COURSE STRUCTURE
&
SYLLABUS

Integrated B.Sc-B.Ed
(MATHEMATICS MAJOR)

DEPARTMENT OF MATHEMATICAL SCIENCES
TEZPUR UNIVERSITY
2011

STRUCTURE OF THE INTEGRATED B.Sc. (major) B.Ed. PROGRAMME

Major in Mathematics

FIRST SEMESTER

Course Code	Course title	L-T-P	CR
EG110	Communicative English	2-0-0	2
CS101	Basics in Computer Applications	2-0-1	3
PD101	Physics- I	2-0-1	3
CD101	Chemistry- I	2-0-2	4
MD101	Mathematics- I	2-1-0	3
BD101	Biology- I	2-0-1	3

Total credit = 18

SECOND SEMESTER

Course Code	Course title	L-T-P	CR
PD102	Physics- II	2-0-1	3
CD102	Chemistry- II	2-0-2	4
MD102	Mathematics- II	2-1-0	3
BD102	Biology- II	2-0-1	3
ES101	Elementary Environmental Science	2-0-0	2
NS102	NSS/NCC	0-0-2	2
SC101	**Sociology: an Introduction**	2-0-0	2

Total credit = 19

THIRD SEMESTER

Course Code	Course title	L-T-P	CR
MD201	Introductory Statistics	2-1-0	3
MD203	Linear Spaces and Complex Numbers	2-2-0	3
MD205	Algebra	2-1-0	3
MD207	Co-ordinate Geometry	2-1-0	3
MD209	Statistics and Dynamics	2-1-0	3
PD201	Electronics-I (Pass subject)	2-1-0	3
PD209	Physics Laboratory -II	0-0-2	2

Total credit = 20

FOURTH SEMESTER

Course Code	Course title	L-T-P	CR
MD202	Probability and Mathematical Statistics	3-1-0	4
MD204	Mathematical Methods and PDE	2-1-0	3
MD206	Integral Equations and Transforms	3-1-0	4
MD208	Linear Algebra	3-1-0	4
BD202	Ecology and Environmental Biology (Pass subject)		
	OR		
PD202	Introductory Quantum Mechanics (Pass subject)	2-1-0	3
BD210	Bioscience Laboratory- IIB		
	OR		
PD210	Physics Laboratory -IV	0-0-2	2

Total credit = 20

FIFTH SEMESTER

Course Code	Course title	L-T-P	CR
ED101	Education and Development- I (C)	2-0-0	2
MD301	Computer Programming+	3-1-0	4
MD303	Real Analysis	3-1-0	4
MD305	Abstract Algebra	3-0-1	4
MD307	Elementary Number Theory	3-1-0	4
MD309	Computer Laboratory	0-0-2	1

Total credit = 19

SIXTH SEMESTER

Course Code	Course title	L-T-P	CR
ED102	Education and Development- II (C)	2-0-0	2
MD302	Numerical Analysis	3-1-0	4
MD304	Topology	3-1-0	4
MD306	Functional Analysis	3-1-0	4
MD308	Theory of Ordinary Differential Equations	3-1-0	4
MD310	Computer Laboratory	0-0-2	1

Total credit = 19

Detailed Syllabi

SEMESTER-I

EG 110 Communicative English   L2 T0 P0 CH2 CR2

Objectives
1. To develop overall proficiency in English with a view to enabling the students to use English for communication and for study purposes;
2. To develop the student's interactive skills by developing their ability to listen to English for formal as in class lectures and informal as in face to face interactive situations) with a high degree understanding, and helping them to speak English with a reasonable degree of fluency and with an acceptable pronunciation of the sounds of English;
3. To develop student's ability to read English-texts-both of scientific and non-scientific nature silently with a high degree of comprehension;
4. To develop the student's skill of writing short paragraphs, formal and informal letters, curriculum vitae/resume, applications of various types, study notes, summery and appropriate words-both scientific and non-scientific.
5. The course has been developed specially for Integrated M.Sc./B.Sc. B.Ed.

Course content and activities
A. Oral Communicative Activities
Information transfer activities: Pair and group works involving transfer of information (reading a brochure and advertise/a notice a schedule or programme/drawing etc. and discussing these, finding a solution, arriving at a decision through speaking); extempore speech using clues, group discussion etc.
Pair work: describing pictures, interpreting diagrams, gleaning information from different types of written materials including articles etc. and talking about them, formal seminar presentation, formal group discussion.

B. Reading
Reading and comprehension: global and local comprehension, drawing interferences
Materials: Stories and essays (preferably a collection of comparatively short essays on scientific, interestingly written topics, biographical/autobiographical writings, short stories- adventure and scientific fiction), Reading silently in class followed by short comprehension questions, brief writing exercises, summaries in brief, personal responses (not typical question-answer type)- both oral and written. Reading material from Internet and talking and writing about them; reading scientific reports, articles collected from newspapers and magazines, Internet etc. and writing notes etc on them.

C. Writing
Preparing reports, project proposals. Writing applications of various types and for various purposes, curriculum vitae/resume, letters to the editors, letters to various agencies. Writing short notes on article/reports read summary of articles/paragraphs read, notes on lectures (talks-radio/TV/audio, video cassettes), opinions on discussions/letters heard, notice both formal and informal/friendly, notes to inform

briefly about them.
others etc., interpreting pictures, advertisements, visuals (video, TV etc.) and writing

D. Vocabulary and grammar:
Using useful but unfamiliar words and phrases in conversation in conversation and in writing; Group verbs, idiomatic expressions; synonyms and antonyms.

Structure of simple sentences; use of adverbials, longer sentences, combining sentences, Tenses, Use of passive in scientific discourse, various types of questions, direct and indirect narration.

E. **Evaluation**
Oral skills: 15% of total marks
Interview/interacting; group discussions; formal seminar presentation
Reading-comprehension: 25% of total marks
Continuous text; chart/graph/drawing/pictures etc.
Vocabulary
Writing: 40% of total marks
Notes/summery/writing; letters; report writing; short essay
Grammar and usages 20% of total marks
Questions on grammar in use (using texts/passages from texts); questions to test knowledge of grammar.

Textbook
Sharma, S. and B. Mishra *Communication Skills for Engineers and Scientists* (PHI, New Delhi, 2009)

Reference book
Thomson and Martinet. *A Practical English Grammar* (Oxford ELBS, Delhi,2008).

PD101 :   Physics-I   L2-T0-P1-CH4-CR3

1. Coordinate systems, elements of vector algebra in plane polar, cylindrical, spherical polar coordinate systems.
2. Dimensional Analysis
3. Solutions for one dimensional equation of motion in various forms, line integrals, conservative forces, potential, work-energy theorems, energy diagrams
4. Conservation of linear momentum and collisions, variable mass problems
5. Forced oscillations, damping, resonance
6. Conservation of angular momentum and elementary rigid body dynamics.
7. Principles of thermodynamics, concept of thermodynamic state, extensive and intensive variables
8. Heat and work, internal energy function and the first law of thermodynamics Equations of state
9. Concepts of entropy, entropy maximum and energy minimum principles
10. Second law of thermodynamics
11. Thermodynamics potentials, enthalpy, Helmholtz potential, Gibbs potential
12. Conditions of equilibrium, first order phase transitions and Clausius-Clapeyron equation, applications
13. Chemical reactions
14. Heat engines and black body radiation

15. Elementary kinetic theory of gases, equilibrium properties-pressure and equation of state
16. Transport processes, illustration with simple examples.

Textbooks
1. Kleppner, Daniel & Kolenkow,Robert *Introduction to mechanics* (McGraw-Hill Book Co. Inc., New York: , 1973.)
2. Zemansky, Mark W. & Dittman, Richard H. *Heat and thermodyamics*: *an intermediate textbook* 7th ed. (McGraw-Hill Book co., Inc., New York, 1997).

Reference Books
1. Sears,Francis W., Zemansky,Mark & Young, Hugh D. *University Physics*. 7th Ed.(Addison Wesley, Masschusetts. 1987)
2. Simon, Keith R. *Mechanics,* 3rd Ed. (Addison Wesley pub. Co., Masschusetts, 1971)

CD101 Chemistry I   L2-T0-P2-CH6-CR4
Unit I
Structure of atom, Hund's rule, Aufbau principle, Pauli's exclusion principle.
Periodic Properties:
Periodicity of the elements, shielding, effective nuclear charge, Slater's rule, the size of the atoms, atomic, covalent and van der Waals radii, ionization energy, electron affinity, electronegativity.
Unit II
Reactivity effects:
Hybridization (sp, sp^2, sp^3) of organic molecules, Inductive effects, Hyperconjugation, Electromeric effect, Mesomeric effect, Resonance theory, Tautomerism, Steric effect, Strain theory, Conformation of substituted and unsubstituted cyclohexane

Nomenclature:
IUPAC nomenclature of organic compounds including bicyclic compounds

Alkanes:
Preparation, properties and reactions

Alkenes:
Preparation, properties and reactions, Cis-trans isomerism, Markownikoff's and anti-Markownikoff's addition rules, Saytzeff rule

Unit-III
First Law of Thermodynamics:
Thermodynamics terms, state and path functions, concept of heat and work, internal energy, enthalpy, first law of thermodynamics; w, q, ΔU and ΔH for expansion and compression of ideal gases, heat capacities, physical change, standard enthalpies of physical and chemical changes, Hess's law, Kirchhoff's law.

Second Law of Thermodynamics:
Spontaneous processes, Carnot cycle, entropy, criteria of spontaneity, statements of the second law of thermodynamics, entropy changes, Clausius inequality, Gibbs energy, Helmholtz energy. Third law of thermodynamics.

Solutions:

Ideal and non-ideal solutions.

Colligative properties.

Practical:
1. Preparation of buffer solution and measurement of pH.
2. Viscosity measurement of solution.
3. Conductometric acid-base titration.
4. Measurement surface tension of liquid by stalagmometer.
5. Verification of Beer-Lamberts law.
6. Titration of a mixture of AcOH, HCl and $CuSO_4$ by conductometric method.

Textbooks
1. Lee, J. D. *Concise Inorganic Chemistry,5thEdn.* (Chapman & Hall, 2002).
2. Viswanathan, B., Raghavan, P. S. *Practical Physical Chemistry* (Viva Books Private Limited, 2005).
3. Carey, F. A., Sundberg, R. J. *Advanced Organic Chemistry, 4th ed.,* (Plenum Publishers, 2001).

Reference Books
1. Atkins, P., Paula, J. de. *Elements of Physical Chemistry, 4th Edn*. (Oxford University Press, 2005).
2. Puri, B. R., Sharma, L. R., Pathania, M. S. *Principles of Physical Chemistry, 2nd Edn.* (Shoban Lal Nagin Chand and Co. 1980).
3. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).

MD101 Mathematics I   L2-T1-P0-CH3-CR3

Inequalities involving arithmetic, geometric, and harmonic means, Cauchy-Schwarz inequality.

Real numbers, Sequences, Cauchy sequence, Cauchy's General principle of convergence, Subsequences, Convergence and divergence of monotonic sequences, Sandwich theorem; Infinite series, statements of basic properties of infinite series (without proofs), Absolute and conditional convergences, Test for convergence: Comparison test, Ratio test, Raabe's test, Leibnitz's test.

Limit, Continuity, Differentiability, Rolle's theorem, Mean value theorems and applications; Linear Approximation, Newton and Picard method, Taylor's theorem (one variable), Approximation by polynomials, Critical points, convexity, curvature of plane curves, Asymptotes, Curve tracing: tracing of catenary, cissoids, asteroid, cycloid, folium of Descartes, cardiod, lemniscate.

Functions of two or more variables, limit, continuity, differentiability, chain rule, Euler's theorem on homogeneous functions; Directional derivatives, Gradient vectors and tangent planes, partial derivatives, Taylor's theorem (statement only) and criteria for maxima/minima/saddle points, Lagrange's method of multipliers.

Improper integrals, Numerical Integration: Trapezoidal and Simpson's rule; error bounds.

Textbooks

1. Thomas and Finney: *Calculus and Analytic Geometry*,(Pearson Education, New Delhi,1998)
.
2. Bartle,R. G. & Sherbert, D. R. *Introduction to Real Analysis*,(John Wiley and Sons, New Delhi, 2007).

Reference Books
1. Apostol, T. M. *Calculus, Vol I & II*, 2ND ed., (John Wiley and Sons, New Delhi, 2007)
2. Mapa, S.K. *Higher Algebra*, (Asoke Prakashan, Kolkata, 2006).

BD101: Biology I   **L2-T0-P1-CH4-CR3**

Diversity of Microbes, Plant and Animal world
Introduction, difference between living and nonliving, Unicellular, colonial and multicellular forms
Chemical basis of life
Chemistry of the living state: micro, macro (trace elements) associated with the structure of cells. Water: molecular structure, dipolar nature, dissociation of water, concept of pH, Acid and base, buffers.
Basic principles of Taxonomy
Concept of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants animals and microorganisms.
Microbial World
Characterisstics with examples of Archaebacteria, eubacteria, viruses, viroids and prions eubacteria and archaea, bacteria.
Plant Kingdom
A general description on lower and higher groups of plants; Specific studies on each of the following groups of plants with description of a typical example (i) Thallophyta (ii) Bryophyta (iii) Pteridophyta (iv) Gymnosperms (v) Angiosperms.
Animal Kingdom
Non chordates and Chordate definition, classification with examples.
Structural Organization
Organization of tissues, organs and organ systems.
Basic concept of Organic Evolution
Theories of evolution: Lamarck; Darwin–concepts of variation, Neo-Darwinism. Evolution and diversity of bacteria, archabacteria ; plants (thallophytes to higher plants); animals (protozoa to mammals)

Textbooks

1.   Campbell, N.A. & Reece J.B. *Campbell Biology: Concepts & Connections with Mastering Biology$^{(R)}$*, 7th ed., (Benzamin-Cummings Publishing Company,2011).
2.   Gunstream, S.E. *Xplorations In Basic Biology*, 11th ed., (Benzamin-Cummings Publishing Company,2011).

Reference books

1.   Groom M.J. & Gary K. Meffe, G.K., *Principles Of Conservation biology*, 3rd Edition, (Sinauer Associates, 2005).

2. Willey, J. & Sherwood, L. *Prescott's microbiology* 8th ed., (Mcgraw-Hill Science/engineering/math, 2008).

Biology-I   Laboratory   L0-T0-P2-CH4-CR2

1. General Laboratory orientation in Microbiology with equipments like inoculation loop, hot air oven, autoclave, laminar air flow, incubator, microscope, haemocytometer, spectrophotometer etc.
2. Sterilization, disinfection and safety in general microbiology laboratory
3. Microscopic observation of soil and water born organism by simple staining
4. Use of haemocytometer in cell count
5. Observation of representative specimens of non-chrodata.
6. Morphology vegetative and reproductive) and anatomy of the taxa :bryophytes, pteridophytes and gymnosperms.
7. Observation of slides differentiating monocots and dicots.
8. Microscopic observation of pre-stained animal tissue slides

Textbooks
1. Bendre, A &. Kumar. *A Text Book Of Practical Botany I* ,(Rastogi Publication, Meerut, 2009).
2. Dubey, R.C., *Practical Microbiology* (S. Chand Publisher, New Delhi,2007).

SEMESTER -II

PD102:   Physics-II   L2-T0-P1-CH4-CR3

1. Summary of electrostatics and magnetostatics
2. Gauss' law in differential form, electrostatic potential and curl of E
3. Electric displacement and boundary conditions, linear dielectrics
4. Motion of charge in electric and magnetic field
5. Current density, curl and divergence of B, Ampere's law, magnetic field H, magnetic susceptibility, boundary conditions of B and H
6. Faraday's law in differential form, displacement current
7. Maxwell's equations in media, e.m. wave equation, plane waves, polarization and types of polarization, energy and momentum of plane e.m. waves, grating and diffraction experiments, X-rays and Braag's laws.

Textbooks
1 Griffiths, David J. *Introduction to Electrodynamics* 3rd ed.(Prentice Hall, New Jersey, 1999.)
2. Hecht, Eugene *Optics* 4th ed. (Addison Wesley, Massachusetts, 2001.)

Reference books
1. Reitz, John R. Milford, Fredrick & Christ, Robert *Foundations of Electromagnetic theory* 4th ed. (Addison Wesley, MassachusettsS, 1993.)

2. Jenkins, Francis A. & White, Harvey e. *Fundamentals of optics* 4th ed. (McGraw–Hill Book Company Inc., New York, 2001)

CD102 : Chemistry-II   L2-T0-P2-CH6-CR4

Unit I
Structure and Bonding:
Valence Bond and LCAO-MO theory, bonding in homonuclear diatomic molecules, covalent and ionic bonding, resonance, formal charge, hybridization, VSEPR model. Polarizability of cations and anions, Fazan's rules.

Unit II
Fundamental reactions of organic molecules:
Chemical reactions and mechanism, nucleophile and electrophile, substitution and elimination reactions, addition reactions, condensation reactions, rearrangement reactions.

Stereochemistry:
Optical isomerism, Chirality, racemic mixture, relative and absolute configuration determination, Fisher, Newman and Sawhorse representation, D-L notation, R/S and E/Z nomenclature

Reactive intermediates:
Carbocation, carbanion, carbene, nitrene, benzyne-Generation, stability and reactions

Unit III
Properties of gases and liquids:
Equations of state, kinetic model of gases, collision theory, real gases, Maxwell distribution of molecular speeds, qualitative description of the structure of liquids, surface tension and viscosity

Electrochemistry:
Conduction in electrolyte solutions, ionic mobility, Kohlrausch law, Ostwald's dilution law, transport number, Debye-Huckel Limiting Law, electrochemical cells, EMF, Nernst equation
Rate of reactions:
Rate equations of zero, first, second, pseudo 1st order reactions, determination of order of a reaction, activation energy, activated complex theory, collision theory.

Practical:
Unit I
Preliminary investigations and qualitative analysis of solid organic compounds with functional groups detection.

Unit II: Qualitative Analysis of Inorganic Mixtures (excluding interfering radicals).

Textbooks*
1. Atkins, P., Paula, J. de. *Elements of Physical Chemistry*, 4th *Edn.* (Oxford University Press, 2005).
2. Shriver, D. F., Atkins, P. W. *Inorganic Chemistry 3rd Edn,* (Oxford University Press, 1999).

3. Furniss, B. S., Ford, A. J. H., Smith, P. W. H., Tatchell, A., R. *Vogel's Textbook of Practical Organic Chemistry, 5th Edn.* (John Wiley, 1989).
4. Svehla, G., *Vogel's Qualitative Inorganic Analysis, 7th Edn.* (Prentice Hall, 1996).
5. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure* (John Wiley, 2001).

* We could not reduce the number of textbook as this paper involves both theory (inorganic, organic and physical) and practicals (inorganic, and organic).

Reference books
1. Viswanathan, B., Raghavan, P. S. *Practical Physical Chemistry* (Viva Books Private Limited, 2008).
2. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).
3. Vishnoi, *Advanced Practical Organic Chemistry,2nd Revised Edn.* (Vikas Publisher, 2007).

SEMESTER-III

PD201: Electronics I   **L2-T1-P0-CH3-CR3**

Circuit Analysis :
Review: Voltage, Current, Power, Circuit elements, Ohm's law, Kirchoff's voltage and current law
Network Theorems: Nodal Analysis, Mesh Analysis, Source transformations, Linearity and Superposition, Thevenin's and Norton's Theorems, Maximum power transfer theorem, Star-Delta and Delta-Star Conversion
Simple RL and RC Circuits, Unit Step Forcing Function, source free RLC Circuits, Sinusoidal Forcing Function, Complex Forcing Function, Phasor Concept, Impedance and Admittance, Phasor diagrams, Response as a Function of w, Instantaneous Power, Average Power, RMS values of Current and Voltage, Apparent Power and Power Factor, Complex Power,
 Introduction to Three Phase Circuits. Two port n/w, Z-parameter, Y-parameter, Transmission (ABCD) parameter, Hybrid(H) Parameter, Interconnection of two port n/ws, T and π representation.
Semiconductors : Mobility and conductivity, transport phenomenon due to donor and acceptor impurities, Hall Effect, conductivity measurement

Diodes and Transistors : Semiconductor Diode, Equivalent Circuits, Diode Testing, Zener Diodes, Load Line Analysis, Rectifier Circuits, Wave Shaping Circuits,

Bipolar Junction Transistors, Transistors Biasing, Transistors Small Signal Analysis, Transistor Amplifier Circuits basic single stage amplifier configuration, multi stage amplifiers.
Power amplifiers: Push-pull amplifiers, Class A, B, AB, C, D stages. Feed concepts, effect of negative feedback, basic feedback topologies and their properties,

analysis of practical feedback amplifiers, stability, frequency compensation.

Junction Field Effect Transistors (JFETs) : Principle of operation and characteristics of BJTs and JFETs, biasing, small signal models, , Small signal analysis.

Textbooks

1. Robbins, Allan H. Wilhelm C Miller *Circuit Analysis*, (Delmar Cengage Learning., 2003)
2. Hayt, W. H. and Kemmerly, J. E. *Engineering Circuit Analysis*, (McGraw Hill, New York, 1993)

Reference books
1. Toro,V. Del *Electrical Engineering Fundamentals*, (PHI, 1994)
2. Smith, R.J. and Dorf, R.C. Circuits, *Devices and Systems*, (John Wiley & Sons, 1992.)

PD203   Classical Mechanics-I   L2-T1-P0-CH3-CR3

Constraints, generalized coordinates, principle of virtual work, D' Alembert's principle, Lagrange's equations of motion, simple applications of Lagrangian formulations, Hamilton's principle, calculus of variation, Lagrangian and Hamiltonian for central forces.
Canonical variables, Poisson brackets, canonical transformations, Jacobi identity, cyclic co-ordinates and conservation laws. Elements of Hamilton-Jacobi theory, action and angle variable, centre of mass and laboratory systems, Kepler's problem.
Small oscillators, normal co-ordinates and application to coupled oscillators, chain molecules, Coriolis forces, rotating frame, elementary treatment of Eulerian co-ordinates, equation of motion of a rigid body, motion of a symmetrical top.
Review of relativity theory, general relativistic formulation, Newton's laws,

Textbooks
1. Biswas, S.N. *Classical Mechanics*, (Books and Allied (P) Ltd. Kolkata, 1998)
2. Takwale and Puranik , *Introduction to Classical Mechanics*, (Tata McGraw Hill, New Delhi,1979)

Reference books
1. Barger & Olsson, *Classical Mechanics A modern Perspective*, 2nd Ed. (McGraw Hill International, 1994)
2. H. Goldstein, *Classical Mechanics*, (Narosa Publishing House, New Delhi, 1980)

PD205:   Electromagnetism -I   L2-T1-P0-CH3-CR3

Concepts of scalar and vector fields, differential and integral calculus of vector fields, gradient, divergence and curl theorems, electric field, electrostatic potential, gauss's law, Poisson's and Laplace's equations, dielectrics, electric dipoles, quadrupoles and multipoles, polarization vector, displacement vector.

Sources of magnetostatic field, Biot Savart's law, Magnetic dipole moment, Magnetic scalar and magnetic vector potential, Scalar and vector potentials.

Plane waves in isotropic dielectric, Reflection, Refraction, and Polarization of e.m. waves, Propagation of e. m. waves through an isotropic crystal, Reflection from metal surfaces, Reflection from ionosphere, Dispersion and Scattering of e.m. waves, Anomalous dispersion, Energy and momentum in electrodynamics, Poynting theorem.

Textbooks
1. Griffiths, David J *Introduction to Electrodynamics*,(Prentice Hall, New Delhi,1999.)
2. Sadiku, M.N.O. *Elements of Electromagnetics*, Fourth Edition, (Oxford University Press, 2008)

Reference book

Miah, Wazed *Fundamentals of Electromagnetism*, (Tata McGraw Hill, 1982).

PD207 Physics Laboratory-I (For major in 3rd semester)

PD209 Physics Laboratory-II (For Non-Physics Major)

Semester-IV

PD202 :   Introductory Quantum Mechanics   L2-T1-P0-CH3-CR3

Limitations of classical physics: Qualitative discussions of the problem of the stability of the nuclear atom. The photo-electric effect. Franck-Hertz experiment and the existence of energy levels. Experimental evidence for wave-particle duality; X-ray diffraction and Bragg law. Compton scattering. Electron and neutron diffraction. Einstein and de Broglie's relations (E = hγ, p = h/λ).

Uncertainty relation: The position-momentum uncertainty relation and simple consequences. Qualitative wave mechanical understanding of the size and stability of the hydrogen atom.

Schroedinger equation: The concept of the wave function as a probability amplitude and its probabilistic interpretation. Plane wave solutions of the one-dimensional time-dependent Schroedinger equation for a particle in free space and elementary derivation of the phase and group velocities (quantitative discussion of wave packets is not required). Solutions of the one-dimensional Schroedinger's equation for an infinite square well potential; qualitative treatment of the finite well (derivation not required). Reflection and transmission at potential steps. Qualitative treatment of barrier penetration for simple rectangular barriers. Simple examples and comparison with classical mechanics.

Hilbert space: Basis and completeness relation. Linear operators. Hermitian operators. Unitary operators.commutation relationship, representation of states and dynamical variables, completeness of Eigen functions, Dirac-delta function, Bra & Ket notation, matrix representation of an operator, harmonic oscillator and its solution by matrix method, Heisenberg equation of motion.

Textbooks
1. Schiff, L.I., *Quantum Mechanics,* 3rd Edition,(McGraw-Hill, New Delhi, 1968.)
2. Ghatak and Lokanathan, *Quantum Mechanics*, Macmillan India Limited, 2004.

Reference books
1. Merzbacher, E. *Quantum Mechanics*, (John Wiley, New York, 2005.)
2. Richtmyer, F.K., Kennard E. H. and Lauritsen, T., *Introduction to Modern Physics,* (McGraw-Hill, 1976.)

PD204 Atomic and Nuclear Physics   L2-T1-P0-CH3-CR3

Atomic Physics: The Bohr model of the hydrogen-like atom. A brief account of the Sommerfeld model (detailed derivations not expected). Electron spin; Stern-Gerlach experiment. Space & spin quantisation. The vector model of the atom. Spin-orbit interaction. Fine structure of spectral lines. LS and jj coupling. The Zeeman effect. Paschen-Back effect. Stark effect. Scattering of light: Rayleigh scattering formula; colour of the sky; polarisation of the scattered light

Nuclear Physics : General properties of Nuclei: Concept of Nuclear size, spin, parity, magnetic dipole moment & electric quadropole moment of nuclei.
 Nuclear forces and Stability of Nuclei: Concept of packing fraction and binding energy, binding energy curve and its significance.
Natural Radioactivity & radioactive decays: Type of radioactive decays, theory of radioactive disintegration, radioactive constants, Meanlife of a radio element, radioactive equilibrium, half life of a radio element, determination of decay constant and half life.
 Nuclear Reactions: Types of nuclear reactions, conserved quantities of nuclear reaction, energies of nuclear reaction–Q-value. Exoergic & endoergic reactions. Nuclear fusion & fission reaction.
 Detector: Principles of detectionof charge particles. Construction and working principle of gas filled detectors. Ionization chamber – its construction & working principle. Interaction of γ-particle with matter. Construction and working principles of scintillating detector.

Textbooks
1. Krane, K. S. *Introductory Nuclear Physics*,(John Wiley New York, 1987).
2. White ,W.H. *Introduction to atomic spectra* ,(McGraw-Hill, Singapore,1934).

Reference Books
1.   Green , *Nuclear Physics* , (McGraw-Hill Book Company, Inc., New York, 1955).
2.   Srivastava, B.N. *Basic Nuclear Physics & Cosmic Relation*, (Pragati Prakashan, Meerut, 1983)

PD206 Electronics- II   L2-T1-P0-CH3-CR3

Operational Amplifiers: Differential and operational amplifier circuits: Transistor review, differential circuits, current source biased amplifiers, multistage differential amplifiers, level shifting, complete operational amplifier.

Op-Amp with and without feedback: Open loop considerations- inverting, non-inverting, differential, feedback- voltage follower, Practical op-amps: Offset considerations- input offset voltage, input bias current, input offset current, thermal drift, effect of power supply voltage, other temperature sensitive parameters, noise, CMRR, maximum common mode input voltages, op-amp instrumentation circuits.

Frequency response of an op-amp and active filter- Gain and phase shift vs. frequency, Bode plots, compensated frequency response, slew rate, active filters, first and second order low pass and high pass, Butterworth filter, band reject filter,

Linear Applications: Op-amp as ac amplifiers, summing and averaging circuits, integrators, differentiators, voltage-current converter, current-to voltage converter, analog computers, voltage regulators.

Non-linear applications: Voltage limiters, comparators, zero detector, Schmitt trigger, voltage to frequency and frequency to voltage converter, small-signal diodes, sample-and-hold circuits and signal generators: oscillators- square-wave, Wien bridge, phase shift

Signals and Systems: Introduction, Examples of signals and systems. Signal types: energy and power signals, continuous and discrete time signals, analog and digital signals, deterministic and random signals. Signal properties: symmetry, periodicity, and absolute integrability. Elementary signals: unit step, unit impulse, the sinusoid, the complex exponential; representation of signals as vectors.

Amplitude Modulation: QAM, SSB, Superheterodyne AM Receiver.

Angle Modulation: Bandwidth, FM wave generation, demodulation(FM), FM receiver

Phase Modulation

eg. Radio and Television Broadcasting, effect of noise on analog communication system

Textbook
1. Horowitz, P. and Hill, W., *The Art of Electronics*, 2nd Edition, Cambridge University Press, 1995.

Reference book
1. Hambley, A. R., *Electronics*, 2nd Edition, Prentice Hall, 2000.

PD208 Physics Laboratory-III   **L0-T0-P3-CH6-CR3**
 (For Majors in 4th Semester)

PD210 Physics Laboratory-IV   **L0-T0-P2-CH4-CR2**
(For Non-Majors in 4th Semester)

PRACTICALS FOR PHYSICS LABORATORY-III AND PHYSICS LABORATORY-IV WILL BE CHOSEN FROM THE FOLLOWING LIST.

(A) General properties of matter:
1. Determination of Young's modulus of the material of a wire by torsional oscillation according to Searle's method.
2. Determination of moment of inertia of some regular bodies by using a moment of inertia table.
3. Determination of the co-efficient of viscosity of water by Poiseullies's method

(B) Heat:
4. Determination of the co-efficient of liner expansion of a metal by optical lever.
5. Determination of the thermal conductivity of a metal by Searle's method.

(C) Light:
6. Determination of the focal length of a concave lens by combination method.
7. Measurement of the wavelength (λ) of a monochromatic light by using Lloyd's mirror
8. Measurement of of the wavelength (λ) of a monochromatic light by using Fresnel's Biprism.
9. Laser Experients
    (a) Determine the power distribution within the beam of a laser.
    (b) Measure the beam-spot size of the given laser.
    (e) Determine the slit width from the study of Fraunhofer diffraction pattern using laser.

(g) Verify the Malus law using laser.

10. To draw í- δ curve of a prism by spectrometer and hence to find out the angle of minimum

     deviation.

11. Determination of the slit width and the separation between the slits of a double slit by observing the diffraction and interference fringes.

12. Calibration of a polarimeter for the study of optical rotation of a solution and hence determination of the concentration of sugar solution.

(D) Magnetism:

13. Determination of the moment of a bar magnet and horizontal component of earth's magnetic field by magnetometers.

(E) Electricity:

 14. Measurement of resistance per unit length of the bridge wire by Carey Foster method.

 15. Measurement of resistance of a suspended coil galvanometer by half deflection method.

 16. Determination of mechanical equivalent of heat by Joule's calorimeter.

 17. Determination of the reduction factor of tangent galvanometer using a copper voltameter.

 18. Determination of e.m.f. of a cell by a potentiometer

     (a) Using a milliammeter (b) without using a milliammeter (c) with the help of a standard cell.

 19. Measurement of the thermo-e.m.f. with a potentiometer and to draw the E-T curve.

(F) Sound:

 20. Determination of the frequency of a tuning fork by a sonometer.

 21. To draw (υ-l) curve with the help of a sonometer and hence to find the frequency of a unknown tuning fork.

(G) Electronics:

 22. To draw the static characteristics of a triode and hence to determine the valve constants.

 23. To draw the I-V characteristic curve of a semiconductor diode (p-n junction).

 24. To draw the static characteristics of a transistor in common emitter, common collector and common base configuration.

 25. To design and develop a circuit to measure the (a) Input offset voltage (b) Input offset current (c) Slew rate and (d) Voltage gain

 Advanced practicals:

(H) Surface Tension:

 26. To determine the coefficient of surface tension using Jaegar's formula, the value of f(r) and hence to determine surface tension at two different temperatures by Jaegar's method.

(I) Thermal Conductivity:

 27. Determination of thermal conductivity of the given disc of bad conductor of heat by Lee's and Chorlton method.

(J) Spectroscopy:

 28. To draw δ-λ curve for the given spectrometer and hence to determine the wavelength of an unknown source.

(K) Magnetism:

 29. To determine the horizontal component of earth's magnetic field by using reflection and vibration magnetometers.

(L) Electricity:

 30. To determine the boiling point of a liquid by a platinum resistance thermometer.

 31. Determination of the melting point of a solid by using a thermocouple.

 32. To determine with the help of a search coil and a ballistic galvanometer the strength of the magnetic field and to draw H - I curve.

 33. Measurement of coefficient of self-inductance of a coil by Anderson's method.

34. To determine the coefficient of a mutual inductance between the two given coils by Carey Foster's method.

SEMESTER-V

PD301 Mathematical Physics   **L2-T1-P0-CH3-CR3**

Beta and gamma functions: Relationship between the beta and gamma functions; Reduction of some classes of integrals to gamma functions; Sterling's formula; Derivation of values of gamma functions.
Useful polynomials: Series integration methods to solve 2nd order ordinary differential equations: Legendre polynomials; Bessel functions; Hermite polynomials; Laguerre polynomials; Differential equations; Generating functions; Recurrence relations; Rodrigue's formulae and Orthogonality of the special functions; Sturm-Liouville's theorem; Elements of hypergeometric functions; Dirac delta function; Green function.
Fourier series: Evaluation of co-efficients; Graphical representations; Even and odd functions; Properties of Fourier series; Fourier integrals.
Partial differential equations in physical problems: Laplace's equation; Poisson's equation; Heat flow equations; Wave equations; Helmholtz equations; Solutions of these equations; Eigen value problems; Boundary value problems; Method of separation of variables.

Textbooks
1. Harper, C., *Introduction to Mathematical Physics*, Prentice Hall, 2009.
2. Arfken, G.B., and Weber, H. J., *Mathematical Methods for Physicists*, (Elsevier Ltd, Oxford 2005).
Reference book
1. Morganeau, H. and Purphy, C.M. *The Mathematics of Physics and Chemistry,* Young Press, 2009.

PD303 Physical and Geometrical Optics   **L2-T1-P0-CH3-CR3**

Geometrical Optics:
Fermat's principle and its application in establishing laws of reflection and refraction at spherical and plane boundaries. Lens system: Sign convention, conjugate foci, relation for refraction of paraxial rays at single spherical surface, Lagrange's law and Helmholtz equation and its modification for telescopic system.
 Defects of image: Spherical aberration and its magnitude for thin lens for object at finite distance and condition for minimum aberration when object is at infinity, Minimisation of spherical aberration by using suitable lens of different radii of curvature and by aplanatic surface,
Qualitative idea about coma, astigmatism and distortion, Chromatic aberration, circle of least confusion, achromatism of two thin lenses separated by a distance.

Physical Optics
Interference: Concept of light wave and its equation, complex representation of superposition of

waves, condition for straight fringes, Stokes' law, interference due to Fresnel's biprism, Newton's rings, Michelson interferometer and its application for finding difference in wavelengths.

Diffraction: Fresnel and Fraunhofer classes of diffraction, halfperiod zones and strips, Zone plate and its lensing property.

Polarisation: Double refraction, optic axis and CaCO3 crystal, plane, circular and elliptically polarised light, Retarding plates and their uses for producing and analysing different polarised light, specific rotation of plane of polarisation and halfshade polarimeter.

Textbooks
1. Jenkins, Francis A. & White,Harvey e. *Fundamentals of optics*: 4th ed.(New York McGraw – Hill Book Company Inc., 2001)
2. B. K. Mathur , *Principles of Optics,* Gopal Printing Press, 1972.

Reference book
   1. Loghurst R.S., *Geometrical and Physical Optics*, 3rd Ed.,(Longman ,London, 1973.)

PD305 Thermodynamics and Statistical Physics   **L2-T1-P0-CH3-CR3**

Maxwell's law of velocity distribution, degree of freedom, law of equipartition of energy, Maxwellian mean free path, transport phenomena – viscosity, Brownian motion (Einstein's – Langevin's theory), Equation of state of a gas, Andrew's experiment, Van der Waal's equation of state, critical constants and law of corresponding states. Platinum resistance thermometer,

thermocouple. Thermal conductivity, Zeroth and first law of thermodynamics, specific heats of gases, isothermal and adiabatic processes**.**

Second law of thermodynamics: Heat engine, Kelvin-Planck statement of second law, Clausius' statement of second law, Entropy: Entropy changes in reversal and irreversible processes, entropy of ideal gas, relation between entropy and probability. Enthalpy, Gibbs-Helmholtz function,

Maxwell's thermodynamic relations and their applications, Gibbs phase rule, triple point, Joule-

Thomson effect, adiabatic demagnetization.

Black body radiation, Kirchoff's law of radiation, radiation pressure.

Stefan-Boltzmann law, Wein's displacement law, Rayleigh-Jean's law, Planck's radiation law.

Ensemble: canonical, microcanonical and grand canonical ensemble

Concept of degenerate energy states,

M-B, F-D, B-E distribution laws.

Textbook
   1. Saha and Srivastava , *A treatise on Heat*, 3rd edition, (The Indian Press.., Kolkata. 1950.)
Reference book
   1. Zemansky and Dittman , *Heat and Thermodynamics*, (McGraw-hill Professional ,1997).

PD307 Basic Material Science   **L2-T1-P0-CH3-CR3**

Crystal Geometry: Space lattice, unit cell, crystal systems in 2-D and 3-D, miller indices of crystal planes and directions.

Structure of Solids: Linear and planar density, ligancy, packing efficiency, closed pack planes and directions, voids.

Chemical Bonding: Primary and secondary bonding, bond length and bond energy

Crystal imperfections: Point imperfections (vacancies and interstitials), dislocations, grain boundary, surface energy.

Phase and Phase transformation: Degree of freedom, Phase rule, binary alloys, Nucleation and phase transformation.

Diffusion: Fick's first and second laws, thermal diffusion.

Textbook
1. Callister William D., *Materials Science and Engineering*, W i l e y 2008.

Reference book
1. Raghavan V., *Materials Science and Engineering*, Prentice Hall of India. Learning, 5th Ed., 2009.

PD399: Physics Laboratory - V

SEMESTER VI

PD302 Digital Electronics and Microprocessors   L2-T1-P0-CH3-CR3

Digital Electronics:

Introductory: Number Systems. Binary codes, logic gates, INHIBIT (ENABLE) operation,

Boolean Algebra: logic operations using De Morgan's laws and other laws, K-maps

Combinatorial digital systems: gate assemblies, binary adders/subtractors, arithmetic functions, decoder, demultiplexer, data selector/multiplexer, encoder, ROM and applications.

Sequential digital systems: flip-flops, shift registers and counters
logic families and their comparison.

D/A and A/D systems, digital-to-analog converters, analog-to-digital converters, character generators.

Memories :RAM, dynamic RAM, PAL, Magnetic memories, MOS ROM.

 Microprocessors
8085 Microprocessor: Programmers model: register structure, addressing modes and assembly languages. 8086.8088 Microprocessor: Architecture of 8086/8088, segmented memory, addressing modes, assembly language instruction, assembler, linkers and software development tools; debugging an 8086/8088 system and microprocessor development systems.

CPU model design: 8086/8088-clock generation, timing diagram analysis, CPU module design in minimum and maximum mode.
Memory system design: Address decoding technique, static RAM interfacing, dynamic RAM (DRAM): refreshing techniques, interfacing and DRAM controller; direct memory access (DMA).Input/output (I/O) design: Isolated I/O, memory mapped I/O, design of parallel I/O, serial I/O, interrupt driven I/O and DMA.Peripherals: Programmable interrupt controller (8259), programmable peripheral interface (8255), serial communication (8251), programmable timer and event counter (8254) and DMA controller (8257). Introduction to x86: Architecture, operating modes (real, protected and virtual), memory management and

protection; overview of advanced processor (P-I to P-IV).Micro-controllers and their interfacing.

Microprocessor laboratory: Assembly language programming for 8085/8086: interfacing of 8085/8086: memory interfacing. Design of I/O modules and interfacing of different peripherals, parallel interfacing using A/D and D/A converters; 8051 based control of stepper motor.

Textbooks
1. Gaonkar, R.S. Microprocessor Architecture, Programming & application with 8085/8080A;NewAge,1995,2/e.
2. John Uffenbeck; 8086 family, programming and interfacing, PHI 2001.

Reference books
1. Hall, D.V. Microprocessing and interfacing;TMH,1995.

PD304 Computational Techniques and Simulation   **L2-T1-P0-CH3-CR3**

C language: flowcharts; algorithms; programming;
Numerical Analysis: Solution of non-linear equations - bisection, regula falsi, newton's method; Solution of a system of linear equations - gaussian elimination; Interpolation - Newton's interpolation formula; Fitting of curves - principle of least squares; Numerical differentiation - central difference formula; Numerical integration - quadrature formula, trapezoidal rule, Simpson's rules; Numerical solution of ordinary differential equations - Euler's method, runge-kutta method;
Simulation: The simulation of continuous and discrete systems - suitable examples; Stochastic simulation - generation of random numbers with different probability distributions; Examples of simulation in physics.

Textbooks
1. Gottfried, Byron S, *C programming language*, McGraw-Hill, 1996.
2. Narsingh Deo, *System Simulation with Digital Computer*, Prentice Hall, 1983.
References book
1. Kanetkar, Yashavant *Let us C, 3rd edition*, Tata McGraw Hill, 2005.

PD306   Measurement System   **L2-T1-P0-CH3-CR3**

Data interpretation and analysis; Precision and accuracy, error analysis, propagation of errors, least squares fitting, linear and nonlinear curve fitting, chi-square test; Transducers (temperature, pressure/vacuum, magnetic field, vibration, optical, and particle detectors), measurement and control; Signal conditioning and recovery, impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding; Fourier transforms; lock-in detector, box-car integrator, modulation techniques.

Textbook
The instructors will select various books for different topics
PD308 Laser Physics   **L2-T1-P0-CH3-CR3**

Planck's law, the Einstein's coefficient, two level atomic systems, light amplification, the threshold condition, laser rate equation, variation of laser power around threshold, optimum output coupling, line broadening mechanism.

Modes of rectangular cavity and open planar resonator, the quality Q-factor, the ultimate bandwidth of laser, mode selection, Q-switching, mode locking of laser, modes of a confocal resonator system, General spherical resonator. Properties of laser beam.

Ruby laser, Neodymium based laser, the He-Ne laser, the CO_2 laser, Dye laser, semiconductor laser, DFB lasers, DH lasers.

Elements of nonlinear optics.

Generation of ultra-fast optical pulses- pulse compression. Femto-second laser and its characteristics.

Textbook
1. Ghatak, A. and Thyagarajan , K. *Optical Electronics*, Cambridge University Press, 2008.
Reference book
1. Yariv ,A. *Quantum Electronics* , 3 edition, Wiley; (1989).

PD300 Minor Project   **L0-T0-P3-CH6-CR3**

PD350 Seminar   **L0-T0-P2-CH4-CR2**

Chemistry

SEMESTER I

CD101 Chemistry I   **L2-T0-P2-CH6-CR4**

Unit I

Structure of atom, Hund's rule, Aufbau principle, Pauli's exclusion principle.

Periodic Properties:

Periodicity of the elements, shielding, effective nuclear charge, Slater's rule, the size of the atoms, atomic, covalent and van der Waals radii, ionization energy, electron affinity, electronegativity.

Unit II

Reactivity effects:

Hybridization (sp, sp^2, sp^3) of organic molecules, Inductive effects, Hyperconjugation, Electromeric effect, Mesomeric effect, Resonance theory, Tautomerism, Steric effect, Strain theory, Conformation of substituted and unsubstituted cyclohexane

Nomenclature:

IUPAC nomenclature of organic compounds including bicyclic compounds

Alkanes:

Preparation, properties and reactions

Alkenes:

Preparation, properties and reactions, Cis-trans isomerism, Markownikoff's and anti-Markownikoff's addition rules, Saytzeff rule

Unit-III

First Law of Thermodynamics:

Thermodynamics terms, state and path functions, concept of heat and work, internal energy, enthalpy, first law of thermodynamics; w, q, ΔU and ΔH for expansion and compression of ideal gases, heat capacities, physical change, standard enthalpies of physical and chemical changes, Hess's law, Kirchhoff's law.

Second Law of Thermodynamics:

Spontaneous processes, Carnot cycle, entropy, criteria of spontaneity, statements of the second law of thermodynamics, entropy changes, Clausius inequality, Gibbs energy, Helmholtz energy. Third law of thermodynamics.

Solutions:

Ideal and non-ideal solutions.

Colligative properties.

Practical:

7. Preparation of buffer solution and measurement of pH.
8. Viscosity measurement of solution.
9. Conductometric acid-base titration.
10. Measurement surface tension of liquid by stalagmometer.
11. Verification of Beer-Lamberts law.
12. Titration of a mixture of AcOH, HCl and $CuSO_4$ by conductometric method.

Textbooks
4. Lee, J. D. *Concise Inorganic Chemistry,5thEdn.* (Chapman & Hall, 2002).
5. Viswanathan, B., Raghavan, P. S. *Practical Physical Chemistry* (Viva Books Private Limited, 2005).
6. Carey, F. A., Sundberg, R. J. *Advanced Organic Chemistry, 4th ed.,* (Plenum Publishers, 2001).

Reference Books
4. Atkins, P., Paula, J. de. *Elements of Physical Chemistry, 4th Edn.* (Oxford University Press, 2005).
5. Puri, B. R., Sharma, L. R., Pathania, M. S. *Principles of Physical Chemistry, 2nd Edn.* (Shoban Lal Nagin Chand and Co. 1980).
6. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).

Semester II

CD102 : Chemistry-II   L2-T0-P2-CH6-CR4

Unit I
Structure and Bonding:
Valence Bond and LCAO-MO theory, bonding in homonuclear diatomic molecules, covalent and ionic bonding, resonance, formal charge, hybridization, VSEPR model. Polarizability of cations and anions, Fazan's rules.

Unit II
Fundamental reactions of organic molecules:
Chemical reactions and mechanism, nucleophile and electrophile, substitution and elimination reactions, addition reactions, condensation reactions, rearrangement reactions.

Stereochemistry:
Optical isomerism, Chirality, racemic mixture, relative and absolute configuration determination, Fisher, Newman and Sawhorse representation, D-L notation, R/S and E/Z nomenclature

Reactive intermediates:
Carbocation, carbanion, carbene, nitrene, benzyne-Generation, stability and reactions

Unit III
Properties of gases and liquids:
Equations of state, kinetic model of gases, collision theory, real gases, Maxwell distribution of molecular speeds, qualitative description of the structure of liquids, surface tension and viscosity

Electrochemistry:
Conduction in electrolyte solutions, ionic mobility, Kohlrausch law, Ostwald's dilution law, transport number, Debye-Huckel Limiting Law, electrochemical cells, EMF, Nernst equation

Rate of reactions:
Rate equations of zero, first, second, pseudo 1st order reactions, determination of order of a reaction, activation energy, activated complex theory, collision theory.

Practical:
Unit I
Preliminary investigations and qualitative analysis of solid organic compounds with functional groups detection.

Unit II: Qualitative Analysis of Inorganic Mixtures (excluding interfering radicals).

Textbooks*
6. Atkins, P., Paula, J. de. *Elements of Physical Chemistry*, *4th Edn*. (Oxford University Press, 2005).
7. Shriver, D. F., Atkins, P. W. *Inorganic Chemistry 3rd Edn,* (Oxford University Press, 1999).
8. Furniss, B. S., Ford, A. J. H., Smith, P. W. H., Tatchell, A., R. *Vogel's Textbook of Practical Organic Chemistry, 5th Edn*. (John Wiley, 1989).
9. Svehla, G., *Vogel's Qualitative Inorganic Analysis, 7th Edn.* (Prentice Hall, 1996).
10. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure* (John Wiley, 2001).

* We could not reduce the number of textbook as this paper involves both theory (inorganic, organic and physical) and practicals (inorganic, and organic).

Reference books
1. Viswanathan, B., Raghavan, P. S. *Practical Physical Chemistry* (Viva Books Private Limited, 2008).
2. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).
3. Vishnoi, *Advanced Practical Organic Chemistry,2nd Revised Edn*. (Vikas Publisher, 2007).

L2-T0-P2-CH6-CR4

Semester III

CD201 : Chemistry-III (For Non-Chemistry Majors)   **L2-T1-P0-CH3-CR3**
Unit-I
Acid -Base concept:
Arrhenius concept, Brønsted-Lowery acids and bases, Lewis acids and bases, Hard soft acids - bases and HSAB principle, Acid and base strength.
Coordination chemistry:
Werner's theory, classification of ligands, coordination number, nomenclature of coordination compounds, isomerism.

Unit-II
Aromaticity and Huckel Rule, Orientation of substituents, Directive influence of substituents, o/p ration, kinetically and thermodynamically controlled reactions
Alkynes:
Preparation, properties and reactions.
Alkyl halides:
Preparation, properties and reactions.

Unit-III

Ionic equilibrium:

Arrhenius theory of electrolytic dissociation, Ostwald dilution law, Dissociation constant of week acids and bases, Ionization of water, pK_w and pH. Salt effect, pH expressions for various neutralization reaction, Henderson- Hasselblak equation, solubility product, common ion effect, Buffer solutions, theory of acid base indicators, acid base titration curves(pH variation).

Textbooks
1. Puri, B. R., Sharma, L. R., Pathania, M. S. *Principles of Physical Chemistry, 2nd Edn.* (Shoban Lal Nagin Chand and Co. 1980).
2. Shriver, D. F., Atkins, P. W. *Inorganic Chemistry 3rd Edn.* (Oxford University Press, 1999).
3. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure* (John Wiley, 2001).

Reference Books
1. Barrow, G. M. *Physical Chemistry, 5th Edn.* (McGraw Hill, 2007).
2. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).
3. Huheey, J. E., Keiter, E. A., Keiter, R. L., Medhi, O. K., *Inorganic Chemistry: Principles of Structure and Reactivity*, *4th Edn.* (Pearson Education, 2006).

L2-T0-P2-CH6-CR4

CD203 : Physical chemistry-I   **L2-T1-P0-CH3-CR3**

Second law of thermodynamics:

Maxwel relations, entropy, variation of entropy with temperature and pressure.

Third law of thermodynamics:

Residual entropy, spectroscopic entropy, Tautons law

Free energy functions:

Gibbs and Helmholtz free energy, variation of free energy with temperature and pressure criteria of spontaneity, Gibbs-Helmholtz equation.

*System of variable composition*s:

Partial Molar quantity, chemical potential, Gibbs-Duhem equation, thermodynamic functions of mixing, excess thermodynamic functions.

Phase equilibria:

Thermodynamic derivation of the phase rule, application of phase diagram to one component system (H_2O, S), Clausius-Clapeyron equation.

Gaseous state:

Kinetic theory and its limitations, kinetic gas equation, Distribution of molecular speed, most probable, root mean square and average velocity. Real gases and ideal gases, Boyle temperature, critical temperature, equation of state for real gases, compression factor, the law of corresponding state, Second virial coefficient. Fugacity, fugacity and equilibrium constant for real gases.

Textbooks
1. Atkins, P. W. *Physical Chemistry, 7th Edn*. (Oxford University Press, 2006).
2. Levine, I. *Physical Chemistry, 5th Edn.* (Tata McGraw Hill, 2007).

Reference books
1. Berry, R. S., Rice, S. A., Ross, J. *Physical Chemistry*, *2nd Edn.* (Oxford University Press, 2000).

2. Moore, W. J. *Physical chemistry, 5th Edn.*(Orient Longmann, 1990).

CD205 : Organic Chemistry – I   L3-T0-P0-CH3-CR3

Some important concepts:
Strength of organic acids and bases, Basicity and nucleophilicity of organic compounds, Aromaticity and Huckel Rule, Orientation of substituents, Directive influence of substituents, o/p ratio, kinetically controlled reaction , thermodynamically controlled reaction, Diffusion controlled reaction.
Aromatic hydrocarbons:
Preparation, properties and reactions of monocyclic and polynuclear hydrocarbons
Alcohols:
1^0, 2^0, 3^0 classification of alcohols and their characteristic reactions, Preparation, properties and reactions, Polyhydric alcohols
Phenols:
Preparation, properties and reactions, Acidity

Textbooks
1. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure* (John Wiley, 2001).
2. Ghosh, S. K., *Advanced General Organic Chemistry, 3rd Edn.* (New Central Book Agency (P) Ltd., 2008).

Reference Books
1. House, H. O. *Modern Synthetic Reaction*, (W. A. Benjamin Inc. 1972).
2. Norman, R. O. C., Coxon, J. M. *Principles in Organic Synthesis*, *3rd Edn.* (Blackie Academic & Professional, 1993).

CD207 : Inorganic Chemistry-I   L2-T1-P0-CH3-CR3

Hydrogen bonding, Metallic bonding, band theory

Classification of hard and soft acids and bases, HSAB principle and its applications.

Oxidation and Reduction: Oxidation numbers, redox potential, half-cell reaction, Nernst equation, Electrochemical series, Latimer and Frost diagrams.

Statistical methods of analysis: Types of errors, accuracy, precision, significant figures, standard and mean deviations, f-test and t-test.

Nuclear chemistry: Nuclear stability, isotopes, isobars and isotones, laws of radioactivity, artificial radioactivity, nuclear fission and fusion, radiocarbon dating.

Textbooks
1. Huheey, J. E., Keiter, E. A., Keiter, R. L., Medhi, O. K. *Inorganic Chemistry: Principles of Structure and Reactivity*, *4th Edn*. (Pearson Education, 2006).
2. Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M. J. K. *Vogel's Quantitative Chemical Analysis*, *6th Edn*. (Pearson Education, 1999).

3. Arnikar, H. J. *Essentials of Nuclear Chemistry*, *4th Edn.* (New Age International, 2008).

Reference Books
1. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F. *Inorganic Chemistry*, (Oxford University Press, 2006).
2. Wulfsberg, G. *Inorganic Chemistry*, *2nd Edn.* (Viva Books Private Limited, 2010).

CD209 : Chemistry Laboratory-I   **L0-T0-P3-CH6-CR3**

Inorganic:
Qualitative Analysis of Inorganic Mixtures (including interfering radical)

Physical:
1. Thermochemistry experiment (determination of heat of hydration)
2. Electrochemistry (determination of redox potential)
3. Chemical kinetics (determination of rate constant of hydrolysis of methyl acetate catalysed by an acid)
4. Conductometric/potentiometric (determination of equivalence conductance of an electrolyte at infinite dilution)
5. UV-VIS spectrophotometric (determination of dissociation constant of ferrithiocyanate complex).

Textbooks
1. Svehla, G. *Vogel's Qualitative Inorganic Analysis, 7th Edn.* (Prentice Hall, 1996).
2. Yadav, J. B. *Advance Practical Physical Chemistry*, (Goel Publishing House, Meerut, 2008).

Reference Books
1. Viswanathan, B., Raghavan, P. S. *Practical Physical Chemistry* (Viva Books Private Limited, 2008).
2. Gurdeep, R. *Advanced Practical Inorganic Chemistry, 1st Edn.* (Goel Publishing, 1983).

CD211 Chemistry Laboratory-II (For Non-Chemistry Majors**)**   **L0-T0-P2-CH4-CR2**

Unit-I Qualitative analysis of inorganic mixture (including interfering radicals)

Unit II
1. Chemical kinetics (determination of rate constant of hydrolysis of methyl acetate catalysed by an acid)
2. Conductometric/potentiometric (determination of equivalence conductance of an electrolyte at infinite dilution)
3. UV-VIS spectrophotometric (determination of composition of the complex formed between iron and thiocyanate ions).

Textbooks
1. Svehla, G. *Vogel's Qualitative Inorganic Analysis, 7th Edn.* (Prentice Hall, 1996).
2. Yadav, J. B. *Advance Practical Physical Chemistry*, (Goel Publishing House, Meerut, 2008).

Reference Books
1. Viswanathan, B., Raghavan, P. S. *Practical Physical Chemistry* (Viva Books Private Limited, 2008).
2. Gurdeep, R. *Advanced Practical Inorganic Chemistry, 1ˢᵗ Edn.* (Goel Publishing, 1983).

Semester IV

CD202 Chemistry-IV (For Non-Chemistry Majors)   L2-T1-P0-CH3-CR3

Unit-I
Nature of Metal –Ligand Bonding in Complexes:
Crystal Field Theory (CFT): Important features of crystal field theory, Crystal field splitting of d-orbitals in octahedral, square planar and tetrahedral complexes. CFSE, factors affecting the magnitude of Δ, strong and weak field ligands and spectrochemical series. Distortion of octahedral complexes and Jahn Teller Effect.

Organometallic Chemistry:
Definition, classification of ligands based on their electron donating ability, electron counting rules.

Unit-II
Amines:
Classification of amines, preparations, properties and reactions

Aromatic hydrocarbons:
Preparation, properties and reactions of monocyclic and polynuclear hydrocarbons

Alcohols:
1^0, 2^0, 3^0 classification of alcohols and their characteristic reactions General methods of preparation, properties and reactions, Polyhydric alcohols

Unit-III
Quantum chemistry:
Plank law, photoelectric effect, de Broglei equation. Wave function and probability. Operators, Schrodinger equation, postulates of quantum mechanics.

Spectroscopy:
Electromagnetic radiation, width and intensity of spectral absorption.
UV-VIS, IR and Rotational spectroscopy.

Textbooks*
1. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure*, (John Wiley, 2001).
2. Meissler, G. L., Tarr, D. A. *Inorganic Chemistry*, 3rd *Edn.* (Prentice Hall, 2003).
3. Chandra, A. K. *Introductory Quantum Mechanics,* 3rd Edn. (Tata McGraw Hill Publishing Company, New Delhi, 2002).
4. Banwell, C. N., McCash, E. M. *Fundamentals of Molecular Spectroscopy,* (Tata McGraw Hill, 1994).

* *We could not reduce the number of textbook as this paper involves courses on inorganic, organic and quantum chemistry as well as spectroscopy.*

Reference Books
1. Levine, I. *Physical Chemistry*, 5*th* *Edn.* (Tata McGraw Hill, 2007).
2. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).

CD204 Physical Chemistry-II   **L2-T1-P0-CH3-CR3**

Electrochemistry:
Types of electrodes, types of cells, EMF, electrochemical series, application of EMF measurement (calculation of ΔG, ΔH and ΔS), Nernst equation, potentiometric titration, batteries, fuel cell, corrosion and its prevention. Electrical double layer, polarization and overvoltage.

Chemical kinetics:
Steady state approximation, kinetics of complex reactions (opposing 1st order, consecutive, parallel, chain, and photochemical reactions). Lindemann theory of unimolecular reaction, fast reactions and oscillatory reactions.

Catalysis:
Classification, characteristic of catalytic reaction, homogeneous and heterogeneous catalysis, acid base catalysis, autocatalysis, inhibitor, enzyme catalysis, Michaelis-Menten equation, lineweaver -burk plot.

Adsorption:
Difference between absorption and adsorption, physical and chemical adsorption, factors influencing adsorption, adsorption isotherms (Langmuir, Freundlich and BET), application of adsorption isotherms for surface area measurement, application of adsorption.

Macromolecules:
Classification of polymers, number average and weight average molar masses of polymers, techniques for determination of molar masses of polymers, electrically conducting polymers and their applications.

Colloids:
Definition of colloids and crystalloids, classification of colloids, preparation and purification techniques of colloidal dispersion, Tyndal effect, Brownian movement, electrophoresis, electro-osmosis, protective colloids, gold number, zeta potential, lyophilic, lyophobic, ampiphilic colloids, gels, emulsifiers, stabilization by emulsification, micelles, critical micelles concentration(CMC).

Textbooks
1. Atkins, P. W. *Physical Chemistry*, 7th *Edn.* (Oxford University Press, 2006).
2. Moore, W. J. *Physical Chemistry*, 5th *Edn.* (Orient Longmann, 1990).

Reference Books
1. Adamson, A. W., Gast, A. P. *Physical Chemistry of Surfaces* (John Wiley and Sons, 1997).
2. Laidler, K. J., *Chemical Kinetics, 3rd Edn.* (Harper and Row, 1987).

CD206 Organic Chemistry-II   **(L2-T1-P0-CH4-CR3**

Ethers:
Preparation, properties and reactions
Amines:
1^0, 2^0, 3^0 classification of amines, Preparation, properties and reactions, Basicity, Diazonium ions and their synthetic utility.
Carbonyl compounds:
Preparation, properties and reactions, Comparisons of reactivity of aldehydes and ketones
Carboxylic acids and its derivatives:
Preparation, properties and reactions, Acidity of substituted benzoic acid, Acid chlorides, Esters, active methylene compounds and synthetic uses of ethyl acetoacetate and diethyl malonate
Carbohydrates:
Monosaccharide, Disaccharide and polysaccharides-their reactions, Configuration and conformation of anomers of glucose, open chain and ring structure of glucose and fructose, mutarotation, epimers

Textbooks
1. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure* (John Wiley, 2001).
2. Ghosh, S. K., *Advanced General Organic Chemistry, 3rd Edn,* (New Central Book Agency (P) Ltd., 2008).

Reference books
1. House, H. O. *Modern Synthetic Reaction*, (W. A. Benjamin Inc. 1972).
2. Norman, R. O. C., Coxon, J. M. *Principles in Organic Synthesis*, *3rd Edn.* (Blackie Academic & Professional, 1993).
3. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).

CD208 Inorganic Chemistry-II   **L2-T1-P0-CH3-CR3**

*Chemistry of Group 13 Elements***:**
The elements and their properties; Chemistry of Boron; Borides; Boron hydrides(Preparation, structure, bonding, reactions and properties); Wade's rule, Boron halides, Boron-Nitrogen chemistry; Boron-Oxygen chemistry.
Chemistry of Group 14 Elements:
The elements and their properties; Allotropy of Carbon: Diamond, Graphite, and Fullerenes; Intercalation); Carbides; Carbon halides and oxides; Compounds with C-N and C-S bonds; Silane reagents, Synthesis, properties and modifications on polysilanes. Condensation vs catenation, Silicides, Silicone Polymers; Oxygen compounds of silicon.
Chemistry of Group 15 Elements:
The elements and their properties; Nitrides; Hydrides of Nitrogen; Oxides of Nitrogen; Oxo acids and anions of Nitrogen; Activation of Nitrogen; Reaction of coordinated NO; Phosphides; Phosphorous halides and oxides; Oxoacids of phosphorous and their salts.

Textbooks
1. Greenwood, N. N., Earnshaw, A. *Chemistry of the Elements* (Pergamon Press, 1984).
2. Cotton, F. A., Wilkinson, G. *Advanced Inorganic Chemistry*, *5th Edn.* (John Wiley, 1988).

Reference Books
1. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F. *Inorganic Chemistry*, (Oxford University Press, 2006).
2. Wulfsberg, G. *Inorganic Chemistry*, *2nd Edn.* (Viva Books Private Limited, 2010).

CD210 Chemistry Laboratory-III   L0-T0-P3-CH6-CR3

Unit I:
Volumetric estimation of iron and copper, Determination of water of crystallization in a molecule of Hydrated Mohr's salt, Estimation of total Hardness of water.

Unit II:
Detection of N, S, and halogens in organic compounds
Preparation of suitable derivatives of functional groups and determination of mp/bp
One step organic preparation using common organic reactions such as nitration, acetylation, benzoylation, diazo- coupling etc.

Textbooks
1. Mendham J., Denney R. C., Barnes J. D., Thomas M. J. K. *Vogel's Text Book of Quantitative Chemical Analysis", 6th Edn.* (Pearson Education, 2004).
2. Furniss, B. S., Ford, A. J. H., Smith, P. W. H., Tatchell, A., R. *Vogel's Textbook of Practical Organic Chemistry, 5th Edn.* (John Wiley, 1989).

Reference Books
1. Vishnoi, *Advanced Practical Organic Chemistry, 2nd Revised Edn.* (Vikas Publisher, 2007).
2. Gurdeep, R. *Advanced Practical Inorganic Chemistry, 1st Edn.* (Goel Publishing, 1983).

CD212 Chemistry Laboratory-IV (For Non-Chemistry Majors)   L0-T0-P2-CH4-CR2

Unit-I:
Volumetric estimation of iron and copper.
Unit-II:
Preparation of suitable derivatives of functional groups and determination of mp/bp
One step preparation using common organic reactions such as nitration, acetylation etc.

Textbooks
1. Mendham J., Denney R. C., Barnes J. D., Thomas M. J. K. *Vogel's Text Book of Quantitative Chemical Analysis", 6th Edn.* (Pearson Education, 2004).
2. Furniss, B. S., Ford, A. J. H., Smith, P. W. H., Tatchell, A., R. *Vogel's Textbook of Practical Organic Chemistry, 5th Edn.* (John Wiley, 1989).

Reference Books
1. Vishnoi, *Advanced Practical Organic Chemistry, 2nd Revised Edn.* (Vikas Publisher, 2007).
2. Gurdeep, R. *Advanced Practical Inorganic Chemistry, 1st Edn.* (Goel Publishing, 1983).

Semester V
CD301 Physical Chemistry-III   (L3-T0-P0-CH3-CR3

Chemical equilibrium:
Reversible reaction, law of mass action, equilibrium constant K, thermodynamic treatment of the law of mass action, relationship among K_p, K_c and K_x. Temperature and pressure dependence of chemical equilibrium, vant Hoffs equation, Le Chatelier principle.

Ionic equilibrium:
Arrhenius theory of electrolytic dissociation, Ostwald dilution law, Dissociation constant of week acids and bases, Ionization of water, pK_w and pH. Salt effect, pH expressions for various neutralization reaction, Henderson- Hasselblak equation, solubility product, common ion effect, Buffer solutions, theory of acid base indicators, acid base titration curves(pH variation).

Solutions:
Ideal and non –ideal solutions, colligative properties, Gibbs-Duhem-Marcules equation, Vapour pressure- composition and boiling point composition curves for completely miscible binary solutions, Partially miscible liquids, azeotropic mixtures, lever rule, lower and upper critical solution temperature, Immiscible liquids, fractional distillation and steam distillation.

Phase equilibria:
Phase diagram for two component systems with eutectic (Pb-Ag, $KI-H_2O$), congruent system (phenol-aniline, $FeCl_6-H_2O$) and incongruent ($NaCl-H_2O$) system. Peritectic reactions. Three component system, tie line, Nernst distribution law and its application.

Textbooks
1. Atkins, P. W. *Physical chemistry*, *7th Edn*. (Oxford University Press, 2006).
2. Castellan, G. W. *Physical Chemistry, 4th Edn*. (McGraw Hill, 1999).

Reference books
1. Berry, R. S., Rice, S. A., J. Ross, *Physical Chemistry, 2nd Edn*. (Oxford University Press, 2000).
2. Mcquarrie, D. A., Simon, J. D. *Physical Chemistry, 1st Edn*. (Viva Books Private Limited, 2008).
3. Moore, W. J. *Physical Chemistry, 5th Edn,* (Orient Longmann, 1990).

CD303 Organic Chemistry – III   L3-T0-P0-CH3-CR3

Stereochemistry:
Conformation of acyclic systems, Free and restricted rotation, Rotamers, their stability and nomenclature, Racemisation and resolution of racemic mixtures, Concept of topocity and prostereoisomerism, Diasteromerism, Conformation of cyclic systems, angle strain, torsional strain
Optical isomerism in disubstituted cyclohexane.

Fats and Oils:
Structure, physical properties and analysis of fats and oils
Proteins:
Amino acids-properties, reactions; peptides, Importance of proteins, Primary, secondary and tertiary structure of proteins, denaturation, isoelectric point

Heterocyclic compounds:
IUPAC nomenclature, synthesis, structure and bonding, properties (basicity, aromaticity)
Organic photochemistry:
Theory of photochemistry, Jablonski diagram, Frank-Condon principle, Photosensitisers, Einstein's law of photochemical equivalence, typical photoreactions such as photoreaction of benzophenone, photolytic reactions of ketones.

Textbooks
1. Finar, I. L. *Organic Chemistry, Vol 1, 6th Edn*. (ELBS, 1997).
2. Finar, I. L. *Organic Chemistry, Vol 2, 6th Edn*. (ELBS, 1997).

Reference Books
1. Rohatgi-Mukherjee, K. K. *Fundamentals of Photochemistry, 2nd Revised Edn*, (New Age international Publishers, 2006).
2. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).
3. Kalsi, P. S. *Stereochemistry, Conformation and Mechanism* (New Age international Publishers, 2009).

CD305 Inorganic Chemistry III   L3-T0-P0-CH3-CR3

The chemistry of the halogens and the noble gases:
Halogen family: Electronic structure and valences, preparation, interhalogen compounds, polyhalides, pseudohalogens, charge transfer complexes of halogens, oxides and oxoacids of halogens.
Noble gas family: Atomic and physical properties of the elements, compounds of xenon, bonding in noble gas compounds, compounds of other noble gases.

Coordination chemistry:
Werner's theory, classification of ligands, coordination number, nomenclature of coordination compounds, isomerism.

Aspects of d- block elements:
Elements of first transition series and their comparison with the second and third series, general periodic trends, chemistry of various oxidation states of first row transition metals and their comparison based on electronic configuration. The splitting of d-orbitals in octahedral, tetrahedral and square planar fields.

Magnetic properties of transition metal complexes:
Dia, para, ferro and antiferromagnetic behaviour of compounds, Curie-Weiss law, Curie temperature, Neel temperature.

Textbooks
1. Huheey, J. E., Keiter, E. A., Keiter, R. L, Medhi, O. K. *Principles of Structure and Reactivity, 1st Ed.*, (Pearson Education, 2006).
2. Dutta, R. L., Syamal, A. *Elements of Magnetochemistry, 2nd Edn.* (East-West Press, New Delhi, 1993).
3. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F. *Inorganic Chemistry*, (Oxford University Press, 2006).

Reference Books
1. Greenwood, N. N., Earnshaw, A. *Chemistry of the Elements* (Pergamon Press, 1984).
2. Cotton, F. A., Wilkinson, G. *Advanced Inorganic Chemistry*, *5th Edn.* (John Wiley, 1988).

CD307 Quantum Chemistry   L3-T0-P0-CH3-CR3

Origin of the quantum theory of matter:
Franck- Hertz experiment, Photoelectric effect, Compton effect, Black body radiation, Planck's law, Weins law, Bohr's theory and atomic spectra.

Matter wave:
Wave-particle duality, uncertainty principle.
Operators and wave functions in quantum mechanics: Operator principles, Hamiltonian and Hermitian operators, postulates of quantum mechanics, Schrödinger equation, free particle, particle in a box (one and three dimensional)

Wave mechanics of simple systems: One dimensional harmonic oscillator, rigid rotator, the hydrogen atom, angular momentum, electron spin, spin-orbit coupling.

Molecular orbital theory: Born-Oppenheimer approximation, LCAO approximation, LCAO MO of H_2 and H_2^+, VB. Theory. Comparison of VB and MO.

Approximate methods:
Basic idea of variation and perturbation theory.

Many electron wave function:
Basic idea of Hartree Fock wave function and SCF MO.

Textbooks
1. Levine, I. N. *Quantum Chemistry* (Pearson Education, Inc. 2004).
2. Chandra, A. K. *Introductory Quantum Mechanics, 3rd Edn.* (Tata McGraw Hill Publishing Company, New Delhi, 2002).

Reference Books
1. McQuarrie, D. A. *Quantum Chemistry* (Viva Books Private Limited, 2003).
2. Prasad, R. K. *Quantum Chemistry* (Wiley Eastern Limited, 2006).

CD309: Chemistry laboratory-III   **L0-T0-P4-CH8-CR4**

Inorganic:
Inorganic preparations, Gravimetric estimation of copper and Nickel. Paper chromatographic separation of Ag(I),Hg(II) and Pb(II) ions,

Organic:
Qualitative Analysis of solid and liquid organic compounds containing one or more functional groups.
Two step organic preparation using common reagents such as Benzil-Benzillic acid rearrangement, Beckman rearrangement etc.

Physical:
Rate constant at elevated temperatures, energy of activation
Polarimetry, Partition function, Critical solution temperature etc.

Textbooks
1. Mendham, J., Danney, R. C., Barnes, J. D., Thomas, M. *Vogel's Textbook of Quantitative Chemical Analysis* (Peterson Education, 2004).
2. Viswanathan, B., Raghavan, P. S. *Practical Physical Chemistry* (Viva Books Pvt. Ltd. 2005).
3. Pasto, D., Johnson, C., Miller, M. *Experiments and Techniques in Organic Chemistry* (Prentice Hall, 1992).

Reference Books
1. Furniss, B. S., Ford, A. J. H., Smith, P. W. H., Tatchell, A., R. *Vogel's Textbook of Practical Organic Chemistry, 5th Ed*. (John Wiley, 1989).
2. Gurdeep, R. *Advanced Practical Inorganic Chemistry, 1st Ed.* (Goel Publishing, 1983).

Semester VI

CD302 Physical Chemistry-IV   **L3-T0-P0-CH3-CR3**
Symmetry and group theory:
Symmetry elements and operators, point groups, determination of point groups of simple molecules, interpretation of character tables, reducible and irreducible representations.

Solid state:
Crystallographic axes, lattice points, lattice constants, crystal classes, Bravais lattice, direction vector, crystal planes, miller indices, planar, atomic and volume density, radius ratio, radius ratio and coordination number. Defects in crystals, point defect, line defects and planar defects.

Diffraction techniques:
Bragg's law, diffraction condition for crystal lattice, X-ray analysis of crystal structure, structure factor, Neutron and electron diffraction.

Electrical properties of solids:
Conductor, semiconductor and insulators, band theory for metallic and non-metallic conductor. Semiconductors, p-n and p-n-p junction, diodes and transistors, variation of conductivity of semiconductors with temperature, superconductivity.

Textbooks
1. Atkins, P. W. *Physical chemistry, 7th Edn*. (Oxford University Press, 2006).
2. Cotton, F. A. *Chemical application of group theory, 3rd Edn.* (Wiley, 2002).

Reference Books
1. Mcquarrie, D. A., Simon, J. D. *Physical Chemistry, 1st Edn*. (Viva Books Private Limited, 2008)
2. Moore, W. J. *Physical Chemistry, 5th Edn.* (Orient Longmann, 1990).

CD304 Organic Chemistry IV   **L3-T0-P0-CH3-CR3**

Oxidation and Reduction:
Some common oxidizing agents-Chromium oxide, selenium dioxide, lead tetracetate, periodic acid, potassium permanganate, osmium tetroxide etc. Oppenauer oxidation, Some common reducing agents-Reduction by metals, Complex metal hydrides etc.
Wolf Kishner reduction, Meerwein - Pondrof - Verley reduction, Rosenmund reduction
*Addition***:**
Peroxide effect, Addition of halogens and halogen acids to olefinic double bonds, hydrogenation of alkenes and alkynes, Addition of HCN and Grignard reagent to carbonyl compound.
Elimination Reactions:
E1 and E2 mechanism, Hoffmann rule.

Substitution reactions:
Free radical substitution reaction (e.g. halogenations of alkanes), Nucleophilic substitution reaction – S_N1, S_N2, S_Ni, electrophilic substitution reaction, e.g. nitration, sulphonation, halogenations, Friedel Craft's alkylation and acylation reactions.
*Rearrangement reactions***:**
Wagner-Meerwein, Wolf, Hoffmann, Lossen, Curtius, Schmidt, Beckmann, Benzil-Benzilic acid, Baeyer-Villiger

Other name reactions:
Aldol condensation, Michael condensation, Knovenagel reaction, Reformatsky reaction, Perkin condensation, Willgerodt reaction, Leuckert reaction, Wittig reaction

Textbooks
1. Smith, M. B., March, J. *March's Advanced Organic Chemistry, Reaction Mechanism and Structure*, (John Wiley, 2001).
2. Clayden, J., Greeves, N., Warren, S., Wothers, P. *Organic Chemistry* (Oxford University Press, 2008).

Reference Books
1. House, H. O. *Modern Synthetic Reaction* (W. A. Benjamin Inc. 1972).
2. Norman, R. O. C., Coxon, J. M. *Principles in Organic Synthesis*, *3rd Ed.* (Blackie Academic & Professional, 1993).
3. Sykes, P. *Guide Book to Mechanism in Organic Chemistry*, *6th Ed.* (Prentice Hill, Longman, 1996).

CD306   Inorganic Chemistry-IV   L3-T0-P0-CH3-CR3

Introduction to symmetry elements and operations, point group (C_{2v} and C_{3v}).

Introduction to Organometallic Chemistry:
Classification of ligands, EAN rule, bonding in metal carbonyl and olefin complexes.

Metal-ligand equilibria in solution:
Stepwise and overall formation constants. Factors affecting the stability of metal complexes, chelate effect, determination of binary formation constants, inert and labile complexes.

Bioinorganic chemistry:
Essential and trace elements in biological systems, heme-protiens– hemoglobin, myoglobin, non-heme protiens- hemerythrin, ferritin and transferrin.

Textbooks
1. Huheey, J. E., Keiter, E. A., Keiter, R. L, Medhi, O. K. *Principles of Structure and Reactivity, 1st Edn.* (Pearson Education, 2006).
2. Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M. *Advanced Inorganic Chemistry, 6th Edn.* (John Wiley, 1999).
3. Cotton, F.A. *Chemical Application of Group Theory, 3rd Edn.* (John Wiley & Sons, 1999).

Reference Books
1. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F., *Inorganic Chemistry,* (Oxford University Press, 2006).
2. Bertini, I., Gray, H. B., Lippard, S. J., Valentine, J. S. *Bioinorganic Chemistry,* (Viva Books Pvt. Ltd. 2004).

CD308: Principles and Applications of Spectroscopy   L3-T0-P0-CH3-CR3
Basic principle of spectroscopy:
Interaction of matter and electromagnetic radiation, Factors affecting widths and intensity of spectral lines.
 IR spectroscopy:
Principle, Instrumentation, and applications of IR spectroscopy.
Electronic spectroscopy:

Basic principle, Lambert-Beer law, types of electronic transitions in organic molecules, applications in functional group detection.

NMR spectroscopy:
Theory, origin of chemical shifts, spin-spin coupling, relaxation processes.

Textbooks
1. Banwell, C. N., McCash, E. M. *Fundamentals of Molecular Spectroscopy* (Tata McGraw Hill, 1994).
2. Kemp, W. *Organic Spectroscopy, 3rd Ed.* (McMillan Press, 1991).

Reference Books
1. Silverstein, *Spectrometric Identification of Organic Compounds, 7th Edn.* (2005)
2. Chandra, S. *Molecular Spectroscopy* (Narosa, 2009).

CD310: Chemistry laboratory-IV   **L0-T0-P4-CH8-CR4**
Computational practicals
1. DOS, WINDOWS and UNIX operating systems
2. Programming with FORTRAN77
3. Numerical methods in chemistry (using MS EXCEL)
4. Generation of an EXCEL chart to display the variation of the H_{1s} radial function with radial distance from the nucleus.
5. Generation of an EXCEL chart to display the variation of the H_{2s} radial function with radial distance from the nucleus.
6. Generation of an EXCEL chart to display the variation of the H_{2p} radial function with radial distance from the nucleus.
7. EXCEL charts for the hydrogenic radial distribution functions.
8. Generation of the numerical radial wave function for the helium atom "1s' atomic orbital.
9. Generation of the numerical radial wave functions Li_{1s} and Li_{2s} orbitals. Etc
10. Quantum Chemical Calculations with GAUSSIAN and GAMESS

Textbooks
1. Balagurusamy, E. *Numerical Methods*, (Tata McGraw-Hill Publishing Company Limited, 2002)
2. Billo, E. J. *Excel for Chemists: A Comprehensive Guide*, (Willy-VCH, 2001).

Reference Book
1. Quinn, C. M. *Computational Quantum Chemistry: An Interactive Guide to Basis Set Theory*, (Academic Press, 2002).

Mathematics

SEMESTER- I

MD101 Mathematics I   **L2-T1-P0-CH3-CR3**

Inequalities involving arithmetic, geometric, and harmonic means, Cauchy-Schwarz inequality.

Real numbers, Sequences, Cauchy sequence, Cauchy's General principle of convergence, Subsequences, Convergence and divergence of monotonic sequences, Sandwich theorem;

Infinite series, statements of basic properties of infinite series (without proofs), Absolute and conditional convergences, Test for convergence: Comparison test, Ratio test, Raabe's test, Leibnitz's test.

Limit, Continuity, Differentiability, Rolle's theorem, Mean value theorems and applications; Linear Approximation, Newton and Picard method, Taylor's theorem (one variable), Approximation by polynomials, Critical points, convexity, curvature of plane curves, Asymptotes, Curve tracing: tracing of catenary, cissoids, asteroid, cycloid, folium of Descartes, cardiod, lemniscate.

Functions of two or more variables, limit, continuity, differentiability, chain rule, Euler's theorem on homogeneous functions; Directional derivatives, Gradient vectors and tangent planes, partial derivatives, Taylor's theorem (statement only) and criteria for maxima/minima/saddle points, Lagrange's method of multipliers.

Improper integrals, Numerical Integration: Trapezoidal and Simpson's rule; error bounds.

Textbooks
3. Thomas and Finney: *Calculus and Analytic Geometry*,(Pearson Education, New Delhi,1998)
.
4. Bartle,R. G. & Sherbert, D. R. *Introduction to Real Analysis*,(John Wiley and Sons, New Delhi, 2007).

Reference Books
1. Apostol, T. M. *Calculus, Vol I & II*, 2ND ed., (John Wiley and Sons, New Delhi, 2007)
2. Mapa, S.K. *Higher Algebra*, (Asoke Prakashan, Kolkata, 2006).

SEMESTER- II

MD102 Mathematics II   **L2-T1-P0-CH3-CR3**

Ordinary differential equations: Basic definitions: order and degree of differential equation, primitives, solutions of differential equations, Integral curves, isoclines, formulation of ODE. Linear, non-linear differential equations. Variables separable, homogeneous, non-homogeneous exact equations and integration factors, equations reducible to first order, Clairaut's equation. Second order Differential Equations: Linear equations with constant coefficients. Standard Methods for solution, Nonhomogeneous, linear with constant coefficients. Method of Variation of Parameter.

Line integral, Double, triple integrals, Jacobian; Surface integrals.
Vector Calculus, vector point function, continuity and differentiation of vector point function, partial derivative of vectors, Curl, Grade, Divergence; Green, Gauss, and Stokes Theorems.

Space co-ordinates, lines and planes, Polar coordinates, Cylinders, Quadric surfaces, Volume, Area, length, volume and surface area of solids of revolution.

Textbooks
1. Thomas and Finney: *Calculus and Analytic Geometry*, Eleventh (Indian) Edition (Pearson Education, New Delhi , 1998).

2. Boyce, William E. and DiPrima, Richard C. *Elementary Differential Equations*, (John Wiley, New Delhi, Indian Edition, 2000).
3. Spiegel, M.R. *Vector Analysis, Schaum's outline series*, (Tata Mc Graw- Hill Education, New Delhi, 2009.)

Note: The first two books do not cover Vector Analysis.

Semester- III

MD201 Introductory Statistics   **L2-T1-P0-CH3-CR3**

Collection of data, methods of collections of primary data, presentation and classification of data, Discrete and continuous variables, Frequency distributions, Graphical representation, cumulative frequency distribution and ogives.

Measure and location of dispersion, the arithmetic mean of group data, properties of arithmetic mean, median and mode; other measures of location: quartiles, deciles and percentiles.
Variance and standard deviation of ungrouped and grouped data, properties of standard deviation.

Moments of higher order, relation between m_r and m_r', skewness and Kurtosis.

Correlation and regression: scatter diagram, coefficients of correlation, linear regression, fitting of regression line, the method of least squares, explained and unexplained variation, coefficient of variation, correlation and regression for grouped data.

Textbooks
1. Medhi, J., *Statistical Methods: An introductory Text*, (New Age International (P) Ltd, New Delhi, 2000).
2. Gupta, S.C. and Kapoor, V. K., *Fundamentals of Mathematical Statistics*, (Sultan Chand. & Company, New Delhi, 2007).

Reference books
1. Feller, W., *An Introduction to Probability Theory and Its Applications*, *Vol. I,* (Wiley, USA, 2005).
2. Uspensky, J.V., *Introduction to Mathematical Probability*, (McGraw Hill, Columbus, 2005).

MD203 Linear Spaces and Complex Numbers   **L2-T1-P0-CH3-CR3**

Algebra of matrices, symmetric, skew symmetric, Hermitian and skew hermitian matrices, rank of a matrix, elementary transformations, reduction to echelon and normal form; System of linear equations, existence and uniqueness of solutions, rank of matrix.

Definitions and examples of vector spaces, elementary properties of R^n and C^n as vector spaces, subspaces, operations on subspaces; linear dependence and independence of vectors, basis and dimension of vector spaces; linear mappings and their algebraic properties; eigen values and eigen vectors, characteristic equation, statement of Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

Complex numbers, geometrical representation, modulus and argument of complex numbers; exponential and trigonometric functions of a complex variable; theorems on limit and continuity of a function of complex variable, differentiability, analytic function, Cauchy-Riemann equations, Harmonic functions, derivatives of elementary functions; Contour integration, Cauchy's integral theorem, Cauchy's integral formula.

Textbooks
1. Churchill R. V., Brown, J. W., *Complex Variables and Applications,* (Tata McGraw-Hill, New Delhi, 2006).
2. Hoffman K. and Kunze, R., *Linear Algebra*, 2nd Edition (Prentice Hall, New Delhi, 2008).

Reference books
1. Datta, K. B., *Matrix and Linear Algebra*, (Prentice Hall of India, New Delhi. 2000).
2. Lang, S., *Linear Algebra*, (Springer-Verlag, New Delhi, 2006).
3. Spiegel, M. R., *Theory and Problems of Complex Variables*, Schum's Outline Series (Tata McGraw-Hill, New Delhi, 2000).

MD205 Algebra   L2-T1-P0-CH3-CR3

Relations, Equivalence relations, Mapping, and binary operations, Groups, subgroups, cosets, Lagrange's theorem, Subgroup generated by a set, cyclic groups, permutation groups, normal subgroups, quotient groups.

Polynomials, Euclid's Algorithm greatest common divisor, unique factorization of polynomials over a field F of numbers (statement only), Fundamental theorem of Algebra (statement only), roots and their multiplicity, Irreducible polynomials over Q, R, C. Relationship between roots and the coefficients, Fundamental theorem of symmetric polynomial (without proof) Evaluation of symmetric functions of roots. Rational roots of polynomials with integral coefficients.

Descartes rule of sign, Strum's theorem (statement only) Solution of cubic equation, Cardon's method and solution of bi-quadratic equation.

Textbooks
1. Gallian, J. A., *Contemporary Abstract Algebra*, (Narosa, New Delhi, 1995).
2. Mapa, S. K., *Higher Algebra*,(Asoke Prakashan, Calcutta, 2006).

Reference books
1. Herstein, I. N., *Topics in Algebra*, 2nd Edition (Wiley Eastern Limited, New Delhi,1998).
2. Fraleigh, J. B., *A First Course in Abstract Algebra*, (Narosa, New Delhi, 1995).
3. Barbeau, E. J., *Polynomials*, (Springer, New Delhi, 2003).

MD207 CO-ORDINATE GEOMETRY   L2-T1-P0-CH3-CR3

Transformation of co-ordinate axes. Pair of straight lines. General equation of second degree and the conditions for representing a pair of straight lines, a parabola, an ellipse, a hyperbola and a circle, the equation of tangent, condition of tangency of line, pole and polar, centre of a conic, equation of a pair of tangents. Reduction to standard forms, central conics, Equation of the axes and length of the axes. Polar equation of a conic, tangent and normal, properties. Parabola, parametric co-ordinates, tangent and normal. Ellipse and its conjugate diameters with properties. Hyperbola and its asymptotes. Circle and its parametric form, Orthogonal circle, condition of orthogonality of circles.

Plane, straight line and shortest distance. change of axes, shift of origin, rotation of axes, Sphere, Cone and Cylinder. Central Conicoids, Ellipsoid, Hyperboloid of one and two sheets. Generating lines, Diametral planes, tangent lines, plane section of conicoids, director sphere, polar plane, section with a given centre, enveloping cone and cylinder. Confocal conicoids. Reduction of second degree equations.

Textbooks
1. Jain, P. K. and Ahmed, K., *Textbook of Analytical Geometry of Two Dimensions/Three Dimensions*, (New Age Publications, New Delhi, 2006).

2. Das, B., *Analytical Geometry and Vector Analysis*, (Orient Book Company, Calcutta, 1995).

Reference books

1. Khan, R.M., *Analytical Geometry & Vector Analysis*, (New Central Book Agency Pvt. Ltd., New Delhi, 2004).
2. Askwith, E. H., *A Course of Pure Geometry*, Michigan Historical Reprint Series, (University of Michigan Library, 2005).
3. Askwith, E. H. and Askwith, E., *A Course Of Pure Geometry*, (Hard Press, USA,2007).

MD209 STATICS AND DYNAMICS   L2-T1-P0-CH3-CR3

Parallel forces, Couples, Reduction of coplanar forces. Analytical conditions of equilibrium of coplanar forces.
Centre of gravity of a plane area, arc and sector of a curve. C. G. of solids and surface of revolution. C. G. of areas bounded by given curve.
Friction, Laws of Friction, Cone of Friction, Angle of Friction, Limiting Friction, Equilibrium of a particle in Rough inclined plane.

Principle of virtual work in two dimensions. Stable and unstable equilibrium.
Velocities and acceleration along radial and transverse directions and along tangential and normal directions. Rectilinear motion with variable acceleration. Motion under inverse square law and other laws of force. Simple harmonic motion, Motion in resisting medium. Motion of particles of varying mass, Motion of a projectile, range on an inclined plane. Impulse, impulsive forces, work and energy, conservation of linear momentum and conservation of energy. Motion of a body in two dimension under finite and impulsive forces. Impact of elastic bodies. Central orbit and Kepler's laws of planetary motion.
Moments and products of inertia. Parallel axes theorem, theorem of six constants. The momental ellipsoid. Equimomental systems. Principal axes. D'Alembert's principle. The general equation of Motion of a rigid body. Motion of a centre of inertia and motion relative to the centre of inertia.

Textbooks
1. Loney, S. L., *Elements of Statics & Dynamics*, *Part I*, (Maxford Books, New Delhi, 2003).
2. Rao, S. *Engineering Mechanics - Statics and Dynamics*, (Pearson Education, New Delhi, 2008).

Reference books
1. Spiegel, M. R., *Schaum's Outline of Theory and Problems of Theoretical Mechanics: with an Introduction to Lagrange's Equations and Hamiltonian Theory*, (Tata McGraw-Hill, 2007), New Delhi.
2. Ramsey, A. T., *Dynamics*, 2nd Edition, (The University Press, London, 2007).
3. Chorlton, F. *Textbook of Dynamics*, 2nd edition (Horwood, UK ,1983).

Semester IV

MD202 Probability and Mathematical Statistics   L3-T1-P0-CH4-CR4

Elements of probability theory, classical definition of probability, axiomatic approach to probability, probability of a simple event, probability of composite event, addition rule, multiplication rule: conditional probability, discrete sample space, Bayes' formula.

Discrete random variable, expected value of a random variable, standard probability distribution: Bernoulli, Binomial, Hypergeometric, Geometric, Poisson and Normal distribution.

Elements of Sampling theory: sampling with and without replacement, sampling distribution of the sample mean, sampling distribution of proportion, standard error.

Textbooks
1. Medhi, J., *Statistical Methods: An introductory Text*, (New Age International (P) Ltd., New Delhi, 2000).
2. Gupta, S.C. and Kapoor, V. K., *Fundamentals of Mathematical Statistics*, (Sultan Chand. & Company, New Delhi, 2007).

Reference books

1. Uspensky, J.V., *Introduction to Mathematical Probability*, (McGraw Hill, Columbus, 2005).
2. Feller, W., *An Introduction to Probability Theory and Its Applications*, *Vol. I,* (Wiley, USA,2005).

MD204 Mathematical Methods and Partial Differential Equations   L2-T1-P0-CH3-CR3

Partial differential equations: What are partial differential equations (PDEs), and where do they come from? Flows, vibrations and diffusions. Solutions of first order PDEs: Charpits method, Jacobi method. Second-order linear equations and their classification. Initial and boundary conditions, with an informal description of well-posed problems. D'Alembert's solution of the wave equation. Duhamel's principle for one dimensional wave equation.

Separation of variables: application of the method to simple problems in Cartesian coordinates for one dimensional wave and heat equations.

Calculus of variation: Variational problems with fixed boundaries-Euler's equation for functionals containing first order derivative and one independent variable. Extremals. Functionals dependent on higher order derivatives. Functionals dependent on more than one independent variable. Variational problems in parametric form. Invariance of Euler's equation under co-ordinate transformation. Variational problems with Moving boundaries-Functionals dependent on one and two functions. One sided vatiations. Sufficient conditions for an extremum - Jacobi and Legendre conditions.

Special Functions: Series solution of differential equations. Power series method. Bessel and Legendre equations. Bessel and Legendre functions and their properties. Convergence. Recurrence and generating functions.

Textbooks

1. Rao, K. S., *Introduction to Partial Differential Equations*, 2nd Edition (Prentice Hall of India, New Delhi, 2007)
2. Gelfand, I. M. and Fomin, S. V. *Calculus of Variation*, (Dover Publications, New York, 2000).

Reference books

1. Andrews, G.E., Askey, R. A. and Roy, R. *Special Functions*, (Cambridge University Press, Cambridge, 1999).
2. Sneddon, I. N. *Elements of Partial Differential Equations*, 4th ed., (Tata Mc-Graw Hill, New Delhi, 2006).

3. Gupta, A. S. *Calculus of Variation with Applications*, (Prentice Hall of India, New Delhi, 1997).

MD206 Integral Equations and Transforms   L3-T1-P0-CH4-CR4

Linear integral equations of the first and second kind of Fredholm and Volterra type: Definitions of integral equations and their classification. Eigen values and Eigen functions. Integral equations of second kind with separable kernels. Reduction to a system of algebraic equations. Method of successive approximations. Iterative scheme for integral equations of the second kind.
Integral Transform Methods: Fourier Series, Generalized Fourier series, Fourier Cosine series, Fourier Sine series, Fourier integrals. Fourier transform, Laplace transform.
Inverse Transform: Inverse Laplace and Fourier Transform, Solution of differential equation by Laplace and Fourier transform methods.
Elementary idea of Improper Integrals, their convergence, Beta and Gamma functions, their properties. Integral as a function of parameter (excluding improper integrals). Continuity and derivability of an integral as a function of a parameter.
Tensor: Transformation of coordinates, summation convention, kronecker delta. Definition of tensors, covariant, contravarient and mixed tensor, symmetric and antisymmetric tensors, outer and inner product of tensors, contraction, quotient law.

Textbooks
1. Parashar, B.P., *Differential and Integral Equations*, 2nd ed., (CBS Publishers, New Delhi, 2008).
2. Mikhlin, S. G., *Linear Integral Equations*, (Hindustan Book Agency, New Delhi, 1990).
3. Spain, B., *Tensor Calculus*, (Radha Publishing House, New Delhi, 2000).

Note: The third book covers the topics on Tensor Calculus

Reference books

1. Kanwal, R. P., Linear Integral Equation. Theory and Techniques, (Academic Press, New York, 1991).
2. Poularikas, D., *The Transforms and Applications*, (CRC Press, 1996).

MD208 Linear Algebra   L3-T1-P0-CH4-CR4

Review of vector spaces, linear maps, matrix representation of linear maps, Eigen vectors and Eigen values of linear maps, characteristic equation, and statement of Cayley-Hamilton theorem.
Linear functional and the double dual; annihilating polynomial, minimal polynomial, triangulation and diagonalization; direct sum decomposition, invariant direct sums, the Primary Decomposition theorem; rational and Jordan forms.
Inner product spaces: inner product; Gram-Schmidt orthogonalization process; linear functional and adjoint; self adjoint, normal and unitary operators; orthogonal projections; spectral theorem for normal operators on a finite dimensional vector space.
Bilinear forms: bilinear, positive and quadratic forms.

Textbooks

1. Strang, G. *Linear Algebra and Its Applications*, 4th Edition, (Cengage Learning India Pvt Lt, New Delhi, 2006).
2. Hoffman, K. and Kunze, R., *Linear Algebra*, 2nd Edition, (Prentice Hall, New Delhi, 2008).

Reference books

1. Williams**,** G., *Linear Algebra with Applications***,** (Jones and Burlet Publishers, New Delhi, 2001).
2. Lang, S., *Linear Algebra*, (Springer-Verlag, Indian Reprint, New Delhi, 2008).
3. Halmos P. R., *Finite Dimensional Vector Spaces, (*Springer-Verlag, New Delhi, 1987).
4. Halmos**,** P. R., *Linear Algebra Problem Book***,** (The Mathematical Association of America (MAA), USA, 1995).

Semester- V

MD301   Computer Programming+   L3-T1-P0-CH4-CR4

Computer fundamentals, major hardware and software components of a digital computer, concepts of machine language, assembly language and high level language. Number systems: binary, octal, hexadecimal; algebraic operations and conversions.

Algorithms and flow charts.

Fundamentals of C: introduction to C; comments in C; data types in C, variables in C, input output statements, constant declaration, arithmetic operators in C, arithmetic expressions, assignment statements, arithmetic assignment operators, increment and decrement operators, type conversions, Boolean expressions, operator precedence.

Loops and decisions: for loop, while loop, do…while loop, if statement, if…else statement, switch statement, conditional operators. The break statement, the continue statement, the goto statement.

Arrays and pointers: Arrays, declaration of one dimensional arrays, two dimensional arrays, pointers.

Structures: User defined data types, structures, array of structures, enumerated data type.

Function in C: Simple functions, passing arguments to functions with return value, call by value; call by reference, overloaded functions, inline functions, default arguments.

Object and classes: class, types of accesses, difference between structure and classes, accessing members of a class, constructors, destructors.

Searching and sorting: Bubble sort, selection sort, insertion sort, linear search and binary search.

Textbooks
1. Balaguruswamy, E., *Programming in ANSI C*, (Tata McGraw-Hill, New Delhi, 2004).
2. Venkateshmurthy, M. G., *Programming Techniques through C*, (Pearson Education, New delhi, 2002).

Reference books
1. Kanetkar, Y. P., *Let us C*, (BPB Publication, New Delhi, 2001).
2. Rajaraman, V., *Fundamentals of computers*, (Prentice Hall of India, New Delhi, 2002).

MD303   Real Analysis   L3-T1-P0-CH4-CR4

Elements of set theory, finite, countable and uncountable sets, Axiom of choice, Real number system.

Metric spaces, convergence, continuity, compactness, connectedness, completeness, Heine-Borel theorem, Intermediate value theorem, Baire Category theorem.

Riemann-Stieltjes integrals, properties, mean value theorems, the fundamental theorem of calculus.

Sequences and series of functions, uniform convergence and its relation to continuity, differentiation and integration.

Functions of several variables, differentiation, implicit function theorem, inverse function theorem, maxima and minima.

Textbooks
1. Rudin, W. *Principles of Mathematical Analysis*,(McGraw Hill, Columbus, 1982).
2. Flemming, W. *Functions of several variables* (3/e), (Springer, New Delhi, 1987).
3. Carothers, N. L *Real Analysis*, (Cambridge University Press, Cambridge, 1999).

Note: The second book covers topics on functions of several variables only.

Reference books
1. Goldberg, R. R *Methods of real analysis,* (Oxford & IBH, 1970), Oxford
2. Apostol, T. M. *Mathematical Analysis*, (Narosa Publishing House, New Delhi, 1985).

3. Simmons, G. F. *Introduction to Topology and Modern Analysis*, (Tata McGraw Hill Book Co. Ltd., New Delhi, 1963.)

MD305 ABSTRACT ALGEBRA   L3-T1-P0-CH4-CR4

Review of Groups, Permutation, Automorphisms of groups, Structure of cyclic groups, conjugate elements, Normalizer of an element, Direct products, Cauchy's theorem, Group action, Sylow's theorems, Finite abelian groups, Generator of subgroups and derived subgroups, Normal series, sub-normal series, Solvable groups.

Ring, Field and homomorphisms, Embedding theorems, Polynomial rings, Division algorithm, Factorization theory in integral domains, Euclidean domains, Gaussian domain, Separable and inseparable extension of fields, Elements of Galois theory.

Textbooks
1. Gallian, J. A. Contemporary Abstract Algebra, (Narosa, New Delhi, 1995).
2. Dummit, D. S & Foote, R. A. Algebra, (John Wiley & Sons, New York, 2005).

Reference books
1. Gopalakrishnan, N. S. *University Algebra*, (Wiley Eastern, New Delhi, 1991).
2. Fraleigh, J. B. *A First Course in Abstract Algebra*, (Narosa, New Delhi 1995).
3. Herstein, I. N. *Topics in Algebra*, (Wiley Eastern Limited, New Delhi, 1975).
4. Lang, S. *Algebra*, 3rd edition, (Addison-Wesley, New Delhi,1993).

MD307 ELEMENTARY NUMBER THEORY   L3-T1-P0-CH4-CR4

Divisibility, greatest common divisor, least common multiple, prime numbers, factorisation in prime numbers, fundamental theorem of arithmetic, the Euclidean algorithm, perfect numbers, Mersenne numbers, Fermat numbers.

Concept of congruences and its elementary properties, congruences in one unknown, complete residue system, reduced residue system, Gauss function, Mobius function, Euler function.

Diophantine equations, linear Diophantine equations, pythagoras equation, sum of two squares.

Quadratic residues and congruences of second degree in one unknown, Legendre symbol, Jacobi symbol, congruences of second degree with prime modulus and with composite modulus.

Primitive roots and indices, order, necessary and sufficient condition for the existence of primitive roots, construction of reduced residue system.

Continued fractions, simple continued fractions, approximation of irrational numbers by continued fractions, solution of Pell's equation.

Textbooks
1. Niven and Zuckerman, H. *An Introduction to the Theory of Numbers*, 5th edition, (Wiley Eastern, New Delhi,2000).
2. Burton, M. *Elementary Number Theory*, 3rd edition, (Tata Mcgraw Hill,, New Delhi, 2007).

Reference books
1. Hsiung, Y. *Elementary Theory of Numbers*, (World Scientific, 1992; First Indian Reprint, Allied Publishers Limited, New Delhi, 1995).
2. Hardy, G. H. and Wright, E. M. *An Introduction to the Theory of Numbers*, 4th edition, (Oxford, Claredon Press, 1960).
3. Andrews, G. E. *Number Theory*, (Hindustan Publishing Corporation, New Delhi, 1992).
4. Telang, S. G. *Number Theory*, (Tata McGraw Hill, New Delhi, 1996).

MD309 COMPUTER LABORATORY (Practical unit for the 1. Computer Programming)
L0-T0-P1-CH2-CR1

SEMESTER- VI

MD302 Numerical Analysis **L3-T1-P0-CH4-CR4**

Definition and sources of errors, Propagation of errors, Backward error analysis, Sensitivity and conditioning, Stability and accuracy, Floating-point arithmetic and rounding errors. Interpolation, extrapolation and inverse interpolation, Hermite interpolation, Spline interpolation, B-splines. Solution of algebraic and transcendental equations, numerical solution of simultaneous equations, solution of ordinary differential equations, curve fitting, Integration formulae: Gauss, Gauss-Legendre, Gauss-Hermite and Gauss-Laguerre quadrature formulae; Newton's formula for repeated integration, solving problems with C.

Textbooks
1. Atkinson, K. E., *Introduction to Numerical Analysis*, 2nd Edition, (John Wiley, New York,1989).
2. Sastry, S. S., *Introductory methods of Numerical Analysis*, (Prentice Hall of India, New Delhi, 1997).
3. Jain, M. . K., Iyengar, S. R. K. Jain, , R. K., *Numerical methods, Problems and Solutions*, (New Age International (P) Ltd., New Delhi, 1996).

Reference books
1. Conte, S. D. and Boor, C. de, *Elementary Numerical Analysis - An Algorithmic Approach*, 3rd Edition (McGraw Hill, Columbus, 1980).
2. Burden, R. L and Faires, J. Douglas Numerical Analysis, Eighth Edition, (Cangage New Delhi, 2005).
3. Hilderbrand,F. B *Introduction to Numerical Analysis*, (Tata McGraw Hill, New Delhi, 1974).
4. Gerald, C. F and Wheatley, P. O. *Applied Numerical Analysis, 5th edition*, (Addison Wesley, New Delhi,1994.)

MD304 Topology **L3-T1-P0-CH4-CR4**

Topological spaces, basis and sub-basis, subspaces, closure, interior and boundary. Continuity, open functions, homeomorphisms, embeddings, strong and weak topologies. Quotient and product spaces. Countability axioms, separability, Lindelof spaces. Separation axioms (T_0, T_1, T_2, T_3, T_4), regularity, complete regularity, normality. Compactness, local compactness, Tychonoff's product theorem, compactification. Connectedness, local and path connectedness, components, products of connected spaces.

Textbooks

1. Kelley**,** J. L *General Topology* (Graduate Texts in Mathematics, Vol. 27), (Springer, Berlin, 1991).
2. Munkres**,** J. R. *Topology : A first course* (2/e), (Prentice-Hall, 2000 or (1/e) Prentice Hall of India, New Delhi, 1983.)

Reference books
1. Joshi**,** K. D. *Topology*, (Wiley-Eastern, New Delhi, 1988.)

MD306 **Functional Analysis**   **L3-T1-P0-CH4-CR4**

Normed linear spaces; equivalent norms; bounded linear operator and functional; Hahn-Banach theorem; Banach spaces.
Uniform boundedness theorem; Open mapping theorem; Closed graph theorem.
Hilbert spaces; polarization identity and parallelogram law; orthogonality; Riesz representation theorem; orthonormal systems; Bessel's inequality; Parseval's identity.
Adjoint operators; normal and self adjoint operators; unitary operators; isometry; orthogonal projection; spectrum of an operator and it's non emptiness.

Textbooks
1. Nair, M Thamban *Functional Analysis: A First Course*, (Prentice Hall of India, New Delhi,2003).
2. Kreyszig, E *Introductory functional analysis with applications, (*John Wiley and Sons, New York, 1978).

Reference books
1.   Youngson, M. A. and Rynne, B *Linear Functional Analysis*, (Springer, Berlin, 2007).
2. Bachman, George and Narici, Lawrence *Functional Analysis*, (Academic Press, New York,
        1966).
3.   Halmos, P. R. *A Hilbert Space Problem Book.,* Second Edition, (Springer-Verlag, Berlin, , 1982).
4.   Limaye, B. V *Functional Analysis*, (Wiley Eastern Limited, New Delhi, 1989).

MD308 **Theory of Ordinary Differential Equations**

                                                            L3-T1-P0-CH4-CR4
Review of fundamentals of ODEs. Existence and Uniqueness of Initial Value Problems: Picard's and Peano's Theorems, Gronwall's inequality, continuation of solutions and maximal interval of existence, continuous dependence.
Power series solutions of ODE, Higher Order Linear Equations, Wronskian, Reduction of higher order linear ODEs to first order linear systems, Fundamental matrix and solutions of linear systems, matrix exponential solution, behaviour of solutions, Stability of linear systems.
Boundary Value Problems, Green's Matrix, Self adjoint boundary value problems, Lagrange Identity, Green's formula, Sturm-Liouville problems, Sturm comparision theorems and oscillations, eigenvalue problems.

Textbooks
1. Simmons, G. F. *Differential Equations*, (Tata McGraw Hill, New Delhi, 1993).
2. Boyce & DiPrima, *Ordinary Differential Equations and Boundary value problems*, (John Wiley & Sons, New Delhi, 2000).
Reference books
1. Rao, M. R. M. *Ordinary Differential Equations: Theory, Method and Applications*, (Affiliated East-West Press Pvt. Ltd., New Delhi, 1979).

2. Coddington, E. A. *An Introduction to Ordinary Differential Equations*, (Prentice-Hall, New Delhi, 1974).
3.   Somasundaram, D. *Ordinary Differential Equations: A First Course*, (Narosa, New Delhi, 2001).
4.   Brauer, Fred & Nohel, J. *The Qualitative Theory of Ordinary Differential Equations: An Introduction*, (Dover Publications, New Delhi, 1989).

MD310   **Computer Laboratory**   (Practical unit for the Course 1. Numerical Analysis)

L0-T0-P1-CH2-CR1

BD101: Biology I   **L2-T0-P1-CH4-CR3**

Diversity of Microbes, Plant and Animal world
Introduction, difference between living and nonliving, Unicellular, colonial and multicellular forms

Chemical basis of life
Chemistry of the living state: micro, macro (trace elements) associated with the structure of cells. Water: molecular structure, dipolar nature, dissociation of water, concept of pH, Acid and base, buffers.

Basic principles of Taxonomy
Concept of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants animals and microorganisms.

Microbial World
Characteristsics with examples of Archaebacteria, eubacteria, viruses, viroids and prions eubacteria and archaea, bacteria.

Plant Kingdom
A general description on lower and higher groups of plants; Specific studies on each of the following groups of plants with description of a typical example (i) Thallophyta (ii) Bryophyta (iii) Pteridophyta (iv) Gymnosperms (v) Angiosperms.

Animal Kingdom
Non chordates and Chordate definition, classification with examples.

Structural Organization
Organization of tissues, organs and organ systems.

Basic concept of Organic Evolution
Theories of evolution: Lamarck; Darwin–concepts of variation, Neo-Darwinism. Evolution and diversity of bacteria, archabacteria ; plants (thallophytes to higher plants); animals (protozoa to mammals)

Textbooks

1. Campbell, N.A. & Reece J.B. *Campbell Biology: Concepts & Connections with Mastering Biology*[(R)], 7th ed., (Benzamin-Cummings Publishing Company,2011).
2. Gunstream, S.E. *Xplorations In Basic Biology*, 11th ed., (Benzamin-Cummings Publishing Company,2011).

Reference books

1. Groom M.J. & Gary K. Meffe, G.K., *Principles Of Conservation biology*, 3rd Edition, (Sinauer Associates, 2005).
2. Willey, J. & Sherwood, L. *Prescott's microbiology* 8th ed., (Mcgraw-Hill Science/engineering/math, 2008).

1. General Laboratory orientation in Microbiology with equipments like inoculation loop, hot air oven, autoclave, laminar air flow, incubator, microscope, haemocytometer, spectrophotometer etc.
2. Sterilization, disinfection and safety in general microbiology laboratory
3. Microscopic observation of soil and water born organism by simple staining
4. Use of haemocytometer in cell count
5. Observation of representative specimens of non-chrodata.
6. Morphology vegetative and reproductive) and anatomy of the taxa :bryophytes, pteridophytes and gymnosperms.
7. Observation of slides differentiating monocots and dicots.
8. Microscopic observation of pre-stained animal tissue slides

Textbooks
1. Bendre, A &. Kumar. *A Text Book Of Practical Botany I* ,(Rastogi Publication, Meerut, 2009).
2. Dubey, R.C., *Practical Microbiology* (S. Chand Publisher, New Delhi,2007).

BD102 Biology – II   L2-T0-P1-CH4-CR3

Anatomy and Physiology – Basic concepts
Anatomy of root, stem and leaf of monocotyledous and dicotyledous plants. Plant physiology: Absorption and transpiration in plants, photosynthesis, nitrogen metabolism, plant growth regulators induction to the site of synthesis and effects, introduction to physiology of flowering a) photoperiodism b) vernalisation **.** Anatomy and physiology of Human: digestive system, vascular, respiratory, exceretory system.

Basics of cell and developmental biology
Cell structure and division, regulation of development of cell; fertilization and embryogenesis

Fundamentals of genetics
Mendelian laws of inheritance, chromosome theory of inheritance, gene interaction, crossing over, sex determination in plants and animals, mutation: spontaneous and induced, mutagens: physical and chemical

Outlines of immunology
Type of immunity: cell mediated immunity, description of various types of T-cells and their functions, innate immunity (specific and non specific) acquired: active and passive immunity, humoral and cell mediated immunity, immune system- lymphocytes. Immunoglobulins-structure and function. A brief account of antigen-antibody reactions.

Elements of Biochemistry
Basic structure and physiological functions of carbohydrates, protein, lipids and nucleic acids. Role of minerals and vitamins in growth and development. Thermodynamics of biological system. Examples of high energy biomolecules.

Conservation biology
Level of biodiversity; global biodiversity and hot spots, tropical biodiversity, economics of biodiversity, threatened and endangered species, conservation of forest and wild life, social forestry, deforestation and consequences. Indian case studies on conservation/management strategy (project tiger, biosphere reserve)

Textbooks
1. Alberts, B. & Bray, D., *Essential Cell Biology* ,(Garland Science,2009).
2. Guyton, A.C., *Textbook of Medical Physiology*, (Elsevier, 2006).

Reference books
1. Odum, E. & Barrick, M., *Fundamentals Of Ecology*, (Ceneage Learning India Pvt. Ltd., 2005).
2. Gilbert, S. F., *Developmental Biology*, (Sinauer Associates, Inc., 2010).

Biology-II   Laboratory   L0-T0-P2-CH4-CR2

1. Introduction to general laboratory safety and different equipments used in modern biological research**.**

2. Preparation of solution and buffers**.**

3. To verify the validity of Beer's law and determine the molar extinction coefficient

4. Separation and identification of amino acids by ascending paper chromatography.

5. To identify lipids in a given sample by Thin Layer Chromatography.

6. Separation and identification of sugars by adsorption Thin Layer Chromatography.

7. Isolation of DNA from *E. coli*.

Textbooks
1. David, P., *Introduction To Practical Biochemistry*, (Tata Mc Graw-hill, 2006).
2. Bose S. C., *Biochemistry: A Practical Manual*, (Pmp /B S Publication, 2010).

Environmental Science

ES 101: Elementary Environmental Science   Credits: 2 [L2 T0 P0]

	Topic	No. of lectures
1.	Environmental Science: Definition, Scope and importance	1
2.	Natural resources: Definition, classification of resources - Renewable and Non-Renewable resources. Resource conservation and sustainable development	2
3.	Ecology Meaning and scope, concept of species, population, community and ecosystems, energy flow in ecosystem- food chains and food webs, ecological pyramids. Different ecosystems and Biomes	5
4.	Biodiversity and conservation: Introduction, definition, genetic, species and ecosystem diversity, values of biodiversity threat to biodiversity, conservation of biodiversity. In-situ and ex-situ conservation method. Biodiversity hotspots	3
5.	Environment pollution: Introduction to environmental pollution: Definition, causes and types- air, water, land and noise pollution. Solid waste-classification and management	5
6.	Social issues and the environment Provision of constitution of India regarding environment- Article 21, 14, 48A, 51A, of Indian Constitution, Green benches, Ecomarks, Development-Environment interface and the emergence of EIA, population growth, environment and human health, Human rights, woman and child welfare	4
7.	Greenhouse gas emission and global warning. Causes and consequences of climate change, Ozone layer depletion, Acid rain	5

Textbooks

1. Seigo, C. *Environmental Science*, (McGraw Hill, New York, 1999)
2. De, A. K. *Environmental Chemistry*, (Willey, New Delhi,2005)

Reference books

1. Miller, T. G. *Living in the Environment*, (Thomson Brooks,Cole, 2000)
2. Odum, E.P. *Fundamentals of Ecology* (W. B Saunders Co., USA, 1971)
3. Manahan, S.E. *Environmental Chemistry*, (CRC press, New York, 2005)
4. Santra, S.C. *Fundamentals of Ecology & Environmental Biology*, (New Central Book agency, Kolkata, 2010)

TEZPUR UNIVERSITY

SYLLABI FOR THE B.Ed. PART OF THE INTEGRATED B.A./B.Sc. B.Ed. PROGRAMME

(*Syllabi of the Education courses prepared on the basis of the Draft Syllabus of the NCTE*)

Preamble

The rapid expansion of secondary education envisaged by its universalization will eventually demand a steady supply of a large number of teachers capable of teaching at this level. The challenges of imparting quality secondary education to the huge number of students across the country cannot be met unless we have qualified and trained competent teachers. Keeping in mind this urgent need the Minister of Human Resource Development stressed the need for introducing integrated B.A./B.Sc. B.Ed programmes in the universities. Tezpur University, therefore, proposes to introduce the B.A./B.Sc. B.Ed programmes in the next academic session beginning in August, 2011.

The syllabus for the programme is devised in such a way as to enable those students who would like to choose teaching as a career to pursue the study of the subjects usually offered at the undergraduate level (with major in a subject of their choice) during the first four semesters of the eight semester (four years) integrated programme and study one course of education (a component of the B.Ed. part) in each of the next two semesters in addition to the usual courses of the B.A./B.Sc. programme. Semesters VII and VIII will exclusively be devoted to the study of the other courses of the one-year B.Ed. programme.

COURSE STRUCTURE OF THE B.ED. PART OF THE INTEGRATED B.A./B.Sc. B.Ed. PROGRAMME

Semester VII : 18 (Note: 4 credits in V,VI semesters already offered)

Course	L T P	CH	CREDIT
ED 101 Education and Development I (C) (to be offered in semester V)	2 0 0	2	2
ED 102 Education and Development I (C) (to be offered in semester VI)	2 0 0	2	2
ED 201 Education: An Evolutionary Perspective (semester VII) (C)	3 0 0	3	3
ED 202 Contemporary Issues and Concerns in Secondary Education (semester VII) (C)	3 0 0	3	3
ED 203 Learner and Learning (semester VII) (C)	2 1 0	3	3
ED 204 Teaching: Approaches and Strategies (semester VII) (C)	2 1 0	3	3
ED 208 Teaching of Modern Indian Languages: Assamese I (semester VII)	2 1 0	3	3
ED 210 Teaching of English I (semester VII)	2 1 0	3	3
ED 212 Teaching of Science I (semester VII)	2 0 1	4	3

Course	LT P CH CR
ED 214 Teaching of Mathematics I (semester VII)	2 1 0 3 3

Note: B.A. students will offer ED 208 and ED 210 as Teaching Specializations at the moment. B.Sc. students will offer ED 212 and ED 214 as Teaching Specializations.

Semester VIII Credit: 19 . Total credits: 22+19=41

Course	LT P CH CR
ED 205 Learning Resources (C)	3 0 0 3 3
ED 206 Assessment for Learning (C)	3 0 0 3 3
ED 207 Classroom Organisation and Management (C)	2 0 0 2 2
ED 209 Teaching of M.I.L:Assamese II	2 0 0 2 2
ED 211 Teaching of English II	2 0 0 2 2
ED 213 Teaching of Science II	1 0 1 3 2
ED 215 Teaching of Mathematics II	2 0 0 2 2
ED 216 Practical: Initiatory School Experiences 1day a week (C)	0 0 2 4 2
ED 217 Practical : Internship in Teaching 4 weeks (C)	0 0 5 10 5

*Note: B.A. students will offer ED 209 and ED 211 as Teaching Specializations.
        B.Sc. students will offer ED 213 and ED 215 as Teaching Specializations.*

Minimum credit for a B.A./B.Sc B.Ed. degree 152 (B.Ed. component 41)
Maximum number of semester for completing the courses 12

ED 101 Education and Development I   L2 T 0 P0 CH 2 CR 2

Course Objectives

On completion of the courses I and II the students will be able to

understand the relationship between Education and individual and National Development.

examine the influences of political and policy decisions on Education and its aims, content   and procedures.

understand how Education derives its relevance from socio cultural contexts and critically   reflect on the influence of education on the quality of life.

analyze the social context of education and its bearing upon the school system.

 examine the changing emphases on Education in the context of Globalization,liberalization and Privatization

Unit-1: Education for National Development

National development –meaning, scope and different view points

Indicators of national development (as mentioned in Education Commission 1964-66, Planning Commission, World Bank, NPE-1986)

Education as a development indicator

Role of education in ensuring sustainable development

A review of the initiatives for educational development in India over decades

The perspective of education for national development in the NCF-2005.

Unit-2: Emerging Interface between Political Process and Education

Education as a key area of public policy- relevance, essentiality

The National and State Education Policies and their formulation- political decision making process; relationship between constitutional provisions and educational policies- Right to Education

Implementation of an educational policy- political will and effort, macro level requirements

 State and Centrally Sponsored Schemes of Education

Research and feedback for policy analysis and planning

Financial supplementation: grants-in-aid and developmental grants for implementing educational policy- the role of planning commission

Sessional work: seminars and group discussions

Analyse writings on analysis of education-development interface and make presentations

Group discussions, debates and dialogue on the themes

Presentations on National educational policies

Textbook

Chandra, S.K. *Education and Development* (Discovery Publishing House, Delhi,2010).

Jayapalan, N.*History of Education in India* (Atlantic Publishers, New Delhi, 2008).

Reference books

School Education in India – Present Status and Future Needs (NCERT, New Delhi,1986).

Ministry of HRD, Department of Education *Learning without Burden,* Report of the National Advisory Committee. Education Act., October, 2004.

UNDPA. *Human Development Reports* (Oxford University Press, New Delhi, 2005).

Education for All: The Quality Imperative. EFA Global Monitoring Report (UNESCO, Paris, 2004).

World Bank. *Reaching The Child: An Integrated Approach to Child Development* (Oxford University Press, New Delhi,2004).

ED 102 Education and Development II   L2 T0 P0 CH2 CR2

Unit-1: Education and Economic Development

Education for economic development- its meaning and nature

Education as development of human resource: Education for employability - academic

concerns in education, consumer- driven educational programmes
Quality of life as an outcome of education
Education as an investment
Privatization, private initiative, and liberalization in education
Unit-2: Education and Individual Development
Education for development of individual capabilities, enhancement of quality of life
Education and Actualization of individual aspirations
Education for development of responsible citizens
Education and development of life skills: preparation of individuals for the 21st century
Unit-3: Education and Socio-cultural Context
Education as an instrument of social change- influence of education on society, family and their practices
Socio-cultural influences on the aims and organization of education
Social acceptability of educational policy and practice
Impingement of cultural history on education
Emerging trends in societies and their repercussions on education: globalization and internationalization of education

Sessional work: seminar and group discussion
Group discussions, debates and dialogue on the themes of education and economic development, and education as an instrument of change

Textbook
Chandra, S.K. *Education and Development* (Discovery Publishing House, Delhi,2010).
Reference books
Govt. of India *National Policy on Education* (Min. of HRD, New Delhi, 1986)
Govt. of India *Programme of Action (NPE)* (Min of HRD, New Delhi, 1992)
Gupta, S. *Education in Emerging India*(Shipra Publications, Delhi, 2008).
Seventh All India School Education Survey (NCERT: New Delhi, 2002)
 Education for All: The Quality Imperative. EFA Global Monitoring Report (UNESCO, Paris,2004).

ED 201 Education: an Evolutionary Perspective   L3 T0 P0 CH3 CR 3

Course objectives
On completion of the course the students will be able to
 analyse the premises and contexts that are unique to education.
understand and appreciate the nature and the purpose of education, their practical ramifications in the school context.
analyze the philosophical reflections and educational thoughts of great Educational thinkers
understand the nature of knowledge in Education and its contribution to status of education as a discipline and interdisciplinary in nature
inquire into the roles of teacher, school and the community in the changing perspectives of pedagogy
appreciate the historical development of education as a system and its evolving structures
examine the concerns and issues related to education system
understand the importance of systemic reforms in achieving quality education
Unit -1: Education as an evolving concept
Meaning of education: ancient to present- education as an organized, institutionalized, formal and state sponsored activity

Concepts in education and their changing connotations: school, curriculum, teacher, learner, teaching, learning, instruction, freedom, autonomy and control in relation to the child and teacher

Shifts in process of education: knowledge giving, didactic and constructivist interpretations

Expansion in modes of education: face-to-face (tutorial, small group, large group) to distant modes of education: oral/aural to digital; individualized and group based

Unit-2: Aims of education

Aims of education: Historicity of aims of education

Changing aims of Education in the context of globalization

Sources of Aims of Education: Educational aims as derived from the Constitution of India

Influence of aims of education on the curriculum and transactional strategies

Ideas of educational thinkers such as Gandhi, Tagore, Aurobindo, Dewey, Krishnamurthy and Friere

Unit-3: Evolving Knowledge base in Education

Nature of knowledge in education: concepts, statements, educational viewpoints, metaphors and theories. Emerging K base in education

Differences between information, knowledge, belief, and opinion

Interfaces with cognate disciplines such as physical, natural and social sciences

Unit-4: Learning Environment: the changing scenario

Changes in Teacher roles, learner participation, knowledge emphasis, learning resources and physical space

Shift in pedagogy: Knowledge focused to teacher focused to learner focused learning environment

Shift in learning environments: Uni-modal to multi-mediated, school based to community linked, and real to virtual learning environments. The open-distance learning environment

Unit-5: Systems and structures in school education

Education as a system: meaning and nature

Evolution of educational network over the past two centuries (1800s to 21st century): a brief overview of historical development of learning systems that resulted in the present network of schools

Differentiation of educational structures: stage wise; stream wise

Role of state-centre: need for a national system of education

Predominant concerns of the education system– co ordination, quality assurance and feasibility

Systemic reforms in education: meaning and need. Demands from the secondary education system upon achieving universal elementary education

Sessional Work : Term paper/ seminar on some of the units

Textbooks

Jayapalan, N.*History of Education in India* (Atlantic Publishers, New Delhi, 2008).

Taneja V R *Socio-Philosophical Approach to Education* (Atlantic Publishers and Distributors, New Delhi, 2005).

Reference books

Dewey, John.'My Pedagogic Creed', in D.J. Flinders and S.J. Thorton(eds.) *The Curriculum Studies Reader* (Routledge: New York, 1997)

Dewey, John *Experience and Education* (Touchstone, New York,1997).

Kumar Krishna . *Learning From Conflict* (Orient Longman, New Delhi,1996).

Margaret, K.T. *The open Classroom* (Orient Longman: New Delhi, 1999).

Ozmon, Howard A and Samuel M Craver *Philosophical Foundations of Education* (Prentice Hall, New York, 2007).

Prema, Clarke.*Teaching & Learning: The Culture of pedagogy* (Sage Publication, New Delhi,2001)

ED 202 Contemporary Concerns and Issues in Secondary Education

L3 T0 P0 CH3 CR3

Course Objectives

On completion of the course the students will be able to

understand the importance of universalisation of secondary education and the constitutional provisions for realizing it

examine the issues and concerns related to universalisation of secondary education

analyse the strategies used for realization UEE and the outcomes of their implementation

realize the need and importance of equity and equality in education and the constitutional provisions for it

identify the various causes for inequality in schooling

realize the importance of Right to Education and the provisions made for realizing it

understand the importance of indicators, standards and strategies for enhancement of quality in secondary schools

understand the need and importance of education for peace and the national and international efforts towards it.

examine the issues and concerns related to global and local environmental crisis

explores the strategies for sensitizing the learners towards environmental conservation

understand the Action measures taken for Environmental Conservation and its sustainability at the international level

explore the school curriculum for integrating environmental concerns.

Unit-1: Universalisation of Secondary Education

Constitutional provisions

Policies and programmes for realizing the constitutional obligations

Right to education and its implications for universalisation of secondary education (USE)

Impact of realizing the USE on secondary education: access, enrolment, participation and achievement; status of USE

USE: issues and concerns

Unit-2: Equity and Equality in Education

Meaning of Equality of Educational Opportunities, provision and outcomes; constitutional provisions for ensuring equity

Nature and forms of inequality including dominant and minor groups, gender

Inequality in schooling: public-private schools; Rural-urban-tribal schools, and differential school systems – schools for education of the challenged

Unit-3: Quality in education

What is 'quality education'?

Indicators of quality: related to learning environment, Student Outcomes

Outcome improvement through: setting standards for performance; supporting inputs known to improve achievement, adopting flexible strategies for the acquisition and use of inputs, and monitoring performance.

Enhancement of quality in secondary schools

Unit-4: Peace Education

Peace as a dynamic Social Reality

Relevance of Peace: regional, national and international contexts

Dangers to Social Security: terrorism, war, natural calamities and impact on quality of life

Peace context: conditions for promotion of peace, UNESCO's concerns on Peace and Understanding

Role of education in promotion of peace: implications for pedagogy

Teacher role in promoting peace
Unit-5: Education for Conservation of Environment
Conservation of environment- an imminent need
Need for sensitizing learners towards concerns of environmental conservation
Integration of environmental concerns in curriculum
Role of teacher in promoting conservation

Sessional Activities: seminar and group discussion/activities
Presentation on the reports and policies on USE
Analysis of school curriculum for integrating environmental concerns
Individual or group projects to visualize feasible school-based strategies for contributing to 'peace' and 'environmental conservation'

Textbooks
Gupta, S. *Education in Emerging India* (Shipra Publications, Delhi, 2008)
Rao, V .K. and Nayak, A.K. *Secondary Education* (A.P.H. Publishing Corporation, New Delhi,
        2002).
Reference books
Govt. of India. *National Policy on Education* (Min. of HRD, New Delhi, 1986).
Govt. of India . *Programme of Action (NPE).* (Min of HRD, New Delhi,1992).
UNESCO. *Education for All: The Quality Imperative. EFA Global Monitoring Report.*
        (UNESCO, Paris, 2004).
Kumar ,Arvind . *Environmental Challenges of the 21st century* (APH Publishing Corporation,
        New Delhi,2003).

ED 203 Learner and Learning   L3 T0 P0 CH3 CR3

Course Objectives
On completion of the course, students will be able to
        develop an understanding about the impact/influence of socio cultural context in shaping human development, especially with respect to the Indian context;
        develop an understanding of dimensions and stages of human development and developmental tasks
        understand the range of cognitive capacities among learners
        reflect on their own implicit understanding of the nature and kinds of learning
        gain an understanding of different theoretical perspectives on learning
        appreciate the critical role of learner differences and contexts in   making meanings, and draw out implications for schools and teachers
Unit 1 Nature of the Learner: Child and Adolescent
Learner as a developing individual; a psycho-social entity; stages of development
Developmental characteristics of a child and an adolescent: physical, cognitive, social, emotional, moral and language; their interrelationships
Developmental tasks of childhood and adolescence and their implications
Factors influencing development such as heredity, nutrition, child-rearing practices, siblings and peers
Unit 2 Understanding Differences between Learners
Differences between individual learners: multiple intelligence, learning style, self-concept, self esteem, attitude, aptitude, skills and competencies, interest, values, locus of control and personality
Understanding differently abled learners: slow learners and dyslexic learners

Methods of assessing individual differences: tests, observation, rating scales, self-reports
Catering to individual differences: grouping, individualizing instruction, guidance and counseling, bridge courses, enrichment activities and clubs

Unit 3 Understanding Learning
Nature of learning: learning as a process and learning as an outcome
Types of learning: factual, associations, conceptual, procedural, generalizations, principles and rules, attitudes, values and skills
An exploration of the theoretical positions on each of the above types of learning
Pedagogic principles for organizing learning: behaviouristic, cognitivistic, and humanistic
A critical analysis of the relevance and applicability of various learning theories for different kinds of learning situations

Unit 4 Factors Influencing Learning
Biological and hereditary factors influencing learning
Factors related to the subject matter content and learning material
Factors related to the method of learning
Factors influencing remembering and forgetting, conceptual organization and reorganization, scaffolding
Attention, motivation and readiness as factors influencing scholastic learning
Role of the teacher and school in addressing various factors influencing learning: a few strategies

Unit 5 Organizing learning: Issues and Concerns
Individual versus group learning: issues and concerns with respect to organizing learning in a classroom such as study habits, self-learning and learning to learn skills
Organizing learning in heterogeneous classroom groups – socio economic background, abilities and giftedness, interest
The issue of media influences on learning – role of parents and teachers
Paradigms for organizing learning: teacher centric, subject centric and learner centric

Sessional Work: seminar and group work
Critical analysis of classroom instruction in the light of the understandings developed in Units 2 & 3
Any one experiment on learning – division of attention, memory, transfer of learning
Case study of a learner with behaviour problem/talented child/a LD child/a slow learner/a disadvantaged child
Study of intelligence of at least 5 school children and relating it with achievement and other background factors

Textbooks
Rao, V.K. and Reddy, R.S (ed.) *Teaching and* Learning(Commonwealth Publishers, New Delhi, 2007).
Sharma, S.K and Tomar, M (eds.)*Learning and Teaching Learning Process* (Isha Books, Delhi, 2007).

Reference books
Vygotsky, L.S. *Mind in Society* (Harvard University Press: Cambridge, 1978).
Woolfolk, A.E. (2009) *Educational Psychology* (11th Edition, My Education Lab Series)
        (Prentice Hall, New York, 2009).

ED 204 Teaching: Approaches and Strategies   L 3 T0 P0 CH3 CR3
Course Objectives
On completion of the course the students will be able to
        demonstrate his/her understanding of the role of a teacher at different phases of
        instruction

write instructional objectives teaching of a topic

demonstrate his/her understanding of different skills and their role in effective teaching

use instructional skills effectively

Unit 1 Understanding Teaching

Teaching as a planned activity – elements of planning

Assumptions underlying teaching and their influence on the planning for teaching

Phases of teaching: pre-active, interactive and post-active.

Proficiency in teaching: meaning and place of awareness, skills, competencies and commitment

The general and subject related skills and competencies required in teaching

Impact of one's own socialization processes, awareness of one's own shifting identities as 'student', 'adult', and 'student teacher', and their influences on 'becoming a teacher'

Teacher's professional identity- what does it entail?

An analysis of teacher roles and functions in the three phases: pre-active phase – visualizing; decision-making on outcomes, preparing and organization; interactive phase facilitating and managing learning; post-active phase – assessment of learning outcomes, reflecting on pre-active, interactive and post-active processes

Unit 2 Pre-active Phase of Teaching

An analysis of teacher roles and functions in the pre-active phase – visualizing; decision-making on outcomes, preparing and organization

Visualizing: the learner and learner readiness characteristics, the subject matter content and their interlinkages, the learning resources, approaches/strategies

Decision-making on outcomes: establishing general instructional goals, specification of objectives and standards for learning, allocation of instructional time for various activities/tasks – instructional time as a variable in learning

Decision-making on instructional approaches and strategies: Expository or Inquiry, Individualized or Small Group or Whole Class – Skills required for learner engagement in the context of the strategy decided

Preparing for instruction: identifying and selecting available learning resources or developing required learning resource

Preparation of a Plan: Unit Plan and Lesson Plan

Unit 3: Interactive Phase of Teaching – Strategies of Teaching

An analysis of teacher roles and functions in the interactive phase - facilitating and managing learning

Expository Strategy as approach to teaching for understanding: Presentation-discussion, demonstration, the Advance Organizer Model

Inquiry Strategy as approach to teaching thinking skills and construction of knowledge:

Concept Attainment/ Concept Formation, Inductive Thinking, Problem Based Learning/Project Based Learning

Unit 4: Interactive Phase of Teaching – Approaches and Skills of Teaching

Approaches to Organizing Learning - Approaches to Individualized Instruction: Computer Managed Instruction, Programmed Instruction, and Learning Activity Packages; Approaches to Small Group and Whole Group Instruction: Cooperative and Collaborative approaches to learning, Brain storming, Role Play and Dramatization, Group Discussion, Simulation and Games, Debate, Quiz and Seminar

Instructional Skills: Structuring, Soliciting and Reacting, Verbal and Non verbal, Feedback and Reinforcement, Discourse, Demonstration and Modeling

Unit 5: Post-active Phase of Teaching

An analysis of teacher roles and functions in the post-active phase: evaluation of pupil learning, evaluation and generating feedback on all three phases of teaching

Using learner achievement as a feedback for evaluating teacher/ teaching effectiveness:

Reflection on appropriateness and sufficiency of planning and implementation activities of a teacher Reflection and appraisal for professional development in teaching: self-reflection, observation and feedback by peers, analysis of teaching using media, appraisal by students Understanding teacher as a professional: expectations and responsibilities of a teacher, teacher as an autonomous functionary and a member of a community of professionals - balancing personal aspirations and professional pressures, developing an 'identity' as a teacher.

Seasonal Work: seminar and group discussion/activity

Study of instructional practices with reference to use of classroom skills

Classification of instructional objectives of a lesson under domains and levels

Writing instructional objectives for different content categories

Identifying skills incorporated in a lesson plan and judging their appropriateness and adequacy

Practice of skills in a simulated situation

Textbooks

Kochar, S.K. *Methods and Techniques of Teaching* (Sterling Publishers, New Delhi,2009).

Sharma, S.K and Tomar, M (eds.)*Learning and Teaching Learning Process* (Isha Books, Delhi, 2007).

Reference books

Bloom, B S., Englehart M D, Furst E J, Hill W H and Khrathwohl, D R *Taxonomy of Objective Handbook* 1, Cognitive Domain, Handbook 2, Affective Domain (Longman, London,1964).

Jangira N K and Ajit Singh *Core Teaching Skills: The Microteaching Approach* (NCERT, New Delhi,1982).

Rao, V.K. and Reddy, R.S (ed.) *Teaching and* Learning(Commonwealth Publishers, New Delhi, 2007).

Sampath K. et al *Introduction to Educational Technology*(Sterling Publishers, New Delhi, 2009).

ED 205 Assessment and Evaluation   L3 T0 P0 CH3 CR3

Course Objectives

On completion of the course the students will be able to

> understand the nature of assessment and evaluation and their role in teaching-learning process.
>
> understand the perspectives of different schools of learning on learning assessment
>
> realise the need for school based and authentic assessment
>
> examine the contextual roles of different forms of assessment in schools
>
> understand the different dimensions of learning and the related assessment procedures, tools and techniques
>
> develop assessment tasks and tools to assess learners performance
>
> analyse, manage, and interpret assessment data
>
> analyse the reporting procedures of learners performance in schools
>
> develop indicators to assess learners performance on different types of tasks
>
> examine the issues and concerns of assessment and evaluation practices in schools
>
> understand the policy perspectives on examinations and evaluation and their implementation practices
>
> traces the technology based assessment practices and other trends at the international level.

Unit 1: Perspectives on Assessment and Evaluation

Meaning of Assessment, Measurement, Tests, Examination, Appraisal, and Evaluation and their interrelationships

Difference between 'true ability' and 'observed ability', Principles of assessment and evaluation,

Behaviorist, Cognitivist and Constructivist Perspectives

Purposes of Assessment: Prognostic, Monitoring of Learning, Providing Feedback, Promotion, Placement, Certification, Grading and Diagnostic

Classification of assessment: based on purpose (prognostic, formative, diagnostic and summative) scope (teacher made, standardized), attribute measured (achievement, aptitude, attitude, etc.), nature of information gathered (qualitative, quantitative), mode of response (oral and written; selection and supply), nature of interpretation (norm referenced, criterion referenced) and context (internal, external)

Need for continuous and comprehensive assessment

School based assessment; Authentic assessment

Unit 2: Assessment of Learning

Dimensions of learning: cognitive, affective and performance

Assessment of cognitive learning: types and levels of cognitive learning: understanding and application; thinking skills –convergent, divergent, critical, problem solving, and decision making; items and procedures for their assessment

Assessment of affective learning: attitude and values, interest, self-concept; items and procedures for their assessment

Assessment of Performance: tools and techniques for assessment of skills

Grading: Concept, Types and Application: indicators for grading; CBSE and State evolved indicators

Unit 3: Assessment for Learning

Assessment information as an input for learning, metacognition and development – need for continuous, formative and diagnostic assessment

Use of Projects, Assignments, Work sheets, Practical work, Performance based activities, Seminars and Reports as assessment devices

Developing Performance Tasks (Subject Specific)

Assessment of Group Processes - Collaborative/Cooperative Learning and Social skills

Portfolio Assessment – its meaning, scope and uses; Planning, development and assessment

Self, Peer and Teacher Assessments

Unit 4: Planning, Construction, Implementation and Reporting of assessment

Consideration of what and why to assess (content and objectives)

Differentiation between instructional, learning and assessment objectives

Stating of Assessment Objectives - Need for integrated objectives.

Deciding on the nature and form of assessment - oral tests and written tests; open book examination; weightage to content, objectives, allocation of time; Preparation of a blue print

Construction/selection of items; Guidelines for construction of test items

Assembling the test items; Guidelines for administration

Scoring procedure – manual and electronic; Development of Rubrics

Analysis and Interpretation of Students' Performance

Processing test performance: calculation of percentages; central tendency measures; graphical representations; and interpreting performance

Item response analysis

Role of Feedback in Improving Learning, and Learners' Development

Ascertaining student needs, identifying student interests and feeding forward for improving learning

Reporting Student Performance – content and formats; Progress reports, Cumulative records, Profiles, and Open house

Using feedback for reporting to different stakeholders – students, parents, and administrators
Use of Feedback for teachers' self-improvement

Unit 5: Issues, Concerns and Trends in Assessment and Evaluation
Existing Practices: Unit tests, half- yearly and annual examinations, semester system, Board examinations and Entrance tests, State and National achievement surveys
Management of assessment and examinations, Use of question bank
Issues and Problems: Marking Vs Grading, Non-detention policy, Objectivity Vs Subjectivity
Impact of entrance test and public examination on teaching and learning – the menace of coaching
Policy perspectives on examinations and evaluation: Recommendations in National Policies of Education and curriculum frameworks
Trends in assessment and evaluation: Online examination, Computer-based examination and other technology based examinations
Standards based assessment – international practices

Sessional Work: seminar and group activity
Planning of an achievement test
Planning of other assessment tools
School visits followed by presentation on evaluation practices in schools
Data processing and interpretation of any achievement test of school students
Presentation of papers on issues and concerns / trends in assessment and evaluation

Textbooks
Sidhu, K.S. *New Approaches to Measurement and Evaluation* (Sterling Publishers, New
        Delhi,2009).

Reference books
Bransford, J., Brown, A.L., & R.R.Cocking (eds.). *How people learn: Brain, mind, experience,*
        and school (Washington, DC: National Academy Press,Washington DC, 2000).
Burke, K. (2005). *How to assess authentic learning* (4th Ed.) (Corwin, Thousand Oaks, CA,
        2005).
NCERT *Curriculum and Evaluation* (NCERT, New Delhi,1985).

ED 206 Learning Resources   L3 T0 P0 CH3 CR3

Course Objectives
On completion of the course the students will be able to
        understand teaching as a process of communication and be aware of various resources
        available for making it effective
        prepare and use appropriate instructional material for effective classroom transaction
        design and develop an ICT integrated learning resource
        critically reflect on the suitability of learning resources planned in teaching-learning
        organise learning with active participation of learners- individually and in groups

Unit 1 Learning, Communication and Experience
Concept, components and types of communication, Classroom communication – an analysis of its facilitative and Inhibitive nature
Role of media in communication process, teaching as interpersonal communication, a reflection on the factors of communication affecting learning and learner
Communicating through learning experiences – nature and role in effectiveness of teaching-learning.
Learning resources and the nature of experiences provided by them – extent of concreteness and directness of experiences provided through different media.
The nature of teacher student communication: verbal and non verbal

Unit 2 Learning Resources for Classroom Teaching

Meaning, purpose, steps in development, guidelines for use, and criteria of judging quality of the following resources: Print Resources: resources for communicating verbal experiences - text book, work book, case study and self instructional material

Audio Resources: resources for communicating audio experiences - educational radio broadcast and audio programmes – an analysis of their formats, strengths and limitations

Visual Resources: Resources for communicating visual experiences –

Non projected visual Resources: graph, map chart, poster, models and material – nature of experiences provided by them, their making and possibilities of using them as learning resources

Projected Visual Resources: still visuals – slide, transparency and film-strip, moving visuals – film, video and animation

Media selection, utilization and integration into teaching and learning – learning resources for different pedagogies: a classification of learning resources based on teaching objectives.

Unit 3 Resources for Promoting Self Learning and Learning to Learn Skills

An analysis of what and how self-learning occurs among students

principles of self-learning.

Ways and means of promoting self-learning: organization, merits and demerits of Computer Assisted Instruction, personalized system of instruction, self-paced activity, learning activity packages, learning centers, mini courses, modular instruction, and programmed instruction.

Designing a self-learning material: principles and steps

Learning to learn skills – an analysis and teacher's role in promoting them

Unit 4 Classroom Learning Community as Learning Resource

Learning as a social cultural process

Learning group as a resource for learning – understanding dynamics of a group, zone of proximal development

Variety of ways of organizing learning in groups - Meaning, scope, advantages and guidelines

Teacher's role in building learning communities in a classroom through promotion of common goals, partnership, shared leadership, co-evolving and co-learning

Cooperation and competition as processes in group learning: possibilities in organizing Cooperative and collaborative learning, peer coaching

Assessment of group learning

Unit 5 Technology-enhanced Learning Resources

ICT and Multimedia as technology-enhanced communication devices in teaching-learning: a comparative review of various learning resources

Interactive white board – its features and advantages

Computer as a learning resource for presentation, documentation, word processing, evaluation

Animation and other visual presentation options on a computer

Internet as an Information Resource, Evaluating information resources on the Internet

Emerging Internet trends and technologies for facilitating learning

Designing and Developing Technology-enhanced Learning Material

Changing roles and competencies of a teacher in technology enhanced learning

Sessional Work: seminar and group activity

Preparation of at least three teaching-learning resources from those mentioned in Unit 2

Planning and preparation of an ICT integrated presentation for secondary level

Identification and use of an internet resource for learning at the secondary level

Critical analysis of an existing learning resource

Textbooks

Das R C *Educational Technology – A Basic Text* (Sterling Publishers, New Delhi,1993).

Kumar, K L *Educational Technology* (New Age International (P) Ltd Publishers, New Delhi,1996).

Reference books

S. Majumdar *Regional Guidelines for Teacher Development for PedagogyTechnology Integration* (UNESCO, Bangkok, 2005).

Internet Resources:

E learning India Website - http://elearning-india.com/

ED 207 Classroom Organisation and Management L3 T0 P0 CH3 CR3

Course Objectives

On completion of the course the students will be able to

understand importance of classroom management

describe approaches to classroom management

understand ways of preventing problems in managing a classroom

list physical resources and describe how to maintain them

explain the role of teachers and the principal in ensuring a vibrant school climate

Unit 1 Classroom Organisation

Meaning of classroom organization – purposes, Concept of a smart classroom

Seating arrangements for various purposes

Display area and chalk board – other facilities such as OHP and Multimedia in a classroom

Characteristics of School climate – conducive, learner friendly, inclusive, vibrant, Relation between school policy and school climate

Unit 2 Physical Facilities in a School

Physical resources in a school - physical space (building) with adequate classroom space, adequate furniture, learning resources such as the labs, library, sports field, and staff rooms, rest rooms, etc.

Management of physical resources - Cleanliness, appropriate use of each with an intent or schedule

Streamlining ways of using the facilities: coordination, sharing

Unit 3 School Environment- Teacher Role

School as an institution with an environment of its own

Leadership style of the headmaster and its influence on teacher role performance

Visualize the requirements- procure, maintain and replenish with support of authorities

Teacher self assessment and accountability – importance of feedback

Factors affecting school environment - goodwill, acceptance, belongingness, openness, orderliness, and access, both among teaches and between teachers and students

Promoting self-esteem among students

Team work and transparency in functioning among teachers

Unit 4 Classroom Management

Classroom management – concept, need and approaches

Roles of students in a classroom – leader, follower and non participant

Role of a teacher in classroom management – relationship between leadership styles of a teacher and classroom discipline

Managing behavior problems in a classroom – Preventative, Supportive and Corrective.

Common mistakes in classroom behavior management. Establishment of routines, rules and procedures

Punishment and its legal implications – the rights of a child

Time management in a classroom – allocated time versus engaged time

Unit 5 Mechanisms for coordinated functioning in school

Planning: annual and long term; annual school calendar

Day to day schedules- time table, notifications, announcements

Monitoring for coordinated functioning: allotment, autonomy and accountability (internal and external)

Staff Meetings: forum for sharing, review and further planning

Regular, documentation of events and activities

Approaches to professional development of teachers in a school

Mechanisms that promote and hinder school-community and teacher-parent relationship

Sessional Work: seminar and group activity

Practice of various approaches to classroom management in simulated group work

Review the school time-table planning and its effectiveness towards attaining academic expectations laid by National Curriculum Framework

Preparation of a plan of action to be implemented during the next three years for improving the functioning of a school

Project work on analyzing good and weak points of school management in private,Government, large sized and small sized classroom

Textbooks

Gupta, S K and Gupta S *Educational Administration and Management* (Manorama Prakashan,
        Indore,1991).

Reference books

Marsh, C. *Handbook for Beginning Teachers*. Second Edition (Pearson Education, Australia,
        2000).

Vashist, Savita (ed)*Encyclopedia of School Education and Management* (Kamal Publishing
        House, New Delhi,1998).

ED 208 TEACHING OF MODERN INDIAN LANGUAGE: ASSAMESE 1
                                        L 2 T1 P 0 CH 3 CR 3

The objective of the course is to make the students capable of understanding the principles of lesson design, strategies of instruction and techniques of assessment and evaluation of Assamese (M.I.L) syllabus of secondary level. This includes the understanding the nature of the Assamese language and its essential grammatical features, the principles and methodology of teaching Assamese as mother tongue and also as a second language.

Students are expected to be able to develop an effective classroom programme and suitable methodology of teaching Assamese as mother tongue and also as a second language.

Unit I : Objectives of Teaching Mother Tongue
        a) The role of Mother tongue in the education of a child.
        b) Child development and its relationship to language.
        c) Objectives of teaching Mother tongue:
        -   developing the fundamental language skills of listening, speaking, reading and writing.
        -   Developing Mother tongue as an instrument of thought, communication, appreciation and creation.
Unit II : The nature of language :
        a) Language - its nature, characteristics and functions
        b) Elements of the Mother tongue(Assamese):
        Assamese Sound System, Vocabulary, Script and Spelling system, Writing system, Sentence structure.
Unit III : Principles of Teaching and Learning Mother Tongue :
        a) The processes of acquiring mother tongue
        b) Principles of teaching mother tongue

c) Problems of teaching mother tongue:
    Assamese- home language and school language
- Standard language
- Interference of dialects, home language and other Modern Indian languages.

Unit IV : Essentials of the grammar of the mother tongue(Assamese) :
    Sounds, juncture, word categories, word formation (pratyays), sentence, mood
    system, use of case endings, meaning of Tenses, usage.

Unit V : The Syllabus and the Textbook :
    a) Syllabus : General principles, principles of selection and gradation, distinction between language and literature.
    b) Textbook : Principles governing, preparation of the textbook
- Reader and Supplementary books
    c) A review of the school syllabus and the textbooks

Unit VI : Development of language skills:
    a) Listening and Speaking :
- Nature of the skills of listening and speaking
- The vocal mechanism of the child
- Teaching of the Sounds of the standard language
- Continued development of the Skill of speaking through dialogues, recitation, discussion, classroom, interaction.
    b) Reading :
Mechanics of the skill of reading; Purposes and types of reading
Reading aloud for pronunciation, fluency silent reading for speed, comprehension and thinking; Intensive and Extensive reading main text and supplementary, rapid readers, reading for appreciation and pleasure- through poetry, stories, plays; Reading for vocabulary expansion, information, information, enjoyment, reference.
c)Writing :
Mechanism of the Writing skills, spelling, punctuation
Various writing experiences-writing out explanation, and salient points, summarising, paraphrasing, story reproduction
Composition-guided and free - Latter and application writing - descriptive and reflective essays; Teaching creative writing.

Unit VII : Method and Classroom techniques :
    a) Approaches to teaching mother tongue
    b) Tackling a text : Main text and Supplementary readers-
Identification off objectives and teaching points
Various ways of using the text in the Classroom.
    c) Planning a Lesson,
    d) Preparation and Use of teaching aids; Use of the black board and Classroom apparatus.
    e) Preparation of practice and exercise materials for Reading Prose and Poetry- Grammar, Composition.

Textbooks
Goswami, Golok Chandra *Asamiya Byakaran Pravesh* (Bina Library, Guwahati ,2000).
Sarma, Madan *Asamiya Bhasha Sikshan Paddhati* .Guwahati: Students Stores, 2009 (3rd edition).

Reference books
Goswami, Golok Chandra *Asamiya Byakaranar Maulik Bichar* (Bina Library, Guwahati, 1990).
Stern, H.H. *Fundamental Concepts of Language Teaching* (Oxford University Press, Oxford, 1983).

ED 209 TEACHING OF MODERN INDIAN LANGUAGE: ASSAMESE 1I

L 2 T0 P0 CH 2 CR2

Unit I : Introduction to the literature of the mother tongue and teaching of literature:
  a) A brief review of the literature of the mother tongue, Literary movements, Major Writers and their works.
  b) Teaching of Literature :
     Development of literary appreciation, Characteristics of literary and critical appreciation. A discussion on the common literary terms- alankar, rasa, metre, literary genres.

Unit II : Evaluation :
     Modern concept of evaluation : Continuous evaluation - oral test, Testing tools Synchronising with the objectives of teaching mother tongue at different school levels.
     Types of tests for evaluating language skills.
     Construction of objective- based tests, Unit test, sessional tests, Final examination; Follow up of test results.

Unit III : Teaching a Major Indian language as a Second language:
  a) The place of a regional language (a second language) in the school curriculum.
  b) Objectives of teaching a second language.
  c) The processes of learning mother tongue and learning a second language.
  d) Principles and problems of teaching a second language.
     Development of the language skills
     Interference of the mother tongue.
  e) The syllabus and the Text for teaching a second language : Basic principles
     Change in perspective in the preparation of syllabus and suitable texts.
  f) Method and Classroom techniques :
     Intensive language work in the second language.
     Providing practice in the skills of speaking, reading and writing in the classroom. Judicious use of the mother tongue in the teaching of the elements of the second language-sounds, vocabulary and grammar , initiating discussion, debate recitation, story telling and writing contests to develop the skills in the second language. Collection and analysis of common errors in pronunciations, spelling, structure and usage and planning remedial exercises.

Practical work :
     Studying critically the common mother tongue and second language syllabuses and texts,
     micro-teaching.
     Observation and discussion of a series of demonstration lessons: planning and discussion
     of some individual lesson plans and implementing these in peer groups and micro-teaching.
     Practice teaching in secondary schools.

Textbooks
Goswami, Golok Chandra *Asamiya Byakaran Pravesh* (Bina Library, Guwahati ,2000).
Sarma, Madan *Asamiya Bhasha Sikshan Paddhati* .Guwahati: Students Stores, 2009 (3rd edition).

Reference books
Goswami, Golok Chandra *Asamiya Byakaranar Maulik Bichar* (Bina Library, Guwahati,

Stern, H.H. *Fundamental Concepts of Language Teaching* (Oxford University Press, Oxford, 1983).

ED 210 TEACHING OF ENGLISH I   L2 T1 P0 CH3 CR3

The objective of the course is to make the students capable of understanding the principles of lesson design, strategies of instruction and techniques of assessment and evaluation of English syllabus of secondary level. This includes the understanding the nature of the English language and its essential grammatical features, the principles and methodology of teaching English as a second language. Students are also expected to acquire the ability to produce effective learning materials and evolve appropriate strategies for teaching English at this level.

Unit I : Objectives of Teaching and Learning English at the Secondary Level :
   a) The use of English in India and the place of English in the Secondary school curriculum.
   b) Objectives of teaching English at different School levels -
   - teaching and learning English as a second language in a multilingual society.
   c) The Curriculum of English at the secondary level.
Unit II : The Nature of language and Language learning :
   a) Language- its nature, characteristics and functions.
   b) Approaches to language and language learning-behaviourist and cognitivist,
   c) Learning mother tongue and a second language: the processes
   - Importance of developing skills in a Second language.
Unit III : Essential Elements of the English language :
   A (a)The phonetic structure of English
   - Sounds, Word stress and sentence stress; intonation patterns; consultation of dictionary for correct pronunciation (use of phonetic symbols and stress marks).
     (b)The syntactic structure of English
   - Importance of Word order
   - Structure words
     c)Meaning : Lexical meaning.
   B. Essentials of English Grammar : Noun and Noun modifiers ; Pre-modifiers and Post modifiers ; Preposition ; Adverbs and Adverbials. Comparisons of Adjectives; Relative clauses ; Noun clauses, Adverbial clauses ; Tense and Modals.
Unit IV : Levels of English language - related Skills and Teaching of these Skills
   A. Listening (understanding) and speaking :
   a) Analysis of listening and Speaking Skills.
   b) How to give pupils practice in listening and comprehension.
   c) Presentation of English speech sounds in meaningful sequences- words, phrases, sentences, corrected speech.
   d) Using pronunciation drills, question-answer exercises, conversation, story telling, Choral recitation of rhymes and jingles.
   e) Reading aloud with correct pronunciation, stress, intonation in class- prose, poetry, drama.
   - how to ask questions, respond to inquiry, introduce and thank a speaker, interact in an interview situation.
   - How to give instructions to pupils- initiate classroom interaction- when and how to use LI in the class.
   f) Listing common mispronunciations and finding ways to correct these.
   N.B.: Intensive training in language skills starts with (e) above.

B. Reading skills and how to teach Reading :
a) Process of reading.
b) Purposes of reading- language learning, pleasure, information, appreciation and reading procedures.
c) Types of reading- reading aloud, silent reading, intensive reading.
d) Teaching reading with appropriate speed for various purposes.
e) Teaching reading for overall comprehension, implication, interpretation, evaluation, making inferences.
f) Teaching rapid, silent reading, encouraging supplementary reading, teaching reference skills,
- teaching contextual meaning, inferring meaning from the context.
g) Training in the use of collateral reading materials - dictionaries, papers, journals, encyclopedias, to expand vocabulary and to get information and enjoyment.
C. Writing Skills and how to teach these skills :
a) Mechanics of writing
-Spelling, punctuation, indenting, title, use of parentheses, abbreviation, capital letters,
-Correct form of address letters, applications.
b) Teaching the organisation of a paragraph, an essay,
- guided, and free composition.
c) Teaching study skills - paraphrasing, summarising, note taking, story.
D. Teaching English Grammar
a) Presenting grammatical structures in the class- inductive and deductive methods.
b) Providing practice in Verb pattern
c) Using the text for teaching grammatical structures
d) Planning for remedial work on various areas of English grammar.
e) Explicating the Tense usage in English

Textbooks
Sarma, Madan M. and D.Mohapatra. *How to Teach English: A Resource Book for Teachers and Teacher Educators (*Bhabani Print and Publications, Guwahati,2009).
Verghese, C. Paul *Teaching English as A Second Language* (Sterling, New Delhi,2009).
Reference books
Richards, JC and D.G.Rogers. *Approaches and Methods in Language Teaching* (Cambridge University Press, Cambridge, 2001).
Stern, H.H. *Fundamental Concepts of Language Teaching* (Oxford University Press, Oxford, 1983).
Subramanian, T. *A Textbook of English Phonetics: For Indian Students* (Macmillan, New Delhi, 2000).
Vyas, M.A. and Y.L.Patel.(eds.) *Teaching English as a Second Language: A New Pedagogy for a New Century*(Prentice-Hall India, New Delhi,2009.)

ED 211 TEACHING OF ENGLISH II   L2 T0 P0 CH 2 CR2

Unit I : Methods of English as a Second Language and Classroom Techniques :
    A. Methods :
    a) The Syllabus and the Method
    1. Syllabuses predetermining method (content - oriented) :

Grammar – translation; Structural; Situational

Selection and grading of teaching materials.

2. Syllabuses not pre-determining methods(Process oriented)

   Communicative approach

   What facilitates language learning

3. Beyond methodology: the current practices

B. Techniques (Practical Work)

   a) Using L I in the class
   b) Activity-based teaching: organizing pair and group activities
   c) Detailed analysis of School Syllabuses and English Textbooks

- Identification of teaching points - instructional objectives
- Handling a language text-prose, poetry, supplementary reader

   d) Planning a lesson, Unit plan
   e) Preparation and use of teaching aids - Use of blackboard and classroom apparatus, use of new media (wherever possible)
   f) Preparation of practice materials

Unit II : Evaluation :

   a) New directions in evaluation
- Continuous and comprehensive evaluation in English Language Teaching (ELT)
   b) Review of existing tests, examination patterns question papers
   c) Qualities of a good tests in ESL.
- Periodic tests, annual/final examination, paper setting, Oral and written tests.
- Informal and formal diagnostic tests, remedial tests and techniques.
   d) Construction of objective-based test items in English
- Unit tests
- Follow up of the Test results

   Practical Work
- Micro teaching

Observation and discussion of a series of demonstration lessons
- Planning and discussing some individual lesson plans and implementing these in real and simulated situations and micro teaching,
- Practice teaching in Secondary schools.

Textbooks

Sarma, Madan M. and D.Mohapatra. *How to Teach English: A Resource Book for Teachers and Teacher Educators (*Bhabani Print and Publications, Guwahati,2009)

Verghese, C. Paul *Teaching English as A Second Language* (Sterling, New Delhi,2009).

Reference books

Nunan, D. *Task-based Language Teaching* (Cambridge University Press, Cambridge, 2004).

Richards, JC and D.G.Rogers. *Approaches and Methods in Language Teaching* (Cambridge University Press, Cambridge, 2001).

Stern, H.H. *Fundamental Concepts of Language Teaching* (Oxford University Press, Oxford, `1983).

Subramanian, T. *A Textbook of English Phonetics : For Indian Students*(Macmillan, New Delhi,2000)

Vyas, M.A. and Y.L.Patel. (eds.) *Teaching English as a Second Language: A New Pedagogy for a New Century*(Prentice-Hall India, New Delhi,2009.)

ED 212 TEACHING OF SCIENCE I   L2 T 0 P1 CH 4 CR3

The objective of the course is to make the students capable of understanding the principles of lesson design, strategies of instruction and techniques of assessment and evaluation of general science syllabus of secondary level. This includes the understanding science as principles, facts, methodology and philosophy and the ability to integrate such to a product of scientific inquiry.

Also, students are expected to be able to:

- Develop an effective classroom programme of teaching science lessons.
- Identify and demonstrate evaluative procedures for assessing science learning.
- Examine ways to integrate science with other disciplines.

Unit I : Nature, scope and objective of teaching Science :
     (i) The concept of science as process and product, Concept of General Science.
     (ii) Place of Science in the modern world
     (iii) Need and place of General Science in the School Curriculum.
     (iv) Concept of objective-based instruction with special reference to Bloom's Taxonomy.
     (v) Objective of teaching science at different school levels-a) Middle, b) Secondary and c) Higher Secondary.

Unit II : Designing a curriculum for science:
     (i) Principles of construction and organisation of General Science syllabus -
     a) Psychological and Logical considerations
     b) Topical and Spiral(concentric) approach
     c) Correlation of General Science with other subjects and with life.
     (ii)   Modern Trends in curriculum construction
     (iii)   Evaluation of existing secondary syllabus.

Unit III : Life and work of a few Indian Scientists :
     (i)   Homi Jahangir Bhaba, (ii) P.C. Ray, (iii) J.C. Bose, (iv) Salim Ali, (v) C.V.Raman, (vi) Har Gobind Khorana, vii) Meghnad Saha

Unit IV : Units and Measurements :
     (i)   Units of Measurement, different systems of Units - CGS, MKS, FPS and SI units of distance, area, volume, mass, weight, velocity, acceleration, force, work, energy, power, momentum, pressure, density surface tension and friction in these systems.
     (ii)   Different measuring tools-metre, scale, vernier caliper, screw, gauge, spheromater, spring balance, physical and chemical balance, plumbline, spirit level.
     (iii) Dimensions of physical quantities and Dimensional equations.

Unit V: Properties of matter
     (i)   States of matter- solids, liquids, gases and plasma
     (ii)   Properties of gases-Boyle's law and Charle's Law.
     (iii)   Properties of solids - Semiconductors(P&N type)
     (iv)   Laws of chemical combination – law of conservation of mass, law of constant composition or law of definite proportions, law of multiple proportions

(v)   Daltons's Atomic theory, structure of atom, atomic models, atomic number and mass number

(vi)   Bohr's model of an atom – distribution of electrons in different energy levels

(vii)   Isotopes and radioactivity

(viii) Mendeleef's periodic table and the modern periodic table, classification of elements and chemical bonding - electrovalent and covalent bonding.

(ix)   Acids, bases and salts; oxidation and reduction;

(x)   Some non- metals and their compounds- oxygen, sulphur, nitrogen

(xi)   Solutions- solubility, effect of temperature on solubility, solubility of a gas; Iron in solutions, concept of PH indicators.

(xii)   Carbon compounds- aliphatic and aromatic compounds, functional groups

Unit VI : The living Body :

(i)   Cells and Tissues - Living Cells, Cell division

(ii)   Organisation - at molecular level cellular level, organ level, organ system

- higher levels of organisation ; Population (habitat, ecosystem)
- factors in the growth of population
- Community(characteristics).

(iii)   Growth :

- Nature, characteristics and types
- Factors of growth in plants
- Factors of growth in animals
- Growth in microorganisms
- Life- cycle in plants

(iv)   Development :

- Anabolism and catabolism
- Developmental stages
- Factors of development

(v)   Reproduction :

- Reproduction in plants :
Vegetative, Asexual and Sexual
Reproduction in animals
Vegetative, sexual, embryo, puberty.

Unit VII: Contemporary environmental issues

Definition of pollutants, types and causes of air, water, soil and noise pollution.
Ecosystems, meaning and scope, food chain , food webs and ecological pyramids.
Concepts of biodiversity and conservation.
Trends in World population :Demography, Population explosion, Communicable and non-communicable diseases.

Textbooks
Das, R.C. *Science Teaching in Schools* (Sterling, New Delhi,2009).
Sharma, R.C.*Modern Science Teaching* (Dhnpat Rai & Sons, New Delhi, 2009).
Reference book
Bloom, B.S. *A Taxonomy of Educational Objectives* (Longmans Green & Co., New York, 1968).
UNESCO *Source Book for Science Teaching* (Equal Productions, Ltd. Wakefield, Yorkshire).

ED 213 TEACHING OF SCIENCE II   L1 T 0 P1 CH 3 CR 2

The objective of the course is to make the students capable of understanding the principles of lesson design, strategies of instruction and techniques of assessment and evaluation of general science syllabus of secondary level. Students are expected to be able to:

- Develop an effective classroom and laboratory programme of teaching science lessons.
- Identify and demonstrate evaluative procedures for assessing science learning.
- Examine ways to integrate science with other disciplines.

Unit I: Planning of Instruction in General Science :
  (i)   Selecting the content for instruction (facts, concepts, generalisation, process, sequencing of content categories). Identifying the teaching points, organisation of content.
  (ii)   Stating instructional objectives, identifying learning outcomes in behavioural terms (Knowledge - define, state, write, recall, recognise, reproduce, name, underline, select, list label, measure etc. Comprehension - identity, illustrate, explain, justify, represent, judge, select, contrast, indicate, formulate clarify etc. Application - predict, choose, construct, select, find, compute, assess, show, use, explain, compare, demonstrate, perform, contrast etc. Skill-Perform, do, draw etc.)
  (iii)   Choosing the appropriate methodology (Lecture- Demonstration method, Heuristic method, problem - solving method, project method).
  (iv)   Using appropriate teaching aids (audio-visual aids, improvised aids, general science laboratory, text-book and other reading materials like hand book, guide book, journals etc.)
  (v)   Using appropriate evaluation tools (Achievement test, qualities of a good evaluation tool-reliability, validity, objectivity, and norms).
  (vi)   Framing different types of test items (Essay type, short answer type, objective type-completion, true/false, classification, odd man out, multiple choice, matching).

Unit II : Understanding energy :
  (i)   Mechanical Energy-Potential and kinetic energy ; motion-velocity, acceleration, motion under uniform acceleration $V=u+at$, $S=ut + 1/2 at$ and $V=u+2as$; three laws of motion; laws of conservation of momentum, gravity and gravitation centre of gravity, rotating body, couple, equilibrium of forces.
  (ii)   Heat
  (iii)   Light
  (iv)   Sound
  (v)   Electrical and Magnetic energy
  (vi)   Atomic and nuclear Energy
  (vii)   Other natural forms of energy - Conventional and non-conventional energy sources. Concepts of renewable energy.

Unit III : Life on earth
  (i)   Classification - Classification of plants, Classification of animals,
  (ii)   The Microorganisms Parasite, saprophytes, symbiants, Virus, Useful and harmful bacteria, Fungi, Algae, Protozoa
  (ii)   Diseases caused by microorganisms and Preventive measures

(iii) Life Processes - Photosynthesis and respiration, Nutrition, Digestion, Excretion, Internal Transport in plant, Transport in animals, Coordination in living being

(iv) Heredity and Variation - Gene and Chromosomes, Mendel's law of heredity, Hybridization

(v) Evolution - Lamarckism, Darwinism, Evidences of Organic Evolution

Unit X : Food and Agriculture :

(i) Types of food

(ii) Plant Nutrients, Physical, chemical and biological properties of soil.
- Nutrient elements : Macro and Micro elements
- Deficiency diseases

(iii) Crop plants :
- Food crop and cash crops
- Crop seasons
- Modern Agricultural Practices
- Study of some economic crops
- Animals at our Service

Laboratory experimental components

A. Physical Science :

1. Handling of following measuring instruments :
   a) Slide Caliper
   b) Screw Gauge
   c) Sphere meter
   d) Improvised balance
   e) Barometer
   f) Maximum and Minimum Thermometer

2. Determination of the specific gravity of a solid (i) heavier than water, (ii) Lighter than water and (iii) soluble in water and a liquid by (a) Nicholson's hydrometer, Hydrostatic balance.

3. Determination of the specific gravity of a liquid by specific gravity bottle, and Hair's apparatus.

4. Verification of the laws of limiting fraction.

5. Verification of the law of length of simple pendulum and hence finding out the acceleration duty to gravity, g.

6. Verification of the Boyle's law

7. Determination of fixed points of a thermometer

8. Determination of the velocity of sound by Resonance tube.

9. Comparison of the illuminating powers of two sources of light by Remford's photometer.

10. Verification of the laws of reflection by Pin method and hence finding out the position of the image formed.

11. Verification of the laws of refraction by Pin method and hence finding out the position of the image formed.

12. Plotting of the I-D curve and determination of the refractive index of material of the prism.

13. Determination of the angle of minimum deviation and hence the refractive index of the material of the prism.

14. Determination of the poles of a bar magnet.

15. Tracing of lines of force due to a bar magnet placed in the magnetic meridian (North Pole pointing North and North Pole pointing South).

16. Demonstration of magnetic field produced by electric current.
17. Verification of Ohm's Law and determination of the resistance of a coil.
18. Connection of resistances and cells in series and parallel.
19. Preparation, collection and verification of the properties of Oxygen, Nitrogen, Hydrogen and Carbon dioxide gases.
20. Separation of the elements of a mixture by common laboratory processes.
21. Neutralization of Acids with Bases
22. Preparation of Models and Charts (e.g. improvised thermometer, pin-hole camera, telescope, periscope, kaleidoscope, motor, engines, ammeter, voltmeter, galvanometer, electric bell, laclanche cell, solar and lunar eclipse etc.)

B. Biological Science :
1. Use of simple and compound Microscopes.
2. Preparation and staining of microscopes slides : human blood, onion, chromosome, lactebasilus bacteria, squamous epithelium, plant tissue(identification of xylem and phloem in dicot and monocot stems etc)
3. Study of permanent slides under microscope: Amoeba, plasmodium, amphibian blood, stages of mitotic and meiotic cell divisions in plants and animals, human nervous, tissue, plant cell, animal cell etc.
4. Chemical tests : Carbohydrate, starch, fat, protein, digestion of carbohydrates by human saliva
5. Morphological study : Typical plant, fine typical seed, modified roots and stems.
6. Physiological experiments : evolution of oxygen during photosynthesis, respiration in plants, transpiration, effect of sunlight in plant growth
7. Disssections : (i) General Viscera and alimentary system of fish, toad, cockroach and earthworm, (ii) circulatory system of toad and fish.
8. Collection of biological specimens and preparation of herbarium
9. Preparation of biological models and charts.

Textbooks
Das, R.C. *Science Teaching in Schools* (Sterling, New Delhi,2009).
Sharma, R.C.*Modern Science Teaching* (Dhnpat Rai & Sons, New Delhi,)
Reference book
 Bloom, B.S. : A Taxonomy of Educational Objectives (Longmans Green & Co., New York, 1968).
UNESCO *Source Book for Science Teaching* (Equal Productions, Ltd. Wakefield, Yorkshire).

Ed 214 TEACHING OF MATHEMATICS 1   L 2 T1 P0 CH 3 CR 3
The objective of the course is to make the students capable of understanding the principles of lesson design, strategies of instruction and techniques of assessment and evaluation of Mathematics syllabus of secondary level. This includes the understanding science as principles, facts, methodology and philosophy and the ability to integrate such to a product of scientific inquiry.

Also, students are expected to be able to:

- Develop an effective classroom programme of teaching Mathematics lessons.
- Identify and demonstrate evaluative procedures for assessing Mathematics learning.
- Examine ways to integrate Mathematics with other disciplines.

Unit I : Nature and Scope of Mathematics and Objectives of Teaching it :
   a) The concept of Mathematics
   b) Place of Mathematics in the Modern World
   c) Need and place of Mathematics in school curriculum
   d) Concept of objectives- based instruction with special reference to bloom's Taxonomy
   e) Aims and Objectives of teaching Mathematics at different stages:
   i)Elementary, ii) Secondary and iii) Higher Secondary level.

Unit 2: a) Contribution of Indian Mathematics :
   (i)   Bhaskaracharya
   (ii)   Aryabhatta and
   (iii)   Ramanujan
   b)Contribution of Arabs and Greeks to the development of Mathematics.

Unit 3: Construction and Organisation Mathematics :
   a) Principles governing the construction and organisation of curriculum.
      (i)   Psychological and Logical consideration
      (ii)   Topical and Spiral(concentric) approach.
      (iii)   Correlation o Mathematics with other subjects and with life
   b) Modern Trends in curriculum construction
   c) Evaluation of existing secondary syllabus
Unit 4 : Planning of Instruction in Mathematics :
   a) Selecting the content for instruction(facts, concepts, generalisation, process, sequencing of content categories),identifying the teacher points, organisation of content.
   b) Stating instructional objectives, identifying learning outcomes in behavioural terms
   c) Choosing the appropriate methodology(Heuristic Method, Analytic-synthetic method, Inductive-deductive method and laboratory method)
   d) Using appropriate teaching aids(improvised aids,TV/Radio lessons, Computer aided instruction(CAL), Testbook, visual aids).
   e) Use of appropriate evaluation tools :
   f) (Achievement test, Qualities of good achievement test-reliability, validity, Objectivity, norms: types of items).
Unit 5: Teaching of Arithmetic with special reference to the following topics :
   Number system, complex number, rational and irrational numbers, decimal fractions, number line, ratio, proportion, percentage, loss and profit, partnership business, discount, interest, shares, stocks and dividends, bank account and other forms of deposits.

Textbooks
Chambers, Paul *Teaching Mathematics* (Sage South Asia, New Delhi,2010).
Sidhu, K.S. *The Teaching of Mathematics* (Sterling Publishers, New Delhi).

ED 215 TEACHING OF MATHEMATICS 1I   L2 T 0 P0 CH 2 CR2

Unit 6 : Teaching of Algebra with special reference to the following topics :
   Exponents, algebraic expressions, square and cube formulae, factorisation, HCF, LCM, polynomials, linear equations, linear simultaneous equations, quadratic equation, graphs, logarithms, surd permutation and combination, A.P. and G.P.

series.

Unit 7 : Teaching of geometry with special reference to the following topics :
Triangles, types of triangles theorems on angles of a triangle and on right angled triangles, congruency and similarity of triangles, circles and related theorems, theorems on concurrency locus, construction and mensuration, Trigonometric ratios of identities, values of trigonometric ratios of some particular angles, heights distances.

Unit 8 : Teaching of Statistics with special reference to the following topics :
Collection, classification tabulation and graphical representation of data and their interpretation, Measures of central tendency, Measures of variability, flow chart and algorithm for solving computational problems.

Textbooks

Chambers, Paul *Teaching Mathematics* (Sage South Asia, New Delhi,2010).
Sidhu, K.S. *The Teaching of Mathematics* (Sterling Publishers, New Delhi).

Internship in Teaching

ED 216 Practical: Initiatory School Experiences 1day a week	0 0 2 4 2
ED 217 Practical : Internship in Teaching 4 weeks	0 0 5 10 5

Course Objectives

On completion of the course the student teacher will be able to
understand the content and pedagogical principles, issues and problems related to teaching
acquire competencies and skills required for effective classroom teaching, class management and evaluation of student learning, organization of co-curricular activities, working with the community
develop proper professional attitudes, values and interests
understand the role of a teacher
familiarize with the existing educational scenario of the respective states.

Organization

The internship will be organised for a continuous period of eight weeks in selected cooperating schools .

Activities

Getting acquainted with various aspects of cooperating schools.
The student will teach 40 lessons in each method/subject. Out of 40 lessons in each subject, 20% will cater to the needs of slow learners, enrichment for talented children, in-group learning set up and on self-learning models.
Participating in school activities and organisation of activities
Administering of diagnostic tests and identifying of learning difficulties
Conducting a case study/action research
Organizing curricular and co-curricular activities

Post-internship Activities

Follow-up activities (remedial and enrichment activities) to be taken up by the University.
Finalization of records and reports related to curricular and co-curricular activities.

Evaluation and Scheme of Assessment

Evaluation of performance during pre-internship will be done on the basis of assessment by the supervisors. Marks will be assigned to different components as follows:

Area   Marks
1. Teaching Subject I   100   (including practical, if applicable)

Subject II   100   (including practical, if applicable)

2. Record of Lesson Observation (Ten in each method) :   Subject I 10

Subject II 10

3. Evaluation Record   Subject I 15

Subject II 15

4. Preparation and presentation of teaching aids   Subject I 15

Subject II 15

5. Record of participation in school activities   Subject I 10

Subject II 10

Total 300

At the end Grades will be awarded for each Teaching Subject.

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