaneous differential equations and Total differential equations.

Unit III: Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, Exact equations, Inverse Differential operators, The Cauchy-Euler equation.

Unit IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Reference Books:

1. Daniel A Murray – Introductory Course to Differential equations
   Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
2. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
   F.Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010
3. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
4. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
5. G. Stephonson – An introduction to Partial Differential Equations.
6. B. S. Grewal – Higher Engineering Mathematics
   E. Kreyszig – Advanced Engineering Mathematics
7. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
8. D. A Murray – Introductory Course in Differential Equations.
9. G. P. Simmons – Differential Equations
10. F. Ayres – Differential Equations (Schaum Series)
11. Martin Brown – Application of Differential Equations.
12. Shepley L.Ross,Differential Equations, 3rd Ed,John Wiley and Sons,1984.

PRACTICAL COMPONENTS-II

1. Obtaining partial derivatives of some standard functions
2. Solution of Differential equation and plotting the solution-I
3. Solution of Differential equation and plotting the solution-II
4. Solution of Differential equation and plotting the solution-III
5. Solution of Differential equation and plotting the solution-IV
6. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
7. Solving second order linear partial differential equations in two variables with constant coefficient.

8. Solutions to the problems on total and simultaneous differential equations.
9. Solutions to the problems on different types of partial differential equations.
10. Solution of Cauchy problem for first order partial differential equation.
11. Plotting the characteristics for the first order partial differential equation.
12. Plot the integral surfaces of a given first order partial differential equation with initial data.

SEMESTER III

Course code: CMC27001/ CMC27002/ CMC27003/ CMC27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOMES:

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

CO1. Deliberate in details with examples finite and infinite sets

CO2. Identify the details of countable and uncountable sets

CO3. Specify the details of sequence

CO4. Learn the characteristics of infinite series

CO5. Deliberate in details with examples comparison test

CO6. Identify the characteristics of sequence and series of function

CO7. Learn the details of uniform convergence

CO8. Understand in details with examples power series and radius of convergence.

DSC III: **Real Analysis**

Unit I: Finite and infinite sets, examples of countable and uncountable sets.Real line, bounded sets, supremum and infimum, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weistrass theorem.

Unit II: Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence .

Unit III: Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test , Definition and examples of absolute and conditional convergence.

Unit IV: Sequences and series of functions, Point wise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. Murray R Speigel – Laplace Transforms
3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
4. Richard R Goldberg, Methods of Real Analysis, Indian ed.
5. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis
6. E.Kreyszig- Advanced Engineering Mathematics, Wiely India Pvt. Ltd.
7. Raisinghania M. D., Laplace and Fourier Transforms S. Chand publications.

Practical components-III

1. Illustration of convergent, divergent and oscillatory sequences.
2. Plotting of recursive sequences.
3. Study of convergence of sequences through plotting
4. Illustration of convergent, divergent and oscillatory series.
5. To study the convergence and divergence of infinite series by plotting their sequences of partial sums.
6. Using Cauchy's criterion on the sequence of partial sums of the series to determine

convergence of series.

7. Cauchy's root test by plotting n^{th} roots.
8. Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ terms.
9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and it's radius of convergence.

SEMESTER IV

CMD27001/ CMD27002/ CMD27003/ CMD27004

(Credits: Theory-04, Practicals-02) **Theory: 60**

Lectures

COURSE OUTCOMES:

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

CO1. Understand in details with examples abelian group

CO2. Identify in details with examples permutation group

CO3. Learn the details of subgroups

CO4. Identify the classification and characteristics of cosets

CO5. Specify the details of commutative ring

CO6. Write down in depth ideals

CO7. Deliberate the characteristics of integral domains and fields

CO8. Write down in details with examples homomorphism

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity, cyclic group, groups of symmetries ,the permutation group , Group of quarter nion's.

Unit II: Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Unit III: Definition and examples of rings, examples of commutative and non- commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternion's, rings of matrices, polynomial rings, and rings of continuous functions. Sub rings and ideals.

Unit IV: Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homeomorphisms', Isomorphism'.

Reference Books :

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. I. N. Herstien – Topics in Algebra.
3. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. J B Fraleigh – A first course in Abstract Algebra.
6. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
7. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
8. R Balakrishan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
9. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2

Practical component-IV

1. Verifying whether a given operator is binary or not.
2. To find identity element of a group.
3. To find inverse element of a group.
4. Finding all possible subgroups of a finite group.

5. Examples to verify Lagrange's theorem.
6. Illustrating homomorphism and isomorphism of groups.
7. Verification of normality of a given subgroup.
8. Verifying Cayley's theorem and isomorphism theorems.
9. Examples for finding left and right coset and finding the index of a group.
10. Examples on different types of rings.
11. Examples on integral domains and fields.
12. Examples on subrings, ideals and subrings which are not ideals.
13. Homomorphism and isomorphism of rings – illustrative examples.
14. Solving polynomial equations.
15. Findind G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

CME 27001/CME27002/CME27003/CME27004

(Credits: Theory-04, Practicals-02) **Theory: 60**

Lectures

COURSE OUTCOMES:

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

CO1. Understand the details of vector space

CO2. Specify the characteristics of dimension of subspaces

CO3. Write down the characteristics of euclidean vectorspace

CO4. Understand the details of orthogonal projection

CO5. Learn in depth linear transformations

CO6. Understand in details with examples rank and nullity

CO7. Learn in details with examples eigen values and eigen vectors

CO8. Write down the characteristics of isomorphism, automorphism theorems

DSE I: Linear Algebra

Unit I: Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces, Direct sum of two subspaces.

Unit II: Inner Product, Inner Product of any two vectors in V (R), Euclidean Vectorspace, Orthogonal Vectors, Ortho normal Basis, Orthogonal Projection, Orthogonal Compliment.

Unit III: Linear transformations, algebra of linear transformations , matrix representation of a linear transformation, null space, range, rank and nullity of a linear transformation,

Unit IV: Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphism, Auto morphism, theorems, invertibility of non singular linear transformation, change of coordinate matrix.

Reference Books:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. S. Kumaresan – Linear Algebra
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

Practical components –V

Credit :2 Hour: 4 Hour per week

1. Vector space, subspace – illustrative examples.
2. Expressing a vector as a linear combination of given set of vectors.
3. Examples on linear dependence and independence of vectors.

4. Basis and Dimension – illustrative examples.
5. Verifying whether a given transformation is linear.
6. Finding matrix of a linear transformation.
7. Problems on rank and nullity.
8. Find characteristics polynomials.
9. To find Eigen values and their multiplicity.
10. Calculation of Eigen vector.
11. Change of basis.
12. Linear transformations to matrices and vice versa.
13. Matrix with respect to change of basis.
14. Orthogonal and orthonormal sets.
15. Gram- Schmidt orthogonalisation of the columns.

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

B N ROAD, MYSURU- 570 025

DEPARTMENT OF MATHEMATICS

Syllabus

CHOICE BASED CREDIT SYSTEM

For B.Sc programmes

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

PROGRAMME: BSc PCM, PROGRAMME CODE: BSc-01 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27001	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27001	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27001	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27001	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27001	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27001	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27201	2	0	0	0

PROGRAMME: BSc PMCS, PROGRAMME CODE: BSc-02 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27002	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27002	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27002	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27002	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27002	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27002	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27202	2	0	0	0

PROGRAMME: BSc PMCM, PROGRAMME CODE: BSc-03 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27003	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27003	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27003	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27003	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27003	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27003	5	0	1	6

7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27203	2	0	0	0

PROGRAMME: BSc PME, PROGRAMME CODE: BSc-04 (2017-18)

SL No	SEMESTER	Title of the paper	DSC/DSE/SEC	Course code	No. of Credits			Total Credits
					L	T	P	
1	I Semester	Differential Calculus	DSC-I	CMA 27004	4	0	2	6
2	II Semester	Differential Equations	DSC-II	CMB27004	4	0	2	6
3	III Semester	Real Analysis	DSC-III	CMC 27004	4	0	2	6
4	IV Semester	Algebra	DSC-IV	CMD 27004	4	0	2	6
5	V Semester	Linear Algebra	DSE-I	CME 27004	5	0	1	6
6	VI Semester	Complex Analysis	DSE-II	CMF 27004	5	0	1	6
7	V Semester/ VI Semester	Vector calculus	SEC	CMF 27204	2	0	0	0

Scheme of Assessment:

Credits L:T:P	Percentage			Maximum marks in the Exam /Assessment			Exam Duration	
	Th	Pr	IA	Th	Pr	IA	Th	Pr
4:0:2	50	20	30	70	70	30	3h	3h
4:0:1	70	-	30	70	-	30	3h	-
2:0:0	70	-	30	50	-	30	2h	-

Note: L-Lecture, T-Tutorial, P-Practical; Th- Theory, Pr-Practical,

I A- Internal Assessment

SEMESTER -I

Course code: CMA27001/ CMA27002/ CMA27003/ CMA27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

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

CO1. Learn in details with examples curvature
CO2. Learn in depth applications of taylor's theorem
CO3. Understand the details of mean value theorems
CO4. Learn the details of linear approximation theorem
CO5. Understand in details with examples partial derivatives
CO6. Specify in details with examples asymptotes
CO7. Identify the classification and characteristics of envelopes
CO8. Deliberate the details of maxima and minima
C09. Understand in details with examples indeterminate forms

DSC I: Differential Calculus

Unit I : Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit II: Linear Approximation theorem, Tangents and normals, Monotone functions, Maxima and Minima, Curvature, Radius of curvature, Centre of curvature , Evolutes

Unit III : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sinx, cosx, e^x , log(l+x), $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Unit IV: Asymptotes, Envelopes, Singular points – Multiple points – Cusp, Node and conjugate points, Orthogonal Trajectories, Tracing of curves,

Reference Books:

1. Frank Ayres and Elliott Mendelson, Schaum's Outline of Calculus, 5th ed.USA: Mc. Graw Hill., 2008.
2. G B Thomas and R L Finney, Calculus and analytical geometry, Addison Wesley, 1995.
3. H.Anton,I.Birens and S. Davis,Calculus,John Wiley and Sons, Inc.,2002
4. J Edwards, An elementary treatise on the differential calculus: with Applications and numerous example, Reprint. Charleston, USA BiblioBazaar, 2010.

5. Lipman Bers – Calculus, Volumes 1 and 2
6. N. Piskunov – Differential and Integral Calculus
7. N P Bali, Differential Calculus, India: Laxmi Publications (P) Ltd.., 2010.
8. Serge Lang – First Course in Calculus
9. S Narayanan & T. K. Manicavachogam Pillay, Calculus.:S. Viswanathan Pvt. Ltd., vol. I & II 1996.
10. Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S Chand and Co. Pvt. Ltd., 2014.

PRACTICAL COMPONENT-1

1. Introduction to Scilab.
2. Operators; trigonometric, inverse trigonometric functions in scilab.
3. Plotting of standard Cartesian curves using Scilab.
4. Plotting of standard polar curves using Scilab.
5. Plotting of standard parametric curves using Scilab.
6. Introduction to Maxima.
7. Creating variables, functions.
8. Creating a Maxima program (simple examples, loops, control sequence).
9. Differentiation and integration using maxima inbuilt functions.
10. Plotting of standard curves- Cartesian, Polar using Maxima.
11. Plotting of standard parametric curves using Maxima.
12. Geometrical meaning of Rolle's theorem of the functions on the given interval.
13. To verify Rolle's theorem , Lagrange's theorem and cauchy's mean value theorem
14. Finding Taylor's theorem for a given function.
15. To illustrate left hand and right hand limits for discontinuous functions.
16. To illustrate continuity of a function.
17. To illustrate differentiability of a function.

SEMESTER-II

Course code: CMB27001/ CMB27002/ CMB27003/ CMB27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

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

CO1. Understand in depth variable separable

CO 2. Specify the characteristics of homogeneous equations

CO3. Identify the details of exact equation

CO4. Learn in depth simultaneous differential equations

CO5. Write down in depth total differential equation

CO6. Identify in depth linear non homogeneous equations

CO7. Write down in depth linear partial differential equation

CO8. Deliberate the characteristics of lagrange's method

DSC II: Differential Equations

Unit I: Linear differential equations of First order, Separation of variables, Equations with homogeneous coefficients, Exact differential equations, Linear differential equations of the form $\frac{dy}{dx} + Py = Q$, Integrating factors, rules to find an integrating factor ,Bernoulli's Equations, Equations with coefficients linear in x and y.

Unit II: First order higher degree equations solvable for x, y, p, Clairaut's form. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order, Simultaneous differential equations and Total differential equations.

Unit III: Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, Exact equations, Inverse Differential operators, The Cauchy-Euler equation.

Unit IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Reference Books:

1. Daniel A Murray – Introductory Course to Differential equations
   Earl David Rainville and Philip Edward Bedient – A short course in Differential equations, Prentice Hall College Div; 6th edition.
2. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013.
   F.Ayres, Schaum's outline of theory and problems of Differential Equations, 1st ed. USA McGraw-Hill, 2010
3. S Narayanan and T K Manicavachogam Pillay, Differential Equations .: S V Publishers Private Ltd., 1981.
4. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
5. G. Stephonson – An introduction to Partial Differential Equations.
6. B. S. Grewal – Higher Engineering Mathematics
   E. Kreyszig – Advanced Engineering Mathematics
7. E. D. Rainville and P E Bedient – A Short Course in Differential Equations
8. D. A Murray – Introductory Course in Differential Equations.
9. G. P. Simmons – Differential Equations
10. F. Ayres – Differential Equations (Schaum Series)
11. Martin Brown – Application of Differential Equations.
12. Shepley L.Ross,Differential Equations, 3rd Ed,John Wiley and Sons,1984.

PRACTICAL COMPONENTS-II

1. Obtaining partial derivatives of some standard functions
2. Solution of Differential equation and plotting the solution-I
3. Solution of Differential equation and plotting the solution-II
4. Solution of Differential equation and plotting the solution-III
5. Solution of Differential equation and plotting the solution-IV
6. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.
7. Solving second order linear partial differential equations in two variables with constant coefficient.

8. Solutions to the problems on total and simultaneous differential equations.
9. Solutions to the problems on different types of partial differential equations.
10. Solution of Cauchy problem for first order partial differential equation.
11. Plotting the characteristics for the first order partial differential equation.
12. Plot the integral surfaces of a given first order partial differential equation with initial data.

SEMESTER III

Course code: CMC27001/ CMC27002/ CMC27003/ CMC27004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOMES:

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

CO1. Deliberate in details with examples finite and infinite sets

CO2. Identify the details of countable and uncountable sets

CO3. Specify the details of sequence

CO4. Learn the characteristics of infinite series

CO5. Deliberate in details with examples comparison test

CO6. Identify the characteristics of sequence and series of function

CO7. Learn the details of uniform convergence

CO8. Understand in details with examples power series and radius of convergence.

DSC III: **Real Analysis**

Unit I: Finite and infinite sets, examples of countable and uncountable sets.Real line, bounded sets, supremum and infimum, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weistrass theorem.

Unit II: Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence .

Unit III: Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test , Definition and examples of absolute and conditional convergence.

Unit IV: Sequences and series of functions, Point wise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

Reference Books:

1. S.C Malik –Real Analysis
2. Murray R Speigel – Laplace Transforms
3. S.C.Malik and Savita Arora, *Mathematical Analysis*, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
4. Richard R Goldberg, Methods of Real Analysis, Indian ed.
5. Asha Rani Singhal and M .K Singhal, A first course in Real Analysis
6. E.Kreyszig- Advanced Engineering Mathematics, Wiely India Pvt. Ltd.
7. Raisinghania M. D., Laplace and Fourier Transforms S. Chand publications.

Practical components-III

1. Illustration of convergent, divergent and oscillatory sequences.
2. Plotting of recursive sequences.
3. Study of convergence of sequences through plotting
4. Illustration of convergent, divergent and oscillatory series.
5. To study the convergence and divergence of infinite series by plotting their sequences of partial sums.
6. Using Cauchy's criterion on the sequence of partial sums of the series to determine

convergence of series.

7. Cauchy's root test by plotting n^{th} roots.
8. Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ terms.
9. Testing the convergence of binomial, exponential and logarithmic series and finding the sum.
10. To find the sum of the series and it's radius of convergence.

SEMESTER IV

CMD27001/ CMD27002/ CMD27003/ CMD27004

(Credits: Theory-04, Practicals-02) **Theory: 60**

Lectures

COURSE OUTCOMES:

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

CO1. Understand in details with examples abelian group

CO2. Identify in details with examples permutation group

CO3. Learn the details of subgroups

CO4. Identify the classification and characteristics of cosets

CO5. Specify the details of commutative ring

CO6. Write down in depth ideals

CO7. Deliberate the characteristics of integral domains and fields

CO8. Write down in details with examples homomorphism

DSC IV: Algebra

Unit I: Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity, cyclic group, groups of symmetries ,the permutation group , Group of quarter nion's.

Unit II: Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Unit III: Definition and examples of rings, examples of commutative and non- commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternion's, rings of matrices, polynomial rings, and rings of continuous functions. Sub rings and ideals.

Unit IV: Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homeomorphisms', Isomorphism'.

Reference Books :

1. Natarajan, Manicavasagam Pillay and Ganapathy – Algebra
2. I. N. Herstien – Topics in Algebra.
3. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. J B Fraleigh – A first course in Abstract Algebra.
6. Michael Artin – Algebra, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
7. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna Prakasan Mandir, 1980.
8. R Balakrishan and N.Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
9. T. K. Manicavasagam Pillai and K S Narayanan – Modern Algebra Volume 2

Practical component-IV

1. Verifying whether a given operator is binary or not.
2. To find identity element of a group.
3. To find inverse element of a group.
4. Finding all possible subgroups of a finite group.

5. Examples to verify Lagrange's theorem.
6. Illustrating homomorphism and isomorphism of groups.
7. Verification of normality of a given subgroup.
8. Verifying Cayley's theorem and isomorphism theorems.
9. Examples for finding left and right coset and finding the index of a group.
10. Examples on different types of rings.
11. Examples on integral domains and fields.
12. Examples on subrings, ideals and subrings which are not ideals.
13. Homomorphism and isomorphism of rings – illustrative examples.
14. Solving polynomial equations.
15. Findind G.C.D of polynomials.
16. Finding units and associates.
17. Test for rational roots.

SEMESTER V

CME 27001/CME27002/CME27003/CME27004

(Credits: Theory-04, Practicals-02) **Theory: 60**

Lectures

COURSE OUTCOMES:

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

CO1. Understand the details of vector space

CO2. Specify the characteristics of dimension of subspaces

CO3. Write down the characteristics of euclidean vectorspace

CO4. Understand the details of orthogonal projection

CO5. Learn in depth linear transformations

CO6. Understand in details with examples rank and nullity

CO7. Learn in details with examples eigen values and eigen vectors

CO8. Write down the characteristics of isomorphism, automorphism theorems

DSE I: Linear Algebra

Unit I: Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces, Direct sum of two subspaces.

Unit II: Inner Product, Inner Product of any two vectors in V (R), Euclidean Vectorspace, Orthogonal Vectors, Ortho normal Basis, Orthogonal Projection, Orthogonal Compliment.

Unit III: Linear transformations, algebra of linear transformations , matrix representation of a linear transformation, null space, range, rank and nullity of a linear transformation,

Unit IV: Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphism, Auto morphism, theorems, invertibility of non singular linear transformation, change of coordinate matrix.

Reference Books:

1. I. N. Herstien – Topics in Algebra.
2. Stewart – Introduction to Linear Algebra
3. S. Kumaresan – Linear Algebra
4. G. D. Birkhoff and S Maclane – A brief Survey of Modern Algebra.
5. Gopalakrishna – University Algebra
6. Saymour Lipschitz – Theory and Problems of Linear Algebra.
7. S.C Mallik –Real Analysis.
8. B.S Grewal – Higher engineering mathematics.

Practical components –V

Credit :2 Hour: 4 Hour per week

1. Vector space, subspace – illustrative examples.
2. Expressing a vector as a linear combination of given set of vectors.
3. Examples on linear dependence and independence of vectors.

4. Basis and Dimension – illustrative examples.
5. Verifying whether a given transformation is linear.
6. Finding matrix of a linear transformation.
7. Problems on rank and nullity.
8. Find characteristics polynomials.
9. To find Eigen values and their multiplicity.
10. Calculation of Eigen vector.
11. Change of basis.
12. Linear transformations to matrices and vice versa.
13. Matrix with respect to change of basis.
14. Orthogonal and orthonormal sets.
15. Gram- Schmidt orthogonalisation of the columns.

JSS MAHAVIDYAPEETA

J. S. S COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)
OOTY ROAD, MYSORE –570 025
(Autonomous under University of Mysore *Re-accredited by NAAC with 'A'Grade)

B. Sc., DEGREE SYLLABUS (SEMESTER SCHEME)

MICROBIOLOGY

(2018-19)

BMF58006

VI SEMESTER

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Specify the details of Industrial Microbiology
CO2. Learn in depth Industrial production
CO3. Understand in depth Food Microbiology
CO4. Specify the details of Dairy Microbiology

UNIT-I
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.

Methods of food preservation: Physical method – high temperature, low temperature, canning. Drying – solar drying, drum drying, spray drying. Radiation.

Chemical methods – chemical preservatives – salient features of the chemical preservatives (propionates, benzoate, sorbates, nitrates and nitrites, sulphur dioxide and sulphates, sugar and salt)

D. Food borne intoxication and infection:

Bacterial intoxication- Staphylococcal intoxication, Botulism,
Bacterial infection- Salmonellosis.
Mycotoxin – Origin, types and importance of toxins with reference to Aflatoxins.

F. Food safety and quality control. –A brief account on FPO, HACCP, Food laws and Food standards(in brief)

UNIT-II
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, preparation of cheese.

Preservation of milk and milk products – Pasteurization, Sterilization. Microbiological standard for milk and milk products.

UNIT-III
INDUSTRIAL MICROBIOLOGY

A. Introduction, Definition and scope.

B. Microorganisms of industrial importance. Biology of industrial microorganisms: Isolation, Screening, Improvement and Preservation.

C. A brief account of production medium, inoculum medium, raw materials-Molasses, corn steep liquor, sulphite waste liquor and whey. Buffers, Precursors, Inhibitors and Antifoam agents.

D. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation. Fermentation process – Surface, Submerged and Solid state fermentation.Types- Batch and Continuous fermentation. Down stream processing: Steps in recovery and purification of fermented products – Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, chromatography, Drying and crystallization.

E. Bioengineering of Microorganisms for industrial purposes.

UNIT-IV

INDUSTRIAL PRODUCTION

A. a. Organic acids – Citric acid.

b. Antibiotics – Penicillin.

c. Enzymes –Pectinase.

d. Alcohol – Ethanol.

e. Amino acid –Glutamatic 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*.

PRACTICALS:

UNIT-I: FOOD MICROBIOLOGY

1. a. Isolation and enumeration of bacteria from utensils
   b. Isolation and identification of fungi from food utensils
2. a. Isolation and enumeration of bacteria from spoiled vegetables
   b. Isolation and identification fungi from spoiled vegetables.
3. a. Isolation and enumeration of bacteria from spoiled fruits.
   b. Isolation and identification of fungi from spoiled fruits.
4. a. Isolation and identification of aspergillus on groundnut by blotters test.
   b. Microscopic examination of idli batter.

UNIT-II: DAIRY MICROBIOLOGY

5. a. Estimation of lactose in milk.
   b. Estimation of lactic acid in milk.
6. a. Turbidity test to detect boiled and unboiled milk.
7. Methylene blue reductase test and Resazurin test to determine the quality of milk.

UNIT-III & UNIT -IV (INDUSTRIAL MICROBIOLOGY+ INDUSTRIAL PRODUCTION)

8. Preparation of wine from grapes.
9. Preparation of alcohol using jaggery or molasses.

10. Estimation of percentage alcohol in a given sample by specific gravity bottle method.

11. Production of citric acid using *Aspergillusniger*.

12. Visit to food industries or food research laboratories, dairy industries and distilleries. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

REFERENCES:

1.AdamsM.R.and Moss M.O., 1995, Food Microbiology. Royal Society of Chemistry , Cambridge University Press.

2.Anathanarayanan C and Paniker, C.K.J. Text Book of Microbiology, 9th ed. Orinet Longman ltd., Chennai.

3.Banwart, G.J.(1987) Basic Food Microbiology. CBS Publishers and distributors, New Delhi.

4.Casida,LEJr 1968 Industrial Mirobiology. New Age International Publishers.

5.Frazier&Westhoff, D.C.1995,Food Microbiology Tata McGraw Hill Pub. Company Ltd.,NewDehli.

6.Jay, J.M. (1985). Modern Food Microbiology.CBS Publishers and distributors, New Delhi.

Banwart, G.J. (1987). **Basic Food Microbiology**.CBS publishers and distributors, New Delhi.

7.Benson,H.J. **Microbiological applications- laboratory manual in general microbiology,** fifth edition.C.Brown publishers.

8.Cappuccino,J.G., And Sherman,N. (1999). **Microbiology- A Laboratory Manual,** Fourth edition.

9.Glodsby Richard A., Kindt Thomas J. And Osborne Barbara A., Kuby Immunology, W. H. Freeman and Company New York.

10.Jagadish Chandra (1996). Text Book of Medical Mycology.Oreint Longman

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13.NandhiniShetty 1993. Immunology: Inductory Text Book . New Age International Ltd.

14. R.P.Singh, Immunology and Medical Microbiology

15.Rajan. S. Medical Microbiology. MJP Publishers, Chennai.

CMF58207

VI SEMESTER

IMMUNOLOGY & MEDICAL MICROBIOLOGY

UNIT-II
IMMUNOLOGY

A. Antigens – Nature and types

B. Antibodies – Basic structure of immunoglobulin (Ig G). Biological properties of Immunoglobulin classes, monoclonal antibodies, antigen antibody reactions – salient features. precipitation reaction, neutralization test, opsonisation , agglutination reaction, compliment fixation. Immunotechniques – RIA, ELISA. Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.

National Immunization program (Tabular form). **12hrs**

UNIT-III AND UNIT- IV
MEDICAL MICROBIOLOGY

A. Introduction – History and development of medical microbiology. Normal flora of human body.

B. Infection and disease transmission – Signs, symptoms, syndrome. Types of infection, mode of transmission.

C. Host pathogen interaction – Pathogenicity, microbial virulence, microbial toxins, opportunists and true pathogens.

D. Antimicrobial chemotherapy – General characteristics and types of antibiotics. Mode of action of -Penicillin, Aminoglycosides, Erythromycin, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Multiple Drug Resistance (in brief).

12hrs

PRACTICALS

UNIT-I AND UNIT II : IMMUNOLOGY

1. Determination of blood group and Rh factor.
2. Enumerate RBC in given blood sample
3. Enumerate WBC in given blood sample

UNIT-II

4. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).
5. Antibiotic sensitivity test.

UNIT-III AND UNIT II: MEDICAL MICROBIOLOGY

6. Estimation of urine bacteria by calibrated loop- direct streak method.

7. Microbial flora of oral cavity (tooth and mouth)

8. Isolation of dermatophytes from human skin.

UNIT-IV

9. Detection of typhoid by Widal test

10. Rapid plasma reagin (RPR) card test for syphillis

11-12.Material/ microscopic observation/ display of photographs of human pathogens: *Mycobacterium tuberculosis*, *Vibrio cholerae, Tryponema pallidum, Salmonella typhi,* Hepatitis virus, polio virus, HIV, *Plasmodium*)

Note: Visit to pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment

REFERENCES:

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
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21. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

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VI SEMESTER
MEDICAL MICROBIOLOGY AND IMMUNOLOGY

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Understand in depth Medical Microbiology
CO2. Specify in details with examples Human diseases
CO3. Learn the details of Immunology
CO4. Specify the classification and characteristics of Antigens and antibodies

UNIT :I **No of Hours: 15**

MEDICAL MICROBIOLOGY

A. Introduction – History and development of medical microbiology. Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract

B. Infection and disease transmission – Signs, symptoms, syndrome. Types of Infection: opportunistic infection and Nosocomial infection, mode of transmission.

C. Host pathogen interaction – Infection, Invasion, Pathogen, Pathogenicity, microbial virulence, microbial toxins, opportunistic and true pathogens.

D. Antimicrobial chemotherapy – General characteristics and types of antibiotics. Mode of action of -Penicillin, Aminoglycosides, Erythromycin, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Amantadine and Azidothymidine .Multiple Drug Resistance (in brief).

UNIT-IV **No. of Hours:15**

IMMUNOLOGY: ANTIGENS AND ANTIBODIES

A. Antigens – Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes), Adjuvants.

B. Antibodies – Basic structure of immunoglobulin (Ig G). Biological properties of Immunoglobulin classes, monoclonal antibodies, antigen antibody reactions – salient features. precipitation reaction, neutralization test, opsonisation , agglutination reaction, compliment fixation. Immunotechniques – RIA, ELISA and ELISPOT. Hypersensitivity (Type I to V - in brief).
Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.
National Immunization program (Tabular form).

PRACTICALS

1.Determination of blood group and Rh factor.
2. Enumerate RBC in given blood sample
3. Enumerate WBC in given blood sample
4. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).
5. Antibiotic sensitivity test.
6. Estimation of urine bacteria by calibrated loop- direct streak method.
7. Determination of susceptibility to dental carrier-Snydal test
8. Identification of dermatophytes from human skin.
9. Detection of typhoid by Widal test
10. Rapid plasma reagin (RPR) card test for syphilis
11. Identify bacteria on the basis of cultural, morphological and biochemical characteristics: IMViC,TSI, nitrate reduction, urease production and catalase tests
12-15.Material/ microscopic observation/ display of photographs of human pathogens as per theory syllabus: Influenza virus, *Corynebacteriumdiphtheriae*,*Blastomycesdermatitidis*,Human papilloma virus,*Tryponemapallidum,Sporothrixschenckii, Plasmodium,* Dengue viruses (DENV),*Salmonella typhi*and *Entamoebahistolytica*)

NOTE: Visit to pharmaceuticals and pathological laboratories.Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

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CME28406

V SEMESTER
Microbial Diagnosis in Health Clinics

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Learn the details of Diagnosis of diseases
CO2. Learn in details with examples Collection of clinical samples
CO3. Understand in depth Microscopic examination of microbes
CO4. Specify the details of Testing for antibiotic sensitivity in bacteria

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, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

UNIT :III **No of Hours: 15**

DIRECT MICROSCOPIC EXAMINATION AND CULTURE

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsastained,Thin blood film for malaria, Preparation and use of culture media – Blood agar,Chocolateagar,Lowenstein-Jensen medium, MacConkeyagar,Distinct colony properties of various bacterial pathogens.

Serological and Molecular Methods

Serological Methods – Agglutination, Precipitation, ELISA and PCR.
Test for Typhoid, Dengue and 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

REFERENCES:

1. Jagadish Chandra (1996). Text Book of Medical Mycology. Oreint Longman
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JSS MAHAVIDYAPEETA

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

B. Sc., DEGREE SYLLABUS (SEMESTER SCHEME)

MICROBIOLOGY

(2018-19)

BMF58006

VI SEMESTER

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Specify the details of Industrial Microbiology
CO2. Learn in depth Industrial production
CO3. Understand in depth Food Microbiology
CO4. Specify the details of Dairy Microbiology

UNIT-I
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.

Methods of food preservation: Physical method – high temperature, low temperature, canning. Drying – solar drying, drum drying, spray drying. Radiation.

Chemical methods – chemical preservatives – salient features of the chemical preservatives (propionates, benzoate, sorbates, nitrates and nitrites, sulphur dioxide and sulphates, sugar and salt)

D. Food borne intoxication and infection:

Bacterial intoxication- Staphylococcal intoxication, Botulism,
Bacterial infection- Salmonellosis.
Mycotoxin – Origin, types and importance of toxins with reference to Aflatoxins.

F. Food safety and quality control. –A brief account on FPO, HACCP, Food laws and Food standards(in brief)

UNIT-II
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, preparation of cheese.

Preservation of milk and milk products – Pasteurization, Sterilization. Microbiological standard for milk and milk products.

UNIT-III
INDUSTRIAL MICROBIOLOGY

A. Introduction, Definition and scope.

B. Microorganisms of industrial importance. Biology of industrial microorganisms: Isolation, Screening, Improvement and Preservation.

C. A brief account of production medium, inoculum medium, raw materials-Molasses, corn steep liquor, sulphite waste liquor and whey. Buffers, Precursors, Inhibitors and Antifoam agents.

D. Fermenters and fermentation process: Design, types and basic function of fermenters, sterilization, devices for aeration and agitation. Fermentation process – Surface, Submerged and Solid state fermentation.Types- Batch and Continuous fermentation. Down stream processing: Steps in recovery and purification of fermented products – Precipitation, Filtration, Centrifugation, Distillation, Cell disruption, Solvent recovery, chromatography, Drying and crystallization.

E. Bioengineering of Microorganisms for industrial purposes.

UNIT-IV

INDUSTRIAL PRODUCTION

A. a. Organic acids – Citric acid.

b. Antibiotics – Penicillin.

c. Enzymes –Pectinase.

d. Alcohol – Ethanol.

e. Amino acid –Glutamatic 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*.

PRACTICALS:

UNIT-I: FOOD MICROBIOLOGY

1. a. Isolation and enumeration of bacteria from utensils
   b. Isolation and identification of fungi from food utensils
2. a. Isolation and enumeration of bacteria from spoiled vegetables
   b. Isolation and identification fungi from spoiled vegetables.
3. a. Isolation and enumeration of bacteria from spoiled fruits.
   b. Isolation and identification of fungi from spoiled fruits.
4. a. Isolation and identification of aspergillus on groundnut by blotters test.
   b. Microscopic examination of idli batter.

UNIT-II: DAIRY MICROBIOLOGY

5. a. Estimation of lactose in milk.
   b. Estimation of lactic acid in milk.
6. a. Turbidity test to detect boiled and unboiled milk.
7. Methylene blue reductase test and Resazurin test to determine the quality of milk.

UNIT-III & UNIT -IV (INDUSTRIAL MICROBIOLOGY+ INDUSTRIAL PRODUCTION)

8. Preparation of wine from grapes.
9. Preparation of alcohol using jaggery or molasses.

10. Estimation of percentage alcohol in a given sample by specific gravity bottle method.

11. Production of citric acid using *Aspergillusniger*.

12. Visit to food industries or food research laboratories, dairy industries and distilleries. Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

REFERENCES:

1.AdamsM.R.and Moss M.O., 1995, Food Microbiology. Royal Society of Chemistry , Cambridge University Press.

2.Anathanarayanan C and Paniker, C.K.J. Text Book of Microbiology, 9th ed. Orinet Longman ltd., Chennai.

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VI SEMESTER

IMMUNOLOGY & MEDICAL MICROBIOLOGY

UNIT-II
IMMUNOLOGY

A. Antigens – Nature and types

B. Antibodies – Basic structure of immunoglobulin (Ig G). Biological properties of Immunoglobulin classes, monoclonal antibodies, antigen antibody reactions – salient features. precipitation reaction, neutralization test, opsonisation , agglutination reaction, compliment fixation. Immunotechniques – RIA, ELISA. Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.

National Immunization program (Tabular form). **12hrs**

UNIT-III AND UNIT- IV
MEDICAL MICROBIOLOGY

A. Introduction – History and development of medical microbiology. Normal flora of human body.

B. Infection and disease transmission – Signs, symptoms, syndrome. Types of infection, mode of transmission.

C. Host pathogen interaction – Pathogenicity, microbial virulence, microbial toxins, opportunists and true pathogens.

D. Antimicrobial chemotherapy – General characteristics and types of antibiotics. Mode of action of -Penicillin, Aminoglycosides, Erythromycin, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Multiple Drug Resistance (in brief).

12hrs

PRACTICALS

UNIT-I AND UNIT II : IMMUNOLOGY

1. Determination of blood group and Rh factor.
2. Enumerate RBC in given blood sample
3. Enumerate WBC in given blood sample

UNIT-II

4. Demonstration of precipitation reaction-Double diffusion in two dimensions (Ouchterlony procedure).
5. Antibiotic sensitivity test.

UNIT-III AND UNIT II: MEDICAL MICROBIOLOGY

6. Estimation of urine bacteria by calibrated loop- direct streak method.

7. Microbial flora of oral cavity (tooth and mouth)

8. Isolation of dermatophytes from human skin.

UNIT-IV

9. Detection of typhoid by Widal test

10. Rapid plasma reagin (RPR) card test for syphillis

11-12.Material/ microscopic observation/ display of photographs of human pathogens: *Mycobacterium tuberculosis*, *Vibrio cholerae, Tryponema pallidum, Salmonella typhi,* Hepatitis virus, polio virus, HIV, *Plasmodium*)

Note: Visit to pharmaceuticals and pathological laboratories. Each student shall submit an independent report on the visit along with the practical record for the internal assessment

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VI SEMESTER
MEDICAL MICROBIOLOGY AND IMMUNOLOGY

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Understand in depth Medical Microbiology
CO2. Specify in details with examples Human diseases
CO3. Learn the details of Immunology
CO4. Specify the classification and characteristics of Antigens and antibodies

UNIT :I **No of Hours: 15**

MEDICAL MICROBIOLOGY

A. Introduction – History and development of medical microbiology. Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract

B. Infection and disease transmission – Signs, symptoms, syndrome. Types of Infection: opportunistic infection and Nosocomial infection, mode of transmission.

C. Host pathogen interaction – Infection, Invasion, Pathogen, Pathogenicity, microbial virulence, microbial toxins, opportunistic and true pathogens.

D. Antimicrobial chemotherapy – General characteristics and types of antibiotics. Mode of action of -Penicillin, Aminoglycosides, Erythromycin, Chloramphenicol, Antifungal drugs-Griseofulvin, Nystatin Antiviral drugs-Acyclovir, Amantadine and Azidothymidine .Multiple Drug Resistance (in brief).

UNIT-IV **No. of Hours:15**

IMMUNOLOGY: ANTIGENS AND ANTIBODIES

A. Antigens – Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes), Adjuvants.

B. Antibodies – Basic structure of immunoglobulin (Ig G). Biological properties of Immunoglobulin classes, monoclonal antibodies, antigen antibody reactions – salient features. precipitation reaction, neutralization test, opsonisation , agglutination reaction, compliment fixation. Immunotechniques – RIA, ELISA and ELISPOT. Hypersensitivity (Type I to V - in brief).
Immunoprophylaxis – Vaccine – Types – killed, Live and Attenuated (Bacterial and Viral) and Toxoid with an example each.
National Immunization program (Tabular form).

PRACTICALS

1.Determination of blood group and Rh factor.
2. Enumerate RBC in given blood sample
3. Enumerate WBC in given blood sample
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NOTE: Visit to pharmaceuticals and pathological laboratories.Each student shall submit an independent report on the visit along with the practical record for the internal assessment.

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39. Roitt I.M., Essentials of Immunology, ELBS, Blackwell Scientific Publishers, London.
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CME28406

V SEMESTER
Microbial Diagnosis in Health Clinics

COURSE OUTCOME:

After successful completion of the course students are able to:

CO1. Learn the details of Diagnosis of diseases
CO2. Learn in details with examples Collection of clinical samples
CO3. Understand in depth Microscopic examination of microbes
CO4. Specify the details of Testing for antibiotic sensitivity in bacteria

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, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

UNIT :III **No of Hours: 15**

DIRECT MICROSCOPIC EXAMINATION AND CULTURE

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsastained,Thin blood film for malaria, Preparation and use of culture media – Blood agar,Chocolateagar,Lowenstein-Jensen medium, MacConkeyagar,Distinct colony properties of various bacterial pathogens.

Serological and Molecular Methods

Serological Methods – Agglutination, Precipitation, ELISA and PCR.
Test for Typhoid, Dengue and 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

REFERENCES:

1. Jagadish Chandra (1996). Text Book of Medical Mycology. Oreint Longman
2. Jawetz, Melnick, Adelberg, Medical Microbiolgy, Prentice Hall Inc, London.
3. Mackie and Mc catney, Medical Microbiolgy I and II. Charchill Livingston , 14th ed.
4. Nandhini Shetty 1993. Immunology: Inductory Text Book . New Age International Ltd.
5. R.P.Singh, Immunology and Medical Microbiology
6. Rajan. S. Medical Microbiology. MJP Publishers, Chennai.
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CRITERION 1_Format for filling AQAR 2020-21

Please send the filled-in format latest by 04/12/2021 (Saturday) to tvlatha64@gmail.com

1.1.2 - Number of Programmes where syllabus revision was carried out during the year 2020-21

Programme Code	Programme Name	Year of introduction (Date)	Status of implementation of CBCS / Elective Course System (Yes/No)	Year of implementation of CBCS / Elective Course System	Year of revision, if any	If revision has been carried out in the syllabus during the year, percentage of content added or replaced
CCAM	Community College	JULY 2014	Yes	UG-2017		
BVOAF	BVOC	JULY 2018	Yes	UG-2017		

Send the calculation sheet as per the word attachment 1.1.2
Send the BOS proceedings of 2020-21 (01 June 2020 to 31 May 2021) as a single pdf file

1.2.2 Details of Programmes offered through Choice Based Credit System (CBCS)/Elective Course System

Programme Code	Programme Name	Year of introduction (Date)	Status of implementation of CBCS / Elective Course System (Yes/No)	Year of implementation of CBCS / Elective Course System	Year of revision, if any	If revision has been carried out in the syllabus during the year, percentage of content added or replaced
			Yes	UG-2017		

1.1.3 - Number of courses focusing on employability/entrepreneurship/ skill development offered by the Institution during the year

Name of the Course	Course Code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development
Character Designer	MES/Q0502	Skill development
Script Researcher	MES/Q3003	Skill development
Animation Director	MES/Q1302	Skill development
Live Action Director	MES/Q1301	Skill development

Send the syllabus of the particular course(s) ONLY along with the highlights as a pdf document

1.2.1 - Number of new courses introduced across all programmes offered during the year

Name of the Course	Course Code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development

1.3.2 - Number of value-added courses for imparting transferable and life skills offered during the year

Send the syllabus and list of students as per the excel attachment 1.3.2

1.3.4 - Number of students undertaking field work/projects/ internships / student projects

Programme Name	Programme Code	Number of students undertaking field projects / internships /student projects
BVOC	BVOAF	11

Send the list of students as per the excel attachment 1.3.4

Model Curriculum

Fruit Pulp Processing Technician

SECTOR: FOOD PROCESSING
SUB-SECTOR: FRUITS & VEGETABLES
OCCUPATION: PROCESSING
REF ID: FIC/Q0106, V1.0
NSQF LEVEL: 4

Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK - NATIONAL OCCUPATIONAL STANDARDS

TABLE OF CONTENTS

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

Program Name	**Fruit Pulp Processing Technician**		
Qualification Pack Name & Reference ID. ID	FIC/Q0106, v1.0		
Version No.	1.0	**Version Update Date**	12/01/2016
Pre-requisites to Training	Preferably Class 8 and 2-3 years' experience in a food processing unit		
Training Outcomes	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	**Introduction to the training program** **Theory Duration** (hh:mm) 00:30 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code** Bridge Module	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
2	**Overview of the "Fruit Pulp processing technician" Role** **Theory Duration** (hh:mm) 01:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code**	Understanding the roles and responsibilities of fruit pulp processing technician Awareness of the nature and availability of job opportunities	Laptop/computer white board, marker, projector, chart papers
3	**Introduction to the Food Processing Industry** **Theory Duration** (hh:mm) 01:30 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code**	Define food processing List the various sub sectors of food processing industry	Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual
4	**Introduction to Fruit & Vegetable Processing** **Theory Duration** (hh:mm)	State the need for fruit and vegetable processing State the common methods of fruit and vegetable processing	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 **Practical Duration** (hh:mm) 01:00 **Corresponding NOS Code**		different subsectors in fruit and vegetable processing e.g. pickle, jam and jelly, ketchup, juices, squashes, fruit pulp etc.
5.	**Overview of Fruit Pulp Processing** **Theory Duration** (hh:mm) 03:00 **Practical Duration** (hh:mm) 01:00 **Corresponding NOS Code** 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.	**Organizational standards and norms** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 01:00 **Corresponding NOS Code** 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.	**Prepare and Maintain Work Area and Process Machineries for pulp processing** **Theory Duration** (hh:mm)	• Identify different equipments used in fruit pulp processing • State the materials and equipments used in cleaning and maintenance of the work area and machineries • State the cleaning processes used to clean the work area	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 **Practical Duration** (hh:mm) 15:00 **Corresponding NOS Code** FIC/N0120 FIC/N0121 FIC/N0122 FIC/N0123 FIC/N9001	• Demonstrate the use of different tools and machineries used for squash and juice • Demonstrate the appropriate method for cleaning and maintain a work area Ensure the work area is safe and hygienic for food processing • Identify and set the machines and tools required for production in working condition • Maintain cleanliness of the process machineries required for production using recommended sanitizers	
8.	**Food Microbiology** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 02:00 **Corresponding NOS Code**	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..	**Prepare for production of fruit pulp** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 12:00 **Corresponding NOS Code** 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
		• Check the conformance of raw material quality to company standards • Organize quality raw material as per production process and company standards • Check the raw material quality and grade • Prepare the raw material for production • List the effect on pulp of manhandling fruits	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.	**Produce fruit pulp from various fruits** **Theory Duration** (hh:mm) 15:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code** FIC/N0122	• Explain the process of pulping fruit Define ripening • Explain fruit ripening process • Demonstrate the process of ripening, sorting, and deseeding fruit • State the procedures used to create the fruit pulp • Demonstrate the process of fruit pulping • State the methods of sterilizing fruit pulp • List the quality control parameters for checking fruit pulp • State the basic categories of packing • State the various types of packaging materials used for packing fruit pulp • State the factors for selecting packaging materials • Explain aseptic packaging in fruit processing industry • Define canning and its purpose • State the process of canning • Demonstrate the canning process of fruit pulp • State the methods for storing raw materials for later use • Explain the process of storing packaged fruit pulp • State the process of maintaining storage conditions • Demonstrate the process of cleaning the work area and machineries after production organizational standards	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.	**Complete documentation and record keeping** **Theory Duration** (hh:mm) 03:00 **Practical Duration** (hh:mm) 01:00 **Corresponding NOS Code** FIC/N0123	• State the need for documenting and maintaining records of raw materials, processes and finished products • State the method of documenting and recording the details of raw material to final finished product • Document daily records in the ERP system effectively	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook, logbooks, internal audit register, food safety manual, quality policy etc.
12.	**Food Safety, Hygiene and Sanitation** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 04:00 **Corresponding NOS Code** FIC/N9001	State the importance of safety, hygiene and sanitation in the baking industry Follow the industry standards to maintain a safe and hygiene workplace Follow HACCP principles to eliminate food safety hazards in the process and products Follow safety practices in the work area	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.	**Professional and Core Skills** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 00:00	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	Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Corresponding NOS Code	Identify potential problems and make sound and timely decision Improve your reading skills State the importance of listening	
14.	**IT Skills** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 08:00 **Corresponding NOS Code**	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.	**Field Visits** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 19:00 **Corresponding NOS Code**	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.	**Revision** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 01:00 **Corresponding NOS Code**	Revised the knowledge gained so far	All the tools and equipment listed above must be available at the time of revision
17.	**Evaluation** **Theory Duration** (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
	Practical Duration (hh:mm) 10:00 **Corresponding NOS Code**		
18.	**On-the-job Training** **Theory Duration** (hh:mm) 14:00 **Practical Duration** (hh:mm) 50:00 **Corresponding NOS Code**	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
	Total Duration **240:00** **Theory Duration** **95:00** **Practical Duration** **145:00**	**Unique Equipment Required**: 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	**Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack "FIC/Q0106", Version 1.0
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	• 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.
4a	**Domain Certification**	Certified for Job Role: "Fruit Pulp Processing Technician" mapped to QP: "FIC/Q0106, v1.0". Minimum accepted score is 80%
4b	**Platform Certification**	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	**Experience**	• 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.

Annexure: Assessment Criteria

Assessment Criteria	
Job Role	Fruit Pulp Processing Technician
Qualification Pack	FIC/Q0106, v1.0
Sector Skill Council	Food Processing

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 canter 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
1. FIC/Q0120: Prepare and maintain work area and process machineries for pulp processing	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	**100**	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
	Total		**100**	**35**	**65**
2. FIC/Q0121: Prepare for production of fruit pulp	PC1. Read and understand the production order from supervisor	**100**	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 machinerie		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
	Total		**100**	**35**	**65**
3. FIC/Q0122: Produce fruit pulp from various fruits	PC1. Receive fruits from the supplier/vendor and check weight	**100**	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)	Marks Allocation		
			Out Of	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 though 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,startmachine, 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

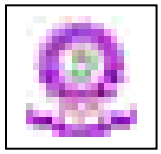
Assessable Outcome	Assessment Criteria	Total Mark (600)	Marks Allocation		
			Out Of	Theory	Skills Practical
	transfer to the storage area and store by maintaining storage conditions and following SOP				
	PC29. Operate can reformer, flanger, seamer, can body beader and embossing machines to form cans		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)	Marks Allocation		
			Out Of	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 codling 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				
	Total		**100**	**35**	**65**
4. FIC/Q0123: Complete documentation and record keeping related to production of fruit pulp	PC1. Document and maintain records of details of raw materials and packaging materials as per organizational standards	**100**	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
	Total		**100**	**60**	**40**
5. FIC/N9001: Food Safety, hygiene and sanitation for processing food products	PC1. Comply with food safety and hygiene procedures followed in the organization	**100**	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 storage areas according to safe food practices	5	2	3	
	PC16. Follow stock rotation based on FEFO/FIFO		10	4	6
	Total		**100**	**35**	**65**
	Grand Total	**500**	**500**	**300**	**200**
	Percentage Weightage		**100**	**60%**	**40%**
	Minimum Pass% to qualify (aggregate):			**70%**	



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


FICSI
Certificate

TABLE OF CONTENTS

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

Program Name	**Supervisor-Fruits and Vegetables Processing**		
Qualification Pack Name & Reference ID. ID	FIC/Q0109, v1.0		
Version No.	1.0	**Version Update Date**	01/08/2018
Pre-requisites to Training	Preferably Class 12 and 2 years' experience in fruit and vegetable processing unit		
Training Outcomes	**After completing this programme, participants will be able to:** • ensure preparation of work area and process machineries for fruit & vegetable processing, • execute production planning of fruits & vegetable processing, • supervise and coordinate activities of workers engaged in production of fruits & vegetable products, • perform documentation and record keeping of raw material, ingredients and the finished good, • apply sanitation and hygiene practices in the work environment, • manage and lead the team.		

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	**Introduction to Training Program and Overview of Food Processing Industry** **Theory Duration** (hh:mm) 07:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code** Bridge Module	• Define food processing • List the various sub sectors of food processing industry • Define fruits and vegetables Processing • List the various units within a fruits and vegetables processing industry • State the roles and responsibilities of supervisor-fruits and vegetables processing	
2	**Organizational Standards and Norms** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 10:00 **Corresponding NOS Code** Bridge Module	• State the roles and responsibilities of a Supervisor-fruits and vegetables processing • 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	Protective Gloves, Head Caps, Lab Coat, Safety Goggles, Safety Boots, Mouth Masks, Sanitizer, Food Safety Manual
3	**Ensure Preparation and Maintenance of Work Area and Process Machineries for Production of Fruit and Vegetable Products** **Theory Duration** (hh:mm) 10:00 **Practical Duration** (hh:mm) 20:00	• Check if the work area is cleaned using approved sanitizers • Describe the importance of cleanliness of the work area • Check if the work area is safe and hygienic for food production • Check the working and performance of all machineries and tools used for fruits and vegetables processing • Check if the equipment are washed with approved sanitizers • Check if the disposal of waste material is as per SOP	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
	Corresponding NOS Code FIC/N0131		
4.	**Execute production planning of Fruit and Vegetable Products** **Theory Duration** (hh:mm) 10:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code** FIC/N0132	• Perform the grouping of ingredients for same type of products • Plan production sequence • Demonstrate the allotting of responsibilities • Perform calculation for raw material requirement • Perform a check on the availability of raw material, ingredients and packaging materials	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.	**Supervise Production of Fruit and Vegetable Products** **Theory Duration** (hh:mm) 15:00 **Practical Duration** (hh:mm) 40:00 **Corresponding NOS Code** FIC/N0133	• Perform a check if all the machineries are clean and in good working conditions • Demonstrate assembling of all components of machines • Perform a pre check on all machineries • Review of the production order • Check if the production area is clean for processing of fruits and vegetables • Check the quality report of fruits and vegetables to ensure conformance to the industry standards • Demonstrate the monitoring of control panel of each fruits and vegetables processing machinery • Co-ordinate with the maintenance team and ensure machine breakdowns are attended • Check for timely production of the food product • Complete all the documents related to production and pass them on to manager • Demonstrate cleaning the machineries used with recommended sanitizers following CIP (clean-in-place) procedure • Demonstrate cleaning the equipment and tools used using recommended cleaning agents and sanitizers	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.	**Complete Documentation and Record Keeping**	• State the need for documenting and maintaining records of raw materials, processes and finished products • State the method of documenting and	Food Safety Manual, Log Books.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Related to Packaging Food Products **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 05:00 **Corresponding NOS Code** FIC/N0134	recording the details of raw material to final finished product • Demonstrate the process of documenting records of production plan, process parameters, and finished products	
7.	**Food Safety, Hygiene and Sanitation for Packaging Food Products** **Theory Duration** (hh:mm) 10:00 **Practical Duration** (hh:mm) 35:00 **Corresponding NOS Code** FIC/N9001	• State the importance of safety, hygiene and sanitation in the baking industry • Apply the industry standards to maintain a safe and hygiene workplace • Apply HACCP principles to eliminate food safety hazards in the process and products • Apply safety practices in the work area	Protective Gloves, Head Caps, Aprons, Safety Goggles, Safety Boots, Mouth Covers, Sanitizer, Food Safety Manual ,Log Books etc.
8.	**Leadership Skills** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 10:00 **Corresponding NOS Code** FIC/N9004	• Perform a check if the team is aware about the schedule and expectations from them • Conduct regular meetings with the team members • Tell the team member to participate in various activities organized by the organization • Demonstrate counselling of team members • Conduct training of team members • Provide feedback to the team members	Computer/Laptop, Log Books
9.	**Professional and Core Skills** **Theory Duration** (hh:mm) 04:00	• Plan a general aptitude self-assessment test • Identify personal strengths and weaknesses • Plan and schedule the work order	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 10:00 **Corresponding NOS Code** Bridge Module	• Manage time effectively to complete the tasks assigned • Identify and resolve potential problems and take preventive measure to prevent it • State the importance of decision making • State the importance of listening	
10.	**IT Skills** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 15:00 **Corresponding NOS Code** Bridge Module	• 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	Computer/Laptop
	Total Duration **240:00** **Theory Duration** **75:00** **Practical Duration** **165:00**	**Unique Equipment Required**: 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	**Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack "FIC/Q0109", Version 1.0
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	• B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hands on experience in a Fruits/Vegetables Unit • M.Sc/M.Tech/ME in Food Technology or Food Engineering with 1-2 years of hands on experience in a Fruits/Vegetables Unit
4a	**Domain Certification**	Certified for Job Role: "Supervisor-Fruits & Vegetables Processing" mapped to QP: "FIC/Q0109, v1.0". Minimum accepted score is 80%
4b	**Platform Certification**	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	**Experience**	• B.Sc/B.Tech/BE in Food Technology or Food Engineering with 2-3 years of hands on experience in a Fruits/Vegetables Unit • M.Sc/M.Tech/ME in Food Technology or Food Engineering with 1-2 years of hands on experience in a Fruits/Vegetables Unit

Annexure: Assessment Criteria

Assessment Criteria	
Job Role	Supervisor-Fruits and Vegetables Processing
Qualification Pack	FIC/Q0109, v1.0
Sector Skill Council	Food Processing

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 evaulations 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**
1. FIC/N0131: Prepare and maintain work area and process machineries for production of fruits & vegetables	PC.1 ensure work area is cleaned using approved sanitizers and cleanliness is maintained to keep it free from dust, waste, flies and pests	**100**	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
			100	**35**	**65**
2. FIC/N0132: execute production planning of fruits & vegetable products	PC1. plan production sequence by • grouping products of same type (varieties of juices, pulps, jams, pickles etc) • using same equipment and machinery for various products such that one product does not impact the quality of the other • planning maximum capacity utilization of machineries • considering the process time for each product • planning efficient utilization of resources/manpower • prioritizing urgent orders		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
			100	**35**	**65**
3. FIC/N0133: Supervise production of fruit and vegetable products	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	**100**	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

Total Marks: 600	Compulsory NOS				
Assessable outcomes	**Assessment criteria for outcomes**	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
	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
			100	**35**	**65**
4. FIC/N0134: Complete documentation	PC1. Document and maintain records of details of raw materials type and variety, grown area, grown season, quantity,	**100**	10	6	4

Total Marks: 600	Compulsory NOS				
Assessable outcomes	**Assessment criteria for outcomes**	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
and record keeping related to production of fruit and vegetable products	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

Total Marks: 600	Compulsory NOS				
Assessable outcomes	**Assessment criteria for outcomes**	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
	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
			100	**60**	**40**
5. FIC/N9001: Food Safety, hygiene and sanitation for processing food products	PC1. Comply with food safety and hygiene procedures followed in the organization	**100**	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

Total Marks: 600	Compulsory NOS				
Assessable outcomes	**Assessment criteria for outcomes**	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
	PC16.Follow stock rotation based on FEFO/FIFO		10	4	6
			100	**35**	**65**
6. FIC/N9004 (Manage and lead a team)	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	3
	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

Total Marks: 600	Compulsory NOS				
Assessable outcomes	**Assessment criteria for outcomes**	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
	disciplinary action as needed in consultation with proper authorities				
			100	**35**	**65**

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

Food Regulatory Affairs Manager

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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

Program Name	**Food Regulatory Affairs Manager**		
Qualification Pack Name & Reference ID. ID	FIC/Q9002, v1.0		
Version No.	1.0	**Version Update Date**	23/02/2016
Pre-requisites to Training	Master's degree in food science with 8-10 years' experience in food processing unitor food regulatory matters		
Training Outcomes	**After completing this programme, participants will be able to:** 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	**Introduction to the training program** **Theory Duration** (hh:mm) 01:30 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code** Bridge Module	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
2	**Overview of the "Food Regulatory Affairs Manager" Role** **Theory Duration** (hh:mm) 01:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code**	Understanding the roles and responsibilities of food regulatory affairs manager Awareness of the nature and availability of job opportunities	Laptop/computer white board, marker, projector, chart papers
3	**Introduction to the Food Processing Industry** **Theory Duration** (hh:mm) 01:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code**	Define food processing List the various sub-sectors of food processing industry	Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual
4	**Introduction to the food regulations and affairs** **Theory Duration** (hh:mm) 05:00 **Practical Duration**	List the terminology used in the food regulation process State various methods to ensure foos regulation State the processes to oversee for ensuring that the food regulations are in compliance	Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	(hh:mm) 30:00 **Corresponding NOS Code**	Understand what are regulatory policies of an organization and follow them	
5	**Design, develop and implement regulatory system** **Theory Duration** (hh:mm) 13:00 **Practical Duration** (hh:mm) 21:00 **Corresponding NOS Code** 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
		produced, processed, marketed, distributed and sold 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 Design regulatory system including provisions for the right of consumers to have access to accurate and sufficient information and make adequate choices 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 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 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 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 Evaluate labels of packed food products to ensure it meets national and international food regulatory standards and provide approval or recommend changes Evaluate promotional and materials for regulatory impact and provide approval Provide support for review of essential documents, development and review of consent forms for submission to regulatory authorities for clearance	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		Initiate and contribute to process improvements which have an impact on regulatory affairs, quality assurance and other departments Conduct audits on food processing unit for compliance with regulatory, safety and hygiene standards implemented and followed in the organisation Conduct periodic audits to evaluate haccp plans and their implementation in the organisation and ensure it meets the regulatory standards 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 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 Monitor company progress toward fulfillment of regulatory commitments 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 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 Provide training on procedures for collecting evidence in case of problems/consumer complaints/consumer cases in court	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		and handling them with technical and scientific approach 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 Provide training on upgradation and changes in the food regulatory system and methods to implement, monitor and achieve them	
6	**Manage change in food regulatory system** **Theory Duration** (hh:mm) 14:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code** FIC/N9012	• Identify procedures, systems, structures that need to be changed for effective implementation of food regulatory system • Assess gaps in the current policies and procedures and analyze the future requirements • Identify and assess barriers to change in regulatory system, develop strategies and plans to overcome those barriers • 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 • Ensure plan for change in regulatory system include short-term as well as longer-term deliverables • Develop system for monitoring and assessing regulatory system to assess progress in changes implemented • Develop reporting and communicating system to review the effectiveness of the changes in regulatory system and to obtain feedback • Provide training and support to implement changes planned in regulatory system • Communicate reasons, importance and benefits of implementing change in regulatory system, future that can be achieved through	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
		implementing and following the change, to management and concerned employees • Make the management and employees welcome change in regulatory system as an opportunity to deliver products of national and international quality • 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 • Implement the strategies and plans for change in regulatory system with available resources • 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 • Set and prioritize objectives for the change in regulatory system, identify and deal with obstacles to change, and support employees through the change process • Communicate progress achieved thorough change in regulatory system to everyone involved, and make them understand and enjoy achievement • Review reports on total quality management system to evaluate effectiveness of changes implemented in regulatory system of the organisation • Organize internal and external audit on total quality management system to evaluate effectiveness of the changes implemented in regulatory system • Monitor changes implemented in regulatory system , document and communicate the outcome of implemented change to the management • Recognize and reward employees and teams for implementing regulatory system and achieving results thorough new policies and procedures	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• 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	
7	**Prepare representations to regulatory authorities and for new product registrations** **Theory Duration** (hh:mm) 09:00 **Practical Duration** (hh:mm) 14:00 **Corresponding NOS Code** FIC/N9013	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 Review regulatory guidance and requirements pertaining to products produced in the organisation and prepare documents providing thoughtful and accurate comments Prepare regulatory documents to authorities that translate regulatory requirements into practical, workable plans with timelines for development and implementation Coordinate with food regulatory authorities to review disputed matters, negotiation and finalization on products and projects, and for comments and formal approvals Prepare documents that include check lists created and maintained to implement regulatory requirements, technical data, and declarations of conformity Interface with consultants, research organizations, partners, co-manufacturers etc. for preparation, review, compilation, finalization and submission of documents for regulatory approvals Prepare responses to communications and other requests from government food regulatory authorities 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 Identify reasons related to non-compliance of food products to regulatory standards, collect relevant information's and data,	Laptop, white/black board, marker, chart papers, projector, trainer's guide, student handbook, quality manual, quality policy, audit documents, regulatory policies

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		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 Interact with various regulatory authorities during concept, development and industrialization stages of projects for clarification and approvals Interact with the notified bodies and competent authorities for developing and reviewing regulatory standards Coordinate with regulatory authorities for reporting, to comment on proposed regulations, and to represent company's interest in the development of standards and guidelines 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 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 Participate in seminar, workshops, conferences and meetings organised by FSSAI and other industry association, representing the organisation to maintain, strengthen and expand contacts 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	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		organisation and to manage them proactively Develop and write clear arguments and explanations for new product license Prepare and present registration documents to regulatory authorities and notified bodies for new product approvals Present written representation for new products and carry out negotiations with regulatory authorities to obtain necessary approvals for new product production and marketing Evaluate, prepare and submit new product registration applications and follow through the application during the evaluation phase to achieve favorable outcome Prepare responses to letter/e-mail communications and other requests from government food regulatory bodies on new product approval Provide regulatory and product compliance report in the area of advertising and label claims for new products	
8	**Field Visits** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code**	Observe the 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
9	**Revision** **Theory Duration** (hh:mm) 01:00	Revised the knowledge gained so far	Allthe tools and equipment listed above must be available at the time of revision

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 01:00 **Corresponding NOS Code**		
10	**Evaluation** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 28:00 **Corresponding NOS Code**	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation
11	**On-the-job Training** **Theory Duration** (hh:mm) 08:00 **Practical Duration** (hh:mm) 24:00 **Corresponding NOS Code**	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
	Total Duration **240:00** **Theory Duration** **79:00** **Practical Duration** **161:00**	**Unique Equipment Required**: 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	**Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack "FIC/Q9002", Version 1.0
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	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	**Domain Certification**	Certified for Job Role: "Food regulatory affairs Manager" mapped to QP: "FIC/Q9002, v1.0". Minimum accepted score is 80%
4b	**Platform Certification**	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	**Experience**	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

Assessment Criteria	
Job Role	Food regulatory affairs manager
Qualification Pack	FIC/Q9002 v1.0
Sector Skill Council	Food Processing

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 canter 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
1. FIC/N9011: Design, develop and implement regulatory system	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	**100**	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)	Marks Allocation		
			Out Of	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
			100	**35**	**65**
2. FIC/N9012: Manage change in food regulatory system	PC1. identify procedures, systems, structures that need to be changed for effective implementation of food regulatory system	**100**	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)	Marks Allocation		
			Out Of	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 thorough 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**
3. FIC/N9013: Prepare representations to regulatory authorities and for new product registrations	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
	Total		**100**	**35**	**65**
	Grand Total	**300**	**300**	**200**	**100**
	Percentage Weightage		**100**	**60%**	**40%**
	Minimum Pass% to qualify (aggregate):			**70%**	

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

Production Manager

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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

Program Name	**Production Manager**		
Qualification Pack Name & Reference ID. ID	FIC/Q9003, v1.0		
Version No.	1.0	**Version Update Date**	30/03/2016
Pre-requisites to Training	Preferably Class 12 and 2-3 years' experience in a food processing unit		
Training Outcomes	**After completing this programme, participants will be able to:** 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	**Introduction to the training program** **Theory Duration** (hh:mm) 00:30 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code** Bridge Module	Introduce each other and build rapport with fellow participants and the trainer.	White board/Chart papers, marker
2	**Overview of the "Production Manager" Role** **Theory Duration** (hh:mm) 01:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code**	Understanding the roles and responsibilities of production manager Awareness of the nature and availability of job opportunities	Laptop/computer white board, marker, projector, chart papers
3	**Introduction to the Food Processing Industry** **Theory Duration** (hh:mm) 01:30 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code**	Define food processing List the various sub sectors of food processing industry	Laptop, white/black board, marker, chart papers, projector ,Trainer's guide, Student manual
4	**Introduction to food processing process** **Theory Duration** (hh:mm) 02:00 **Practical Duration** (hh:mm)	List the common machineries used in food processing Explain the process of testing food for accepted quality standards Demonstrate the test for checking the quality of food Describe the procedure for processing various food	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	04:00 **Corresponding NOS Code**	Identify different equipment used in food industry	
5	**Organizational standards and norms** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 02:00 **Corresponding NOS Code**	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	**Manage production process in food processing unit** **Theory Duration** (hh:mm) 15:00 **Practical Duration** (hh:mm) 11:40 **Corresponding NOS Code** FIC/N9014	• 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 • Achieve department targets and organisation goals by understanding the organisation and employees, developing a leadership style and applying them appropriately • 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 • Motivate and support employees to achieve their work and development objectives, and provide recognition when they are successful • Encourage employees to take responsibilities, to take own decisions within agreed boundaries, to take lead in their own areas of expertise for their development • Initiate personnel actions, such as promotions, transfers, discharges or disciplinary measures • Lead production department and team successfully through difficulties and challenges • Review the sales forecast for the week/month (or) monthly production	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		plan discussed with plant manager (or) customer requirement (as applicable) and identify production priorities to meet market requirement • 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 • Plan details of production in terms of output quantity and quality, cost, time and manpower requirements • 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 • 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 • 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 • 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 • Co-ordinate with maintenance manager/supervisor to understand materials, consumables and manpower requirement and availability for maintenance activities, for uninterrupted production • Understand equipment maintenance process and procedure and co-ordinate for maintenance activities during breakdown, emergency response, routine cleaning and servicing, etc. • Analyze equipment maintenance data to interpret equipment	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		performance and arrive at production capability of each process equipment • 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 • Lead and build team spirit between production and maintenance personnel through effective communication to enhance equipment performance and to identify production improvement opportunities • Ensure maintenance procedures are followed meet food safety and environmental requirements • Monitor production process for usage of raw materials, packaging materials, manpower, wastage against production plan and identify reason for variances against plan • Address the reason for variation in achieving production schedule, production target within allocated budget • Adjust production schedule in response to variables affecting achievement of production target • Monitor production output and cost, adjust processes and resources to minimize cost and to achieve quantity and quality product • 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 • 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 • Set polices, plans and procedures, and take initiative to implement the identified improvement opportunities	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		to control cost and to achieve better yield and quality • 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 • 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 • Prepare technical production procedures considering all engineering and process parameters for new product trial, educate and train supervisors and operators on trial procedure • Identify and consider all possible hazards, prepare plan and procedures to prevent and control hazards, provide training to trial team to handle hazards • 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 • 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 • Document and evaluate trial production data and identify process/parameters to be modified/changed to achieve product of required specification • Prepare trial production report with recommendations on improvement opportunities, and share with cross function heads and relevant authorities for suggestion and consideration	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
7	**Manage production optimization and cost efficiency** **Theory Duration** (hh:mm) 08:00 **Practical Duration** (hh:mm) 12:00 **Corresponding NOS Code** FIC/N9015	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 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 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 Calculate utilities and energy usage in production area and for production process, identify methods to minimize usage Develop plans and procedures to minimize use of utilities and energy without affecting the production efficiency 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 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 Analyze usage pattern of energy and other utilities in production area and process against budget allocation, identify cost effective options for	Laptop, white board, marker, chart papers, projector, trainer's guide and student handbook ,

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		minimizing wastage, and implement changes 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 Communicate with relevant authorities/superiors the need for change, results and benefits expected our of change 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 Provide training and support to implement changes, develop a strategy to help teams implement change Monitor changes implemented in production process and ensure changes are effective and meet the organisation and regulatory requirements Document and communicate the progress achieved through implemented change to the management and everyone involved, and make them understand and enjoy achievement Recognize and reward employees and teams for implementing change in production system and achieving better efficiency Manage budget efficiently by managing production with available resource, by avoiding overtime and too many casual workers/helpers 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 Identify situations where actual budget exceeds the approved budget, investigate reason for variance and take appropriate	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		corrective action to keep budget under control 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 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 Encourage team to think and identify ways of reducing expenditure, analyse and pursue the suggested ideas	
8	**Manage documentation system and implement safety and environmental policies** **Theory Duration** (hh:mm) 07:00 **Practical Duration** (hh:mm) 09:00 **Corresponding NOS Code** FIC/N9016	• Establish to production team the importance of documentation, provide training on documentation system, and ensure all documents are maintained systematically • Ensure all relevant records and documents are complete, up-to-date and accessible for audits on production process • During audit provide the auditor with access to all relevant information, records and documents • Ensure corrective actions recommended and implemented are documented to assure production process is carried in accordance with organisation and regulatory standards • Establish methods to track production information from documented and maintained records • 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 • 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	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
		• Ensure safe work procedures are followed in production area and during production process • 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 • Identify safety and environmental hazards relevant to production processes, implement system to handle risks • Provide or organize training through relevant authorities on safety and environmental management system, to understand methods to control and prevent hazards • Conduct inspections in work place on use of protective clothing and accessories, and to ensure safety system is followed during production process • 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 • 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 • Respond to environmental management hazard identification and incidents in an appropriate and timely way • Review practice and procedures followed on safety, conduct risk assessments, identify non-compliance, and provide recommendations to address gaps and non-conformances • 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	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
9	**Professional and Core Skills** **Theory Duration** (hh:mm) 03:00 **Practical Duration** (hh:mm) 05:00 **Corresponding NOS Code**	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	**IT Skills** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 07:00 **Corresponding NOS Code**	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	**Field Visits** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 30:00 **Corresponding NOS Code**	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	**Revision** **Theory Duration** (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
	Practical Duration (hh:mm) 02:00 **Corresponding NOS Code**		
13	**Evaluation** **Theory Duration** (hh:mm) 08:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code**	Assess the knowledge and skills acquired by the participants	All the tools and equipment listed above must be available for evaluation
14	**On-the-job Training** **Theory Duration** (hh:mm) 30:00 **Practical Duration** (hh:mm) 65:00 **Corresponding NOS Code**	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
	Total Duration **240:00** **Theory Duration** **88:00** **Practical Duration** **152:00**	**Unique Equipment Required:** 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	**Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack "FIC/Q9003", Version 1.0
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	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	**Domain Certification**	Certified for Job Role: "Production Manager" mapped to QP: "FIC/Q9003, v1.0". Minimum accepted score is 80%
4b	**Platform Certification**	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	**Experience**	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

Assessment Criteria	
Job Role	Production Manager
Qualification Pack	FIC/Q9003, v1.0
Sector Skill Council	Food Processing

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 canter 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
1. FIC/N9014: Manage production process in food processing unit	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	100	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)	Marks Allocation		
			Out Of	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 polices, 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**
2. FIC/N9015: Manage production optimization and cost efficiency in food processing unit	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	**100**	2	0.5	1.5
	PC2. Compile performance data on process and equipment to identify cause for lack of performance, evaluate opportunities to improve, identify cost saving options, propose changes in process, and implement proposal with proper approvals		3	0.5	2.5
	PC3. Review production process with supervisor and machine operators to identify reasons for slowdown or stop of production process, provide recommendations to overcome efficiency issues, take feedback, develop plans for implementing recommended changes, monitor changes implemented, and review changes and improvement		3	1	2
	PC4. Calculate utilities and energy usage in production area and for production process, identify methods to minimize usage		2	0.5	1.5
	PC5. Develop plans and procedures to minimize use of utilities and energy		2	0.5	1.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	without affecting the production efficiency				
	PC6. Identify energy and utility losses or sources of waste, analyze reason, recommend methods to improve efficient energy/utility application, ensure recommendations are implemented, and monitor improvement		2	0.5	1.5
	PC7. Identify areas where utilities and energy can be saved, and identify methods to save energy like recycling energy and utilities such as steam, heat and water, following proper maintenance methods to avoid leaks and losses etc, and prepare efficient production schedule such that target is met with efficient utilization of energy and utility		3	1	2
	PC8. Analyze usage pattern of energy and other utilities in production area and process against budget allocation, identify cost effective options for minimizing wastage, and implement changes		3	1	2
	PC9. Identify system, production process that need to be changed, identify opportunities for implementing change in production process, analyze impact of change on product quality, impact on the team and present production process		3	1	2
	PC10. Communicate with relevant authorities/superiors the need for change, results and benefits expected our of change		1	0.5	0.5
	PC11. Design new processes, procedures, systems, structures with roles and responsibilities, key performance indicators, training needs, safety system, contingency plans, monitoring and reporting system to implement planned changes in production process		1	0.5	0.5
	PC12. Provide training and support to implement changes, develop a strategy to help teams implement change		2	0.5	1.5
	PC13. Monitor changes implemented in production process and ensure		4	1.5	2.5

Assessable Outcome	Assessment Criteria	Total Mark (600)	Out Of	Marks Allocation	
				Theory	Skills Practical
	changes are effective and meet the organisation and regulatory requirements				
	PC14. Document and communicate the progress achieved through implemented change to the management and everyone involved, and make them understand and enjoy achievement		4	1.5	2.5
	PC15. Recognize and reward employees and teams for implementing change in production system and achieving better efficiency		5	2	3
	PC16. Manage budget efficiently by managing production with available resource, by avoiding overtime and too many casual workers/helpers		4	1.5	2.5
	PC17. Plan effectively to secure, confirm and allocate required manpower to meet production target within budget, monitor resource utilization, to achieve production target within existing resource		4	1.5	2.5
	PC18. Identify situations where actual budget exceeds the approved budget, investigate reason for variance and take appropriate corrective action to keep budget under control		1	0.5	0.5
	PC19. Identify the impact on budget of production-related decisions like scheduling holidays, adjusting production volume, scheduling equipment maintenance etc, before scheduling production, and identify opportunities to improve performance against budget		1	0.5	0.5
	PC20. Identify the causes for any significant variances in budget control, discuss with team and ensure prompt corrective action is taken to keep expenditure under control		3	1	2
	PC21. Encourage team to think and identify ways of reducing expenditure, analyze and pursue the suggested ideas		4	1	3
			100	**35**	**65**
3. FIC/N9016: Manage documentation system and implement	PC1. Establish to production team the importance of documentation, provide training on documentation system, and ensure all documents are maintained systematically	**100**	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-todate 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, andprovide 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
	Total		**100**	**35**	**65**
	Grand Total	**400**	**400**	**300**	**100**
	Percentage Weightage		**100**	**60%**	**40%**
	Minimum Pass% to qualify (aggregate):			**70%**	

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**

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.

Program Name	**Junior Software Developer**		
Qualification Pack Name & Reference ID.	Junior Software Developer SSC/Q0508, version 1.0		
Version No.	1.0	**Version Update Date**	31/12/2015
Pre-requisites to Training	10th Standard		
Training Outcomes	**After completing this programme, participants will be able to:** • assist in performing software construction and software testing entry-level tasks in the IT Services industry • manage work to meet requirements • maintain a healthy, safe and secure working environment		

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: ❚❚Demonstrate basic computer and internet literacy including operating a computer, describing its major components and how they work, using Windows and Linux OS, operating a browser, searching the internet, managing mails and using social internet media.	SSC/N0506	Refer to Unique Equipment Required section
2	Problem Solving and Program Design	30:00	60:00	Candidates will be able to: ❚❚Demonstrate aptitude for analysing information and making logical conclusions.	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
				▮▮Demonstrate knowledge of the foundational mathematical concepts in computing.		
3	Basic Algorithms and Application Development	30:00	60:00	Candidates will be able to: • Design algorithms to solve problems and convert them into code using the appropriate programming language constructs. • Read and execute a test case and record the outcome in the appropriate template. • Communicate effectively with appropriate people w.r.t. assigned roles in simple English – both oral and written.	SSC/N0506	Refer to Unique Equipment Required section
4	Self and work Management	30:00	70:00	Candidates will be able to: • Establish and agree work requirements with appropriate people • Keep immediate work area clean and tidy • Utilize time effectively • Use resources correctly and efficiently • Treat confidential information correctly • Work in line with organization's policies and procedures • Work within the limits of job role • Obtain guidance from appropriate people, where necessary • Ensure work meets the agreed requirements	SSC/N9001	Refer to Unique Equipment Required section

5	Team Work and Communication	12:00	38:00	Candidates will be able to: • Obtain guidance from appropriate people to agree the analysis to be performed on the data • Obtain advice and guidance from appropriate people on issues with data analysis	SSC/N9002	Refer to Unique Equipment Required Section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				outside their area of competence or • Review the results of their analysis with appropriate people • Undertake modifications to your analysis based on inputs from appropriate people • Communicate with colleagues clearly, concisely and accurately • Work with colleagues to integrate their work effectively with them • Pass on essential information to colleagues in line with organizational requirements • Work in ways that show respect for colleagues • Carry out commitments they have made to colleagues • Let colleagues know in good time if they cannot carry out your commitments, explaining the reasons • Identify any problems they have working with colleagues and take the initiative to solve these problems • Follow the organization's		

				policies and procedures for working with colleagues		
6	Managing Health and Safety	12:00	38:00	Candidates will be able to: • Comply with organization's current health, safety and security policies and procedures • Report any identified breaches in health, safety, and security policies and procedures to the designated person • Identify and correct any hazards that can deal with	SSC/N9003	Refer to Unique Equipment Required section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				safely, competently and within the limits of authority • 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 • Follow their organization's emergency procedures promptly, calmly, and efficiently • Identify and recommend opportunities for improving health, safety, and security to the designated person • Complete any health and safety records legibly and accurately		

7	Data and Information Management	15:00	35:00	Candidates will be able to: • 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 • Obtain the data/information from reliable sources • Check that the data/information is accurate, complete and up-to-date • Obtain advice or guidance from appropriate people where there are problems with the data/information • Carry out rule-based analysis of the data/information, if required • Insert the data/information into the agreed formats • Check the accuracy of work, involving colleagues where required • Report any unresolved anomalies in the	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
				data/information to appropriate people Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time		

8	Learning and Self Development	05:00	20:00	Candidates will be able to: • Obtain advice and guidance from appropriate people to develop your knowledge, skills and competence • Identify accurately the knowledge and skills they need for your job role • Identify accurately their current level of knowledge, skills and 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 new knowledge and skills in the workplace, under supervision • Obtain feedback from appropriate people on their knowledge and skills and how effectively you apply them • Review their knowledge, skills and competence regularly and take appropriate action	SSC/N9005	Refer to Unique Equipment Required Section
	Total Duration:	**114:00**	**286:00**	**Unique Equipment Required:** 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.		
Sr. No.	**Module**	**Theory Duration (hh:mm)**	**Practical Duration (hh:mm)**	**Key Learning Outcomes**	**Corresponding NOS Code**	**Equipment Required**

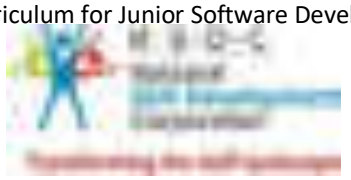
				For Domain NOS, For NOS SSC/N0506 – HTML, C++ / Java, IDE General: • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning • White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • Presentation Tools to support learning activities: • Intranet • Email • IMs • Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities • Handy Camera • 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. • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. • Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.

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

Assessment Criteria for Junior Software Developer	
Job Role	**Junior Software Developer**
Qualification Pack	**SSC/Q0508**
Sector Skill Council	**IT-ITeS**

Sr. No.	**Guidelines for Assessment**
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	**Assessment criteria (PC)**	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
1.SSC/N0506 (Deal remotely with customer queries - Domestic)	PC1. greet customers and verify details, following your organization's procedures	**120**	12.5	2.5	10
	PC2. read carefully, summarize, and obtain **customer** confirmation of, your understanding of queries		12.5	2.5	10
	PC3. express your concern for any difficulties caused and your commitment to resolving queries		15	0	15
	PC4. record and categorize queries accurately using your organization's query management tool		5	0	5
	PC5. refer queries outside your area of competence or authority promptly to appropriate people		2.5	0	2.5

	PC6. access your organization's knowledge base for solutions to queries, where available		2.5	0	2.5
	PC7. resolve queries within your area of competence or authority in line with organizational guidelines and service level agreements (SLAs)		15	0	15
	PC8. obtain advice and guidance from appropriate people, where necessary		2.5	0	2.5
	PC9. obtain confirmation from **c**ustomers that queries have been resolved to satisfaction		10	0	10

	PC10. record the resolution of queries accurately using your organization's query management tool		35	15	20
	PC11. comply with relevant standards, policies, procedures and guidelines when dealing remotely with customer queries		7.5	0	7.5
		NOS Total	**120**	**20**	**100**
2.SSC/N9001 (Manage your work to meet requirements)	PC1. establish and agree your work requirements with appropriate people	**40**	10	5	5
	PC2. keep your immediate work area clean and tidy		5	0	5
	PC3. utilize your time effectively		5	5	0
	PC4. use resources correctly and efficiently		5	2.5	2.5
	PC5. treat confidential information correctly		5	0	5
	PC6. work in line with your organization's policies and procedures		2.5	0	2.5
	PC7. work within the limits of your job role		2.5	0	2.5
	PC8. obtain guidance from appropriate people, where necessary		2.5	0	2.5
	PC9. ensure your work meets the agreed requirements		2.5	0	2.5
		NOS Total	**40**	**12.5**	**27.5**
3.SSC/N9003 (Maintain a healthy, safe and secure working environment)	PC1. comply with your organization's current health, safety and security policies and procedures	**40**	10	5	5
	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		5	0	5

	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority		10	5	5
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		5	0	5
	PC5. follow your organization's emergency procedures promptly, calmly, and efficiently		5	0	5
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		2.5	0	2.5
	PC7. complete any health and safety records legibly and accurately		2.5	0	2.5
		NOS Total	**40**	**10**	**30**

Annexure2: Trainer Prerequisites for Job role: Junior Software Developer mapped to Qualification Pack: SSC/Q0508

Sr. No.	Area	Details
1	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0508.
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	Minimum 12thStandard; Preferred Master's degree in any discipline
4a	**Domain Certification**	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	**Platform Certification**	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	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred

4E-Vandana Building (4th Floor)
11. Tolstov Marg
New Delhi-110001
Phone: 91-11- 4151 9230/60
Fax: 91-11- 4151 9240
Email: ssc@nasscom.in

Model Curriculum

WEB DEVELOPER

WEB DEVELOPER

SECTOR: **IT-ITeS**
SUB-SECTOR: **IT Services**
OCCUPATION: **Application Development**
REFERENCE ID: **SSC/Q0503, version 1.0**
NSQF LEVEL: **5**

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.

Program Name	**Web Developer**		
Qualification Pack Name & Reference ID.	Web Developer SSC/Q0503, version 1.0		
Version No.	1.0	**Version Update Date**	31/12/2015
Pre-requisites to Training	Graduate degree/ diploma in web design/ media design or any other related field		
Training Outcomes	**After completing this programme, participants will be able to:** • Contribute to the design of software products and applications • Develop media content and graphic designs for software products and Applications • Manage their work to meet requirements • Work effectively with colleagues • Maintain a healthy, safe and secure working environment • Provide data/information in standard formats • Develop their knowledge, skills and competence		

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 functionalityin line with requirements defined in	SSC/N0501	Refer to Unique Equipment Required Section

				BRS/URS, SRS and HLD		
2	Analysis and Design of Web based Applications	20:00	30:00	Candidates will be able to: ❚❚Check their understanding of the Business Requirements Specification (BRS)/User	SSC/N0501	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

				Requirements Specification (URS) with appropriate people • Check their understanding of the Software Requirements Specification (SRS) with appropriate people • Check their understanding of High Level Design (HLD) with appropriate people • Review their designs with appropriate people • Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs • Document their designs using standard templates and tools • Comply with their organization's policies, procedures and guidelines when contributing to the design of software products and applications		
3	Media Content and Graphics Design	20:00	80:00	Candidates will be able to: • 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 • Access reusable components, media and graphical packages and tools from their organization's knowledge base	SSC/N0503	Refer to Unique Equipment Required Section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				• Convert requirements into media content and graphic designs, leveraging reusable components where available • Review media content and graphic designs with appropriate people and analyze their feedback • Record any defects and corrective actions taken to inform future work • Rework media content and graphic designs, incorporating feedback • Submit media content timely and graphic designs for approval by appropriate people • Update their organization's knowledge base with their experiences of the media content and graphic designs developed • Comply with their organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications		

4	Self and work Management	12:00	38:00	Candidates will be able to: • Establish and agree their work requirements with appropriate people • Keep their immediate work area clean and tidy • utilize their time effectively	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
				• Use resources correctly and efficiently • Treat confidential information correctly • Work in line with organization's policies and procedures • Work within the limits of their job role • Obtain guidance from appropriate people, where necessary • Ensure their work meets the agreed requirements		

5	Team Work and Communication	12:00	38:00	Candidates will be able to: • Communicate with colleagues clearly, concisely and accurately • Work with colleagues to integrate their work effectively with them • Pass on essential information to colleagues in line with organizational requirements • Work in ways that show respect for colleagues • carry out commitments they have made to colleagues • Let colleagues know in good time if they cannot carry out their commitments, explaining the reasons • Identify any problems they have working with colleagues and take the initiative to solve these problems • Follow the organization's policies and procedures for working with colleagues	SSC/N9002	Refer to Unique Equipment Required Section

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required

6	Managing and Health Safety	05:00	20:00	Candidates will be able to: • Comply with their organization's current health, safety and security policies and procedures • Report any identified breaches in health, safety, and security policies and procedures to the designated person • Identify and correct any hazards that they can deal with safely, competently and within the limits of their authority • 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 • Follow their organization's emergency procedures promptly, calmly, and efficiently • Identify and recommend opportunities for improving health, safety, and security to the designated person • Complete any health and safety	SSC/ N 9003	
7	Data and Information Management	15:00	35:00	Candidates will be able to: ❚❚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	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
				• Obtain the data/information from reliable sources • Check that the data/information is accurate, complete and up-to-date • Obtain advice or guidance from appropriate people where there are problems with the data/information • Carry out rule-based analysis of the data/information, if required • Insert the data/information into the agreed formats • Check the accuracy of their work, involving colleagues where required • Report any unresolved anomalies in the data/information to appropriate people • Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time		

8	Learning and Self Development	5:00	20:00	Candidates will be able to: • Obtain advice and guidance from appropriate people to develop their knowledge, skills and competence • Identify accurately the knowledge and skills they need for their job role • Identify accurately their current level of knowledge, skills and	SSC/N9005	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
				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		

	Total Duration:	**109:00**	**291:00**	**Unique Equipment Required**: 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. For Domain NOSs: • NOS SSC/N0501: HTML5, Javascript, CSS, SQL, Web Builder, Word Press, Joomla and modelling tools such as Visio, UML • NOS SSC/N0503: HTML5, CSS, Flash, Photoshop, Windows media player, Eclipse, XAMPP General: • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				• White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • Presentation Tools to support learning activities: ○ Intranet ○Email ○IMs ○ Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities ❚❚ Handy Camera • 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/ other Email Clients • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. • Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.		

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 write design specifications (in SSC/N0501) are different from the writing skills required to prepare a time plan (in SSC/N9001). Training providers are advised to,
    a. Embed such skills development in the learning pedagogy for each expected outcome
    b. Prepare a detailed session plan for training delivery with focus on sequence and duration of training
    c. Run a diagnostic test to assess prior learning of students and help trainers / students identify the need for gap training, optimal duration, and suitable training methodology. Accordingly, more introductory level sessions may be included in guided or self-paced mode of learning. E.g. adding some sessions on Functional English or Use of Internet and MS Office.

Annexure 1: Assessment Criteria

Assessment Criteria for Web Developer	
Job Role	**Web Developer**
Qualification Pack	**SSC/Q0503**
Sector Skill Council	**IT-ITeS**

Sr. No.	**Guidelines for Assessment**
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	**ASSESSMENT CRITERIA** (PC)	**TOTAL MARKS**	**OUT OF**	**THEORY**	**SKILLS PRACTICAL**
1. SSC/N0501 (Contribute to the design of software products and applications)	PC1. check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	**100**	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
		Total	100	40	60
2. SSC/N0503 (Develop media content and graphic designs for software products and Applications)	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	**100**	10	10	0
	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
		Total	100	20	80
3.SSC/N9001 (Manage their work to meet requirements)	PC1. establish and agree their work requirements with appropriate people	**100**	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
		Total	100	22.5	77.5
4.SSC/N9002 (Work effectively with colleagues)	PC1. communicate with colleagues clearly, concisely and accurately	**100**	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
		Total	100	20	80
5.SSC/N9003 (Maintain a healthy, safe and secure working environment)	PC1. comply with their organization's current health, safety and security policies and procedures	**100**	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 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
		Total	100	30	70
6.SSC/N9004 (Provide data/information in standard formats)	PC1. establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it		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	**100**	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
		Total	100	30	70
7.SSC/N9005 (Develop their knowledge, skills and competence)	PC1. obtain advice and guidance from appropriate people to develop their knowledge, skills and competence		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	**100**	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
		Total	100	21	79

Annexure 2: Trainer Prerequisites for Job role: Web Developer mapped to Qualification Pack: SSC/Q0503

Sr. No.	Area	Details
1	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0503.
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	Minimum Graduate degree/ diploma in web design/ media design or any other related field; Preferred Master's Degree in Media Design
4a	**Domain Certification**	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	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/1402". Minimum accepted score is 70%.
5	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred

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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

Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

TABLE OF CONTENTS

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.

Program Name	**Software Developer**		
Qualification Pack Name & Reference ID.	Software Developer SSC/Q0501, version 1.0		
Version No.	1.0	**Version Update Date**	31/12/2015
Pre-requisites to Training	BSc (Stat, Math, Physics, Chemistry, Geology) or BE/ BTech		
Training Outcomes	**After completing this programme, participants will be able to:** • Contribute to the design of software products and applications • Develop software code to specification • Manage their work to meet requirements • Work effectively with colleagues • Maintain a healthy, safe and secure working environment • Provide data/information in standard formats • Develop their knowledge, skills and competence		

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	**Programming and Algorithms** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 30:00 **Corresponding NOS Code** SSC/N0501	Candidates will be able to: •Design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD	Refer to Unique Equipment Required Section
2	**Analysis and Design of Software Applications** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 30:00 **Corresponding NOS Code** SSC/N0501	Candidates will be able to: • Check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people • Check their understanding of the Software Requirements Specification (SRS) with appropriate people • Check their understanding of High Level Design (HLD) with appropriate people • Review their designs with appropriate people • Analyse inputs from appropriate people to identify, resolve and record design defects and inform future designs • Document designs using standard templates and tools • Comply with organization's policies, procedures and guidelines when contributing to the design of software products and applications	Refer to Unique Equipment Required Section

3	**Application Development** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 80:00 **Corresponding NOS Code** SSC/N0502	Candidates will be able to: • 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 • Access reusable components, code generation tools and unit testing tools from their organization's knowledge base • Convert technical specifications into code to meet the requirements, leveraging reusable components, where available • Create appropriate unit test cases (UTCs) • Review codes and UTCs with appropriate people • Execute UTCs and document results • Rework the code and UTCs to fix identified defects	Refer to Unique Equipment Required Section

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• Analyse inputs from appropriate people to inform future designs • Record corrective actions for identified defects to inform future designs • Submit tested code timely for approval by appropriate people • Update their organization's knowledge base with their experiences of the code developed • Comply with their organization's policies, procedures and guidelines when developing software code to specification	
4	**Self and work Management** **Theory Duration** (hh:mm) 12:00 **Practical Duration** (hh:mm) 38:00 **Corresponding NOS Code** SSC/N9001	Candidates will be able to: • Establish and agree their work requirements with appropriate people • Keep their immediate work area clean and tidy • utilize their time effectively • Use resources correctly and efficiently • Treat confidential information correctly • Work in line with organization's policies and procedures • Work within the limits of their job role • Obtain guidance from appropriate people, where necessary • Ensure their work meets the agreed requirements	Refer to Unique Equipment Required Section

5	**Team Work and Communication** **Theory Duration** (hh:mm) 12:00 **Practical Duration** (hh:mm) 38:00 **Corresponding NOS Code** SSC/N9002	Candidates will be able to: • Communicate with colleagues clearly, concisely and accurately • Work with colleagues to integrate their work effectively with them • Pass on essential information to colleagues in line with organizational requirements • Work in ways that show respect for colleagues • carry out commitments they have made to colleagues • Let colleagues know in good time if they cannot carry out their commitments, explaining the reasons • Identify any problems they have working with colleagues and take the initiative to solve these problems • Follow the organization's policies and procedures for working with colleagues	Refer to Unique Equipment Required Section
6	**Managing Health and Safety** **Theory Duration** (hh:mm) 05:00	Candidates will be able to: • Comply with their organization's current health, safety and security policies and procedures • Report any identified breaches in health, safety, and security policies and procedures to the designated person • Identify and correct any hazards that they can deal	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	Practical Duration (hh:mm) 20:00 **Corresponding NOS Code** SSC/ N 9003	with safely, competently and within the limits of their authority • 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 • Follow their organization's emergency procedures promptly, calmly, and efficiently • Identify and recommend opportunities for improving health, safety, and security to the designated person • Complete any health and safety	

7	**Data and Information Management** **Theory Duration** (hh:mm) 15:00 **Practical Duration** (hh:mm) 35:00 **Corresponding NOS Code** SSC/N9004	Candidates will be able to: • 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 • Obtain the data/information from reliable sources • Check that the data/information is accurate, complete and up-to-date • Obtain advice or guidance from appropriate people where there are problems with the data/information • Carry out rule-based analysis of the data/information, if required • Insert the data/information into the agreed formats • Check the accuracy of their work, involving colleagues where required • Report any unresolved anomalies in the data/information to appropriate people • Provide complete, accurate and up-to-date data/information to the appropriate people in the required formats on time	Refer to Unique Equipment Required Section
8	**Learning and Self Development** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code** **SSC/N9005**	Candidates will be able to: • Obtain advice and guidance from appropriate people to develop their knowledge, skills and competence • Identify accurately the knowledge and skills they need for their job role • Identify accurately their current level of knowledge, skills and 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	Refer to Unique Equipment Required Section
Sr. No.	**Module**	**Key Learning Outcomes**	**Equipment Required**
		knowledge and skills and how effectively they apply them • Review their knowledge, skills and competence regularly and take appropriate action	

	Total Duration **Theory Duration** **109:00** **Practical Duration** **291:00**	**Unique Equipment Required:** 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. **For Domain NOSs:** • For NOS SSC/N0501: C/C++, UML tools such as Rational suite • For NOS SSC/N0502: JDK / Eclipse General: • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning • White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • **Presentation Tools to support learning activities:** o Intranet o Email o IMs o Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities • Handy Camera • 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/ other Email Clients • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition. • Reading Resources: Access to relevant sample documents and learning forums to enable self-study before and after each training session.

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	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0501.
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	Minimum Bachelor's Degree in Computer Science or any related field; Preferred Master's Degree in Computer Science
4a	**Domain Certification**	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	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer" mapped to the Qualification Pack: "SSC/Q1402". Minimum accepted score is 70%.
5	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred

Annexure: Assessment Criteria

Assessment Criteria for Software Developer	
Job Role	Software Developer
Qualification Pack	SSC/Q0501
Sector Skill Council	IT-ITeS

Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
1.SSC/N0501 (CONTRIBUTE TO THE DESIGN OF SOFTWARE PRODUCTS AND APPLICATIONS)	PC1. check their understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	**100**	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	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
		Total	100	35	65
2.SSC/N0502 (DEVELOP SOFTWARE CODE TO SPECIFICATION)	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	**100**	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	0

				MARKS ALLOCATION	
ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
	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
		Total	100	20	80
3.NOS/N9001 (MANAGE THEIR WORK TO MEET REQUIREMENTS)	PC1. establish and agree their work requirements with appropriate people	**100**	6.25	0	6.25
	PC2. keep their immediate work area clean and tidy		12.5	6.25	6.25
	PC3. utilize their time effectively		12.5	6.25	6.25
	PC4. use **resources** correctly and efficiently		18.75	6.25	12.5
	PC5. treat confidential information correctly		6.25	0	6.25
	PC6. work in line with their organization's policies and procedures		12.5	0	12.5
	PC7. work within the limits of their job role		6.25	0	6.25
	PC8. obtain guidance from appropriate people, where necessary		6.25	0	6.25
	PC9. ensure their work meets the agreed requirements		18.75	6.25	12.5
		Total	**100**	**25**	**75**
4.SSC/N9002 (WORK EFFECTIVELY WITH COLLEAGUES)	PC1. communicate with colleagues clearly, concisely and accurately	**100**	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
		Total	**100**	**20**	**80**
5.SSC/N9003 (MAINTAIN A	PC1. comply with their organization's current health, safety and security policies and procedures	**100**	20	10	10

		MARKS ALLOCATION

ASSESSMENT OUTCOME (NOS CODE AND DESCRIPTION)	ASSESSMENT CRITERIA (PC)	TOTAL MARKS	OUT OF	THEORY	SKILLS PRACTICAL
HEALTHY, SAFE AND SECURE WORKING ENVIRONMENT)	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of their authority		20	10	10
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people 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
		Total	**100**	**30**	**70**
6.SSC/N9004 (PROVIDE DATA/INFORMATION IN STANDARD FORMATS)	PC1. establish and agree with appropriate people the data/information you need to provide, the formats in which you need to provide it, and when you need to provide it	**100**	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-todate data/information to the appropriate people in the required formats on time		6.25	0	6.25
		Total	**100**	**25**	**75**
7.SSC/N9005 (DEVELOP THEIR KNOWLEDGE,	PC1. obtain advice and guidance from appropriate people to develop their knowledge, skills and competence	**100**	10	0	10

SKILLS AND COMPETENCE)	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
		Total	**100**	**20**	**80**

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**

Format: ModCur_2015_1_0

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User Interface (UI) Developer

Curriculum / Syllabus

This program is aimed at training candidates for the job of a **User Interface (UI) Developer** in the **IT-ITeS** Sector/Industry and aims at building the following key competencies amongst the learner.

Program Name	**User Interface (UI) Developer**		
Qualification Pack Name & Reference ID.	User Interface (UI) Developer SSC/Q0502		
Version No.	1.0	**Version Update Date**	31/01/2015
Pre-requisites to Training	Bachelor's Degree in Science/Technology/Computers or any graduate course		
Training Outcomes	**After completing this programme, participants will be able to:** • Contribute to the design of software products and applications • Develop software code to specification • Develop media content and graphic designs for software products and applications • Manage your work to meet requirements • Work effectively with colleagues • Maintain a healthy, safe and secure working environment • Provide data/information in standard formats • Develop your knowledge, skills and competence		

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	Candidates will be able to: • check your understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people • check your understanding of the Software Requirements Specification (SRS) with appropriate people • check your understanding of High Level Design (HLD) with appropriate people • design basic programming structures to implement functionality in line with requirements defined in BRS/URS, SRS and HLD • review your designs with appropriate people	SSC/N0501	Refer to Unique Equipment Required

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
				• analyze inputs from appropriate people to identify, resolve and record design defects and inform future designs • document your designs using standard templates and tools • comply with your organization's policies, procedures and guidelines when contributing to the design of software products and applications		
2.	Develop software code to specification	20:00	80:00	Candidates will be able to: • 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 • access reusable components, code generation tools and unit testing tools from your organization's knowledge base • convert technical specifications into code to meet the requirements, leveraging reusable components, where available • create appropriate unit test cases (UTCs) • review codes and UTCs with appropriate people • execute UTCs and document results • rework the code and UTCs to fix identified defects • analyze inputs from appropriate people to inform future designs • record corrective actions for identified defects to inform future designs • submit tested code for approval by appropriate people • update your organization's knowledge base with your experiences of the code developed • comply with your organization's policies, procedures and guidelines when developing software code to specification	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	Candidates will be able to: • 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 • access reusable components, media and graphical packages and tools from your organization's knowledge base • convert requirements into media content and graphic designs, leveraging reusable components where available • review media content and graphic designs with appropriate people and analyze their feedback • record any defects and corrective actions taken to inform future work • rework media content and graphic designs, incorporating feedback • submit media content and graphic designs for approval by appropriate people • update your organization's knowledge base with your experiences of the media content and graphic designs developed • comply with your organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications	SSC/N0503	

4.	Manage your work to meet requirements	12:00	38:00	Candidates will be able to: • establish and agree your work requirements with appropriate people • keep your immediate work area clean and tidy • utilize your time effectively • use resources correctly and efficiently • treat confidential information correctly • work in line with your organization's policies and procedures • work within the limits of your job role • obtain guidance from appropriate people, where necessary • ensure your work meets the agreed requirements	SSC/N9001	

Sr. No.	Module	Theory Duration (hh:mm)	Practical Duration (hh:mm)	Key Learning Outcomes	Corresponding NOS Code	Equipment Required
5.	Work effectively with colleagues	10:00	40:00	Candidates will be able to: • communicate with colleagues clearly, concisely and accurately • work with colleagues to integrate your work effectively with theirs • pass on essential information to colleagues in line with organizational requirements • work in ways that show respect for colleagues • carry out commitments you have made to colleagues • let colleagues know in good time if you cannot carry out your commitments, explaining the reasons • identify any problems you have working with colleagues and take the initiative to solve these problems • follow the organization's policies and procedures for working with colleagues	SSC/N9002	

6.	Maintain a healthy, safe and secure working environment	7:00	18:00	Candidates will be able to: • comply with your organization's current health, safety and security policies and procedures • report any identified breaches in health, safety, and security policies and procedures to the designated person • identify and correct any hazards that you can deal with safely, competently and within the limits of your authority • 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 • follow your organization's emergency procedures promptly, calmly, and efficiently • identify and recommend opportunities for improving health, safety, and security to the designated person	SSC/N9003	

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	Candidates will be able to: • 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 • obtain the data/information from reliable sources • check that the data/information is accurate, complete and up-to-date • obtain advice or guidance from appropriate people where there are problems with the data/information • carry out rule-based analysis of the data/information, if required • insert the data/information into the agreed formats • check the accuracy of your work, involving colleagues where required • report any unresolved anomalies in the data/information to appropriate people • provide complete, accurate and upto-date data/information to the appropriate people in the required formats on time	SSC/N9004	
8.	Develop your knowledge, skills and competence	5:00	20:00	Candidates will be able to: • obtain advice and guidance from appropriate people to develop your knowledge, skills and competence • identify accurately the knowledge and skills you need for your job role • identify accurately your current level of knowledge, skills and competence and any learning and development needs • agree with appropriate people a plan of learning and development activities to address your learning needs • undertake learning and development activities in line with your plan • apply your new knowledge and skills in the workplace, under supervision • obtain feedback from appropriate people on your knowledge and skills and how effectively you apply them	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		

Total Duration:	**95:00**	**305:00**	**Unique Equipment Required:** 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. **Domain NOS requirements** • Visio, UML, freeminds, mockingbird • HTML 5, CSS, Java Script and SQL • IDEs such as Web Builder, Word Press, Joomla ❚❚Wordpress, psdGraphics etc. • HTML, CSS, Flash, Photoshop, Windows media player, Eclipse, XAMPP **Common requirements** • Comfortable seats with adequate lighting, controlled temperature and acoustics for training and learning • White Board, Markers and Eraser • Projector with screen • Flip chart with markers • Faculty's PC/Laptop with latest configuration and internet connection • Supporting software / applications for projecting audio, video, recording, • Presentation Tools to support learning activities: o Intranet ○Email ○IMs o Learning management system e.g. Moodle, Blackboard to enable blended learning • Microphone / voice system for lecture and class activities ❚❚Handy Camera • 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. • Assessment and Test Tools for day to day online Tests and Assessments • For team discussions: Adequate seating arrangement in full / half circle format for one or more teams as per planned team composition.

Grand Total Course Duration: **400 Hours 0 Minutes**

*(This syllabus/ curriculum has been approved **IT-ITeS Sector Skills Council NASSCOM**.)*

Notes from IT-ITeS Sector Skills Council NASSCOM

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.		

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

Assessment Criteria for <QP Name>	
Job Role	**User Interface (UI) Developer**
Qualification Pack	**SSC/Q0502**
Sector Skill Council	**IT-ITeS**

Sr. No.	**Guidelines for Assessment**
1	Criteria for assessment for each Qualification Pack (QP) will be created by the Sector Skill Council (SSC). Each performance criteria (PC) will be assigned Theory and Skill/Practical marks proportional to its importance in NOS.
2	The assessment will be conducted online through assessment providers authorised by SSC.
3	Format of questions will include a variety of styles suitable to the PC being tested such as multiple choice questions, fill in the blanks, situational judgment test, simulation and programming test.
4	To pass a QP, a trainee should pass each individual NOS. Standard passing criteria for each NOS is 70%.
5	For latest details on the assessment criteria, please visit www.sscnasscom.com.

Assessable Outcomes	**Assessment criteria for the outcome**	**Total Mark**	**Out of**	**Theory**	**Skills Practical**
1. SSC/N0501 (Contribute to the design of software products and applications)	PC1. check your understanding of the Business Requirements Specification (BRS)/User Requirements Specification (URS) with appropriate people	**100**	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
		Total	100	35	65
2. SSC/N0502 (Develop software code to specification)	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	**100**	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 Practica
	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
		Total	100	20	80
3. SSC/N0503 (Develop content and for designs sc products and Applications)	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	**100**	10	10	0
	PC2. access reusable components, media and graphical packages and tools from your organization's knowledge base		10	0	10
	PC3. convert requirements into media content and graphic designs, leveraging reusable components where available		25	0	25
	PC4. review media content and graphic designs with appropriate people and analyze their feedback		10	10	0
	PC5. record any defects and corrective 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 approval by appropriate people		5	5	0
	PC8. update your organization's knowledge base with your experiences of the media content and graphic designs developed		10	0	10
	PC9. comply with your organization's policies, procedures and guidelines when developing media content and graphic designs for software products and applications		10	0	10
		Total	100	25	75
4.SSC/N9001 (Manage your work to meet requirements)	PC1. establish and agree your **workrequirements** with **appropriate people**	**100**	6.25	0	6.25
	PC2. keep your immediate work area clean and tidy		12.5	6.25	6.25
	PC3. utilize your time effectively		12.5	6.25	6.25
	PC4. use **resources** correctly and efficiently		18.75	6.25	12.5

Assessable Outcomes	**Assessment criteria for the outcome**	**Total Mark**	**Out of**	**Theory**	**Skills Practical**
	PC5. treat confidential information correctly		6.25	0	6.25
	PC6. work in line with your organization's policies and procedures		12.5	0	12.5
	PC7. work within the limits of your job role		6.25	0	6.25
	PC8. obtain guidance from **appropriate people**, where necessary		6.25	0	6.25
	PC9. ensure your work meets the agreed requirements		18.75	6.25	12.5
		Total	**100**	**25**	**75**
5.SSC/N9002 (Work effectively with colleagues)	PC1. communicate with colleagues clearly, concisely and accurately	**100**	20	0	20
	PC2. work with colleagues to integrate your work effectively with theirs		10	0	10
	PC3. pass on essential information to colleagues in line with organizational requirements		10	10	0
	PC4. work in ways that show respect for colleagues		20	0	20
	PC5. carry out commitments you have made to colleagues		10	0	10
	PC6. let colleagues know in good time if you cannot carry out your commitments, explaining the reasons		10	10	0
	PC7. identify any problems you have working with colleagues and take the initiative to solve these problems		10	0	10
	PC8. follow the organization's policies and procedures for working with colleagues		10	0	10
		Total	**100**	**20**	**80**

6.SSC/N9003 (Maintain a healthy, safe and secure working environment)	PC1. comply with your organization's current health, safety and security policies and procedures	**100**	20	10	10
	PC2. report any identified breaches in health, safety, and security policies and procedures to the designated person		10	0	10
	PC3. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority		20	10	10
	PC4. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		10	0	10
	PC5. follow your organization's **emergency procedures** promptly, calmly, and efficiently		20	10	10
	PC6. identify and recommend opportunities for improving health, safety, and security to the designated person		10	0	10
	PC7. complete any health and safety records legibly and accurately		10	0	10
		Total	**100**	**30**	**70**
	PC1. establish and agree with appropriate people the data/information you need to provide, the formats	**100**	12.5	12.5	0
Assessable Outcomes	**Assessment criteria for the outcome**	**Total Mark**	**Out of**	**Theory**	**Skills Practical**
7.SSC/N9004 (Provide data/information in standard formats)	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
		Total	**100**	**25**	**75**
8.SSC/N9005 (Develop your knowledge, skills and competence)	PC1. obtain advice and guidance from appropriate people to develop your knowledge, skills and competence	**100**	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
		Total	**100**	**20**	**80**

Annexure2: Trainer Prerequisites for Job role: User Interface (UI) Developer mapped to Qualification Pack:SSC/Q0502

Sr. No.	Area	Details
1	**Job Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack SSC/Q0502.
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	Bachelor's Degree in Science/Technology/Computers or any graduate course

4a	**Domain Certification**	Minimum accepted score in SSC Assessment is 90% per NOS being taught in SSC/Q0502. Additional certification in computers/technology/ animation/graphics
4b	**Platform Certification**	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	**Experience**	Field experience: Minimum 2 years' experience in the same domain Training experience: 1 year preferred

IT-ITeS Sector Skills Council NASSCOM
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T +91 11 41519230/60 | F +91 11 41519240
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SYLLABUS

Short Term Training at CSIR-Central Food Technological Research Institute

M.Voc (Food Processing and Engineering) 2020 -21 Batch
NSQF Level : 9
Job Role : Plant Manager
Sub Sector: Multi Sectorial
PRACTICALS:

1. Demonstration of Ultra High Pressure System for Food Preservation.
2. Demonstration of Non-Aqueous Applications of Membrane Technology.
3. Demonstration of Process of Smart Packaging.
4. Demonstration of MPACK Software.
5. Demonstration of process of Vacuum Frying System.
6. Demonstration of bottling process of various Beverages.
7. Demonstration of different methods of Advanced Drying Techniques.
8. Demonstration of process of Carbonated Beverages.
9. Demonstration of different methods of Twin screw extrusion equipment, Cryogenic grinding system, drying systems, Roasting systems and forming machinery.
10. Determination of proximate composition, nutritional analysis (oils and fats, milk and milk products, sweets and confectionaries), analysis of food additives (preservatives, synthetic colours, artificial sweeteners, antioxidants, etc.), Food Testing.
11. Demonstration of microbiological safety for food products.
12. Demonstration of Post-Harvest Technologies for Fruits & Vegetables. Demonstration of different tools and machineries (fruit washer, peeler, slicer, fruit pulper, steam jacketed kettles, boiler for steam production, packaging machines, etc) used for fruit pulp processing.
13. Demonstration of aseptic packaging of fruit pulp.
14. Demonstration of can reformer, flanger, seamer, can body beader and embossing machines to form cans and complete canning process of fruit pulp (fruits of regional importance).

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(AUTONOMOUS)

OOTY ROAD, MYSURU-570 025

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

MASTERS OF VOCATIONAL COURSE

M.Voc (Software Development)

Department of M.Voc

JSS College of Arts, Commerce and Science

Ooty Road, Mysore-25

2018-19

NOS Code : SSC/N0502

Develop Software code to specification

C, Java

Course Outcomes: At the end of the course students will be able to:

CO1. Check your understanding of the Business Requirements specification (BRS), Software Requirements Specification (SRS), High Level Design (HLD) and Low Level Design (LLD) with appropriate peopleaccess reusable components, code generation tools and unit testing tools from your organization's knowledge base.

CO2. Convert technical specifications into code to meet the requirements, leveraging reusable components, where available

CO3. Create appropriate Unit test cases (UTCs)

CO4. Review codes and UTCs with appropriate people

CO5. Analyze inputs from appropriate people to inform future designs

CO6. Submit tested code for approval by appropriate people

Mango DB on AWS **Hr:-15**

- Introduction
- Creating, reading and updating data
- Schema design
- Performance
- Aggregation framework
- Application engineering
- Case studies