Semester VI

B. Sc. B. Ed. (CBCS) Semester- VI

GROUP C: CORE COURSE (CC)

Semester VI

PHY 302: PHYSICS SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

Time: 3 Hours Max. Marks: 100

Credits- 4 Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives: The student teacher will be able to:

- Understand the basic concepts of solid state physics and electronics.
- Understand the thermal, electrical and magnetic properties of solids.
- Apply the concepts in understanding the working of some electronics devices.
- Solve the problems related to solid state physics and electronics.
- Establish the link between theory and experiments.

Course Contents

Unit I: SolidState Physics

Overview: Crystalline and glassy forms, liquid crystals, glass transition.

Structure: Crystal structure, periodicity, lattices and bases, fundamental translation vectors, unit cell, Wigner-seitz cell, allowed rotations, lattice types, lattice planes, common crystal structures, Laue's theory of X-ray diffraction, Bragg's law, Laue patterns.

Bonding: Potential between a pair of atoms, Lennard-Jones potential, concept of cohesive energy, covalent, Vander Walls', ionic, and metallic crystals.

Magnetism: Atomic magnetic moment, magnetic susceptibility, Dia-, Para- and Ferro-magnetism, Ferromagnetic domains, hysteresis.

Unit II:Thermal properties and band structure

Thermal properties: lattice vibrations, simple harmonic oscillator, second order expansion of Lennard-Jones potential about the minimum, vibrations of one dimensional monatomic chain under harmonic and nearest neighbor interaction approximation, concept of phonons, Debye model; lattice specific heat, low temperature limit.

Band structure: Electrons in periodic potential, nearly free electron model (qualitative), energy bands, energy gap, metals, insulators, semiconductors.

Motion of electrons: Free electrons, conduction electrons, electron collisions, mean free path, conductivity and Ohm's law, Density of states, Fermi energy, Fermi velocity, Fermi-Dirac distribution.

Unit III: Semiconductors

Intrinsic semiconductors, electrons and holes, Fermi level, Temperature dependence of electron and hole concentrations, Doping, impurity states, n and p type semiconductors, conductivity, mobility, Hall effect, Hall coefficient.

Semiconductor devices: metal-semiconductor junction, p-n junction, majority and minority carriers, diode, Zener and tunnel diodes, light emitting diode, transistor, solar cell.

Unit IV:Electronics

Power supply: Diode as a circuit element, load line concept, rectification, ripple factor, Zener diode, voltage stabilization, IC voltage regulation, characteristics of a transistor in CB, CE and CC mode, graphical analysis of the CE configuration, low frequency equivalent circuits, h-parameters, bias stability, thermal runaway.

Field effect transistors:I-V curves of JFET, biasing of JFET, operation of JFET, source follower, depletion and enhancement mode, MOSFET, biasing of MOSFET, FET as variable voltage resistor, digital MOSFET circuits, Tunnel diode, concept of negative resistance, characteristics and working of tunnel diode, UJT- its construction and working, UJT as relaxation oscillator.

Small signal amplifiers: General principles of operation, classification, distortion, RC coupled amplifier, gain, frequency response, input and output impedance, multistage amplifiers, transformer coupled amplifiers, Equivalent circuits at low, medium and high frequencies, emitter follower, low frequency common-source and common-drain amplifier, Noise in electronic circuits.

Suggested Readings:

1. C.Kittel, Introduction to Solid State Physics, V Edition (John Wiley and Sons, New York, 1976)
2. A.J. Dekker, Solid State Physics, (Macmillan & Co, 1967)
3. S Blackmore, Solid state Physics, II Edition (Cambridge University press, Cambridge)
4. N W Ascroft and N D Mermin, Solid State Physics (Holt, Rinehart and Winston, New York, 1976)
5. R. J. Singh, Solid State Physics (Pearson, 2012)
6. J. P. Srivastava, Elements of Solid State Physics (PHI, 2006)
7. B G Streetman,Solid State Electronic devices, II Edition (Prentice-Hall of India, New Delhi, 1986)
8. W D Stanley,Electronic Devices, Circuits and Applications, (Prentice-Hall, New Jersey, USA, 1988)
9. J D Ryder,Electronics Fundamentals and Applications, II Edition (Prentice-Hall of India, New Delhi, 1986)
10. J Millman and A Grabel; Microelectronics, International Edition (McGraw-Hill Book Company, New York, 1988).
11. B L Theraja, Basic Electronics (S. Chand Publishing, 2005)

Practicals

Distribution of Marks for End Semester Practical Examination	
Activity	**Marks**
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

All the following experiments are to be done. Few more experiments may be set at the institutional level.

1. To trace an output waveform of RC phase-shift oscillator and determine its frequency for different values of capacitance used.
2. To study the characteristics of field effect transistor (FET) and find out r_p, g_m, and μ.
3. To study diode rectifier and effect of load resistance on ripple factor for L and π filters in full wave rectifier and bridge rectifier.
4. To study the unijuction transistor (UJT) and plot V-I characteristic of a given transistor.
5. To measure the hybrid parameters h_{ie}, h_{re}, h_{fe}, and h_{oe} of a given transistor.
6. To study the performance of an electronically regulated power supply in terms of its regulation characteristics.
7. To study the zener diode in terms of voltage regulation.
8. To study the temperature dependence of resistance of semi-conducting material by four probe method.
9. To study the Hall Effect and calculate Hall coefficient and the carrier concentration.
10. Determine the magnetic susceptibility of a given material and study its field dependence.

GROUP C: CORE COURSE (CC)
Semester VI
CHM 302: CHEMISTRY: ORGANIC CHEMISTRY

Time: 3 Hours Max. Marks: 100
Credits- 4 Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives:

- Students will gain an understanding of the fundamental electronic structure and bonding in carbonyl compounds, substituent effects on pKa (in the case of carboxylic acids), the reactivity of carbonyl compounds with both hard and soft nucleophiles (carboxylic acids, aldehydes and ketones), the ability of synthetic organic chemistry to prepare specific molecular targets in a selective manner through a series of simple bond-forming processes.
- To know about important functional group transformations and bond-forming methods in organic synthesis
- To introduce students to the chemistry of carbonyl compounds including structure and reactivity, 1,2- and 1,4-addition and enols and enolates. Chemistry of Nitrogen Compounds, Synthetic transformation of aryl diazonium salts, azo coupling. Chemistry of Heterocyclic compounds.

Course Contents

Unit I: Chemistry of Hydroxy Compounds and ether

Chemistry of hydroxy compounds

- **Alcohols:**classification and nomenclature.Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.
  Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HlO_4] and pinacol-pinacolone rearrangement.
  Trihydric alcohols- nomenclature and methods of formation, chemical reactions of glycerol.
- **Phenols**: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanism of Fries rearrangement, Claisen

rearrangement, Gatterman synthesis, Hauben-Hooesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

- **Ethers and Epoxides:** Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and auto oxidation, Ziesel's method.Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and Organolithium reagents with epoxides.

UnitII: Chemistry of Carbonyl Compounds including Enolates

- **Aldehydes and Ketones**: Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties,
  Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Witting reaction, Mannich reaction.
  Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-kishner, $LiAlH_4$ and $NaBH_4$ reductions, Halogenation of enolizable ketones.
- Introduction to α, β unsaturated aldehydes and ketones.
- **Organic Synthesis via Enolates**: Acidity of α-hydrogens. Synthesis of ethyl acetoacetate by Claisen condensation and Synthesis of diethylmalonate. Keto-enoltautomerism in ethyl acetoacetate. Synthetic applications of ethyl acetoacetate and diethylmalonate. Alkylation of 1,3-dithianes.

UnitIII: Chemistry of Nitrogen Compounds

- **Nitroalkanes and Nitroarenes**: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes.Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.Picric acid.Halonitroarenes: Reactivity.
- **Amines**: Structure and nomenclature of amines, physical properties. Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines, Structural features effecting basicity of amines, Amines salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactions of amines: Electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

Unit IV: Chemistry of Heterocyclic compounds

- **Heterocyclic Chemistry:** Introduction: Molecular orbital picture and aromatic characteristic of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution.Mechanism of nucleophilic substitution reactions in pyridine derivatives.Comparison of basicity of pyridine, piperidine and pyrrole.

Suggested Readings:

1. Bruckner, R. Advanced organic chemistry: Reaction Mechanisms Academic Press
2. Lowry, Thomas H. Mechanism and theory in organic chemistry Addison-Wesley
3. Kalsi P S Reaction Mechanism 6th Edition
4. Singh Mukherjee, Reaction Mechanism
5. Francis A Carey Organic Chemistry fourth edition.

6. Bahl, Arun A textbook of organic chemistry S. Chand and Co. Ltd.
7. Gupta R, Kumar M, Gupta V, Heterocyclic Chemistry, Springer
8. Francis A. Carey, Richard A. Sundberg, Advanced Organic Chemistry
9. David E. Lewis Advance Organic Chemistry Oxford University Press.
10. Bernard Miler Advanced Organic Chemistry: Reactions And Mechanism Prentice Hall College
11. David R. Klein, Organic Chemistry 4th Edition John Wiley & Sons.

Practical

Distribution of Marks for End Semester Practical Examination	
Activity	**Marks**
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

1. Synthesis of Organic Compounds

- **a.** Acetylating of salicylic acid, aniline, glucose and hydroquinone.
- **b.** Benzoylation of aniline and phenol.
- **c.** Aliphatic electrophilic substitution: Preparation of iodoform from ethanol/ acetone.
- **d.** Aromatic electrophilic substitution:
  - **i.** Nitration: Preparation of m-dinitrobenzene and p-nitroacetanilide
  - **ii.** Halogenation: Preparation of *p*-bromoacetanilide and 2,4,6-tribromophenol
- **e.** Diazotization/coupling: Preparation of methyl orange and methyl red
- **f.** Oxidation: Preparation of benzoic acid from toluene
- **g.** Reduction: Preparation of aniline from nitrobenzene and *m*-nitroaniline from *m*-dinitrobenzene.

GROUP C: CORE COURSE (CC)

Semester VI

ZOO 302: ZOOLOGY: ENVIRONMENTAL STUDIES, ETHOLOGY AND ECONOMIC ZOOLOGY

Time: 3 Hours Max. Marks: 100

Credits- 4 Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives:

To enable students to understand the energy sources, flow of energy and conservation; to understand the recycling of minerals and nutrients in ecosystem; to understand the dynamics of population; to understand causes of pollution; to comprehend origin of life, animal behaviour and economic importance of animals with wild life protection.

Course Contents

Unit I: Ecosystem

- Environment: - Atmosphere, lithosphere and hydrosphere as habitats and ecological factors.
- Abiotic factors: Light and Temperature as ecological factors, limiting factors, Liebig's law of minimum and Shelford Law of tolerance
- Ecosystem: Dynamics of Ecosystem, Ecological Pyramids, Energy flow, Food chain and Food web,Productivity.
- Biochemical cycle: water, nitrogen and suphur cycles recycling of organic nutrients.
- Population: Definition and attributes–density, natality, vital index, age distribution, growth patterns, migration, dispersal, dispersions, carrying capacity.
- Biotic Community: Definition, Structure, Ecotone, edge effects, habitat and different types of niche, Ecological succession, Infra and Interspecific interaction. All types of animal association.
- Elementary statistics: Central tendency and Correlation Coefficient.

Unit II: pollution and its effect

- Pollution Types and Causes
- Air pollution: sources, acid rain, photochemical smog, prevention and control
- Water pollution, sources, prevention and control, eutrophication.
- Noise pollution: sources, prevention and control.
- Soil pollution: sources, prevention and control
- Thermal pollution.
- Green house effect and global warming

- Depletion of ozone layer.
- Natural Disaster: Earthquake, Tsunami
- Natural Resources and conservation – Non Renewable and Renewable
- Bioaccumulation and Biomagnifications.

Unit III: Ethology

- Introduction and history of Ethology.
- Behaviour: Innate (tropism, Texas, reference instincts) and Acquired (learning and reasoning)
- Motion: Classification of directional movements:- kinesis, tropism & taxes
- Communication: Definition ,types of signal (touch, sound, Chemical, and visual),
- Societies: characteristics and advantage with reference to honey bee, and monkey

Unit IV: Economic Importance and Wild life

- Economic Importance of Invertebrates (Apiculture, Aquaculture, Sericulture).
- Insects as pests and their management
- Economic Importance of vertebrates (Fish culture and Poultry culture.)
- Wild life of India, causes of depletion of wild life, modes of wild life conservation, Red data book. Environmental legislations (Wildlife Protection Act, Environment act. Biodiversity act). Wild life scenario in and around central foot hills of the Aravalli and the Thar desert.

Suggested Readings:

1. Environmental Biology, M Calver, Cambridge Pub 2009.
2. Fundamentals of Ecology of E.P. Odum – W.B. Saunders, Philadelphia)
3. Fundamentals of Ecology of Gene P Odum &Gray W Barrett 5th ed., Cengage Learning 2011
4. Environmental studies by S.V.S Rana – Rastogi Publication, 2008
5. Animal Ecology by S.P. Singh 6th Revised Edition – Rastogi Publications,2008
6. Basic Ecology by E.P. Odum (Holt, Rinehart & Winston , New York)
7. Ecology by S.K. Charles(Prentice Hall of India, New Delhi)
8. Ecology : Principle and Applications by Chapman E (1988) – Cambridge University Press
9. Modern concept of ecology by Kumar HD (1986) Vikas Publication House.
10. Ecology and Environment by Sharma PD (1991) Rastogi Publication
11. Environmental Biology by Trievedi PR &Gurudeep Raj (1992)
12. Animal Ecology and Biostatistics. KC Soni Hindi Edition college book centre, Chaura Rasta, Jaipur
13. Mammalian Endrocrinology and Animal Behavior, VS Pawar, Hindi Edition, College book centre, Chaura Rasta

Practicals

Distribution of Marks for End Semester Practical Examination	
Activity	**Marks**
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

Course Contents

1. Simulation of an ecosystem in the laboratory.
2. Determination of oxygen content of water sample by Winkler's method.
3. Determination of chloride content of water sample.
4. Determination of dissolved CO_2 content of water.
5. Determination of Alkalinity in the pond water.
6. Determination of total solid content of water.
7. Determination of pH of soil sample.
8. Determination of water content in a given simple of soil.
9. Demonstration of Phototactic responses by *Tribolium* / House fly / *Drosophila*.
10. Demonstration of Geotactic responses by Earthworm.
11. Exercise on mean, median, mode and test of significance- Correlation Coefficient.

GROUP C: CORE COURSE (CC)
Semester VI
BOT 302: BOTANY: PLANT PHYSIOLOGY AND METABOLISM

Time: 3 Hours Max. Marks: 100
Credits- 4 Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives: After completion of this course the student teachers will be able to;

- Understandthe sub-cellular physiological phenomena inplants;
- Understand the water relations inplants;
- Understand the functioning of plant from the physiological point ofview;
- Understand about enzymes and their mechanism of action
- Understand various facets of growth, differentiation and physiology of flowering in angiosperms.

Course Contents

Unit I: Movement of water molecules in plants

- Importance of water to plant life, properties ofwater.
- Review of diffusion, osmosis and imbibition – definitions, concept of water potential, osmotic potential, pressure potential, solute potential.
- Absorption of water: Root as an absorbing organ, mechanism and pathways of water movement from root hair to root xylem - symplast, apoplast and trans-membrane pathways.
- Ascent of sap: Vertical pathway of water in plants, structural properties of xylem, root pressure theory, cohesion – tension hypothesis.

Unit II: Respiration in plants

- Transpiration: Definition, types, mechanism of stomatal opening and closing (role of K^+ and Abscisic acid), anti-transpirants, factors and significance of transpiration, guttation.
- Cellular respiration: Introduction, respiratory quotient, aerobic and anaerobic respiration, structure of mitochondrion, glycolysis, synthesis of acetyl CoA, Krebs cycle, oxidative phosphorylation, electron carrier complexes, chemiosmotic hypothesis, proton pump theory, synthesis of ATP, pentose phosphate pathway.

Unit III: Manufacture &transport of organic substances

- Photosynthesis: Introduction, brief history, ultrastructure of chloroplast,

photosynthetic pigments, absorption and action spectra, photochemical (light) reaction, photophosphorylation, Z-scheme, Calvin cycle, C4 pathway, CAM pathway, photorespiration, factors and significance of photosynthesis.

- Transport of Organic Substances: Ultrastructure and functions of phloem, (sieve tube), mechanism of phloem transport, source – sink relationship, theories and factors affecting photosynthesis.
- Mineral Nutrition: Major and micro-nutrients, absorption of mineral salts, mechanism and theories of mineral uptake; passive absorption – mass flow, Donnan equilibrium: active absorption – carrier concept, cytochrome pumphypothesis.Role of N, P, K, Ca, Mg, Fe, N and Zn in plant metabolism, Mineral deficiency symptoms.

Unit IV: Plant Hormones

- Growth and Development: Definitions, phases of growth and development, photomorphogenesis, brief account of phytochromes – discovery, physiological role and mechanism of action.
- Plant growth Regulators: General account, discovery, chemical nature, physiological effects and applications of auxins, cytokinins, gibberellins, ethylene and abscisic acid. Brief account of plantmovements.
- Physiology of flowering: (i) Brief account of photoperiodism, short day, long day and day-neutral plants, night interruption phenomenon, florigen concept, role of phytochromes (ii) Brief account ofvernalization.

Suggested Readings:

1. Taiz, L. and E. Zeiger, 1998, Plant Physiology (2nd Ed.), Sinauer Associates Inc.USA.
2. Salisbury, F.B. and C.W.Ross, 1992, Plant Physiology (4th Ed.) Wadsworth Publishing Co.USA.
3. Leo, P.J. and R.C.Leegood, 1999, Plant Biochemistry and Molecular Biology, John Wiley & Sons,England.
4. Hopkins, W.J.1995, Introduction to Plant Physiology, John Wiley and Sons, Inc., New York.
5. Lehninger A.B.,1982, Principles of Biochemistry, CBS Publishers and Distributors, NewDelhi.
6. John, J.L., 1994, Fundamentals of Biochemistry, Sultanchand& Co., New Delhi.
7. Srivastava, H.S., 2005, Plant Physiology, Biochemistry and Biotechnology, Rastogi Publications,Meerut.
8. Srivastava H.S. and N Shankar, 2006, Plant Physiology and Biochemistry, Rastogi Publications,Meerut.
9. Salisbury F.B. and Ross C.W. 2005. Plant Physiology (4th Ed.) CBS Publishers & Distributors N. Delhi.

Practicals

Distribution of Marks for End Semester Practical Examination	
Activity	**Marks**
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

All the following experiments are to be done. Few more experiments may be set at the institutional level.

- To demonstrate osmosis using egg membrane, onion/tomato peels, potato osmoscope.
- To study the effect of temperature and alcohol on the permeability of membranes.
- To demonstrate plasmolysis.
- To compare the water holding capacity of soils (clay, peat and sand).
- To demonstrate transpiration pull.
- To compare the rates of transpiration in different environmental conditions.
- To demonstrate the evolution of oxygen during photosynthesis.
- To compare the rates of photosynthesis under different environmental conditions.
- To demonstrate the necessity of light, CO_2 and chlorophyll for photosynthesis.
- Separation of photosynthetic pigments by paper chromatography.
- Demonstration of aerobic respiration.
- Demonstration of anaerobic respiration.
- To demonstrate the liberation of CO_2 during aerobic respiration.

GROUP C: CORE COURSE (CC)
Semester VI
MTH 302: MATHEMATICS: COMPLEX ANALYSIS

Time: 3 Hours Max. Marks: 100
Credits- 4 Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objective:
To develop the understanding and application of concepts of complex variables in problem solving situations.

Course Contents

Unit I: Complex Function
Complex numbers, function of a complex variable, limits, Cauchy-Riemann equations (Cartesian & polar forms), continuity, differentiability of a function, Analytic functions, Harmonic functions, Construction of an analytic function.

Unit II: Complex integration
Complex integration, Complex line integrals, Cauchy's integral theorem, Morera's theorem, Indefinite integral, Fundamental theorem of Integral calculus, Derivative of an analytic function, Liouville's theorem, Poisson's integral formula.

Unit III: Series And Analytic Functions
Taylor's &Laurents series, Maximum modulus principle, Schwarz's Lemma, Singularities, Zeros of an analytic function, branchpoint, Meromorphic functions and Entire functions, Reimann's theorem, Casorati-Wierstrass theorem.

Unit IV: Theorems
Residue theorem, residue at a pole, residue at infinity, computation of residue, Rouche's theorem, fundamental theorem of algebra, Mittag-leffer expansion theorem, evaluation of real definite integrals by contour integration, Conformal mapping, Bilinear transformation and its properties.

Suggested Readings:
1. Complex Analysis: L. Alhfors (1979) McGraw Hill
2. Functions of One Complex Variable I: J.B. Conway (1978) GTM Springer
3. Complex Analysis (Princeton Lectures in Analysis): E.M. Stein, R. Shakarchi (2003) Princeton University Press
4. Complex Analysis: G. N. Purohit and S. P. Goyal, JPH, 2005.

5. Complex Analysis: A. R. Vasishtha, Krishna Prakashan Media (P) Ltd., Meeruth, 11th ed, 2010.
6. Real and Complex Analysis: Walter Rudin, Mc-Graw Hill, New Delhi, 2006.
7. Functions of a Complex Variable:J.N. Sharma, Krishna Prakashan, Meerut, 1998.
8. Function Theory of One Complex Variable: R.E. Greene and S.G. Krantz (2006) AMS.

GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)
III: Curriculum and Pedagogic Studies (CPS)
Semester VI
CPSPS 302: PHYSICAL SCIENCE: PEDAGOGY OF PHYSICAL SCIENCE

Time: 3 Hours Max. Marks: 100
Credits- 4 Theory: 80, Internal: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 16 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 16 marks each.

iv) All questions will carry equal marks.

Objectives: On completion of the course, the student teacher will be able to:

- Gain insight about the nature of science and its curriculum.
- Comprehend the approaches and strategies of learning physical science at secondary level.
- Apply pedagogic aspects in teaching-learning of physical science effectively by adopting appropriate teaching strategy.
- Discuss a topic in Science, construct test items to measure objectives belonging to various cognitive levels.
- Use teaching aids effectively in teaching science.
- Gain insight the salient features of curriculum,strategy and principles of curriculum and science curriculum for the secondary level.
- Comprehend the objectives of teaching science at secondary level.
- Apply the principles of learning processes in the teaching of science.
- Teach a topic in science effectively by adopting appropriate teaching strategy.
- Construct test items to measure objectives belonging to various cognitive levels.
- Use effectively the teaching aids in teaching science.

Course Contents

Unit I: Nature of science and its Curriculum:

Nature of Science: History, Philosophy and nature of science, its role and importance in daily life, Science as interdisciplinary area of learning, development of science and technology, their interdependence and impact on society.

Curriculum Development: need and salient features of curriculum, strategy and principles of curriculum construction, trends in science curriculum, development of science curriculum in India, basic criteria of validity of a science curriculum in the light of NCF – 2005, curriculum for the secondary level. Objectives of teaching science at upper primary level and secondary level.Analysis of syllabus and textbooks of science at upper primary and secondary level.

Unit II: Approaches and Strategies of Learning Physical Science

Lesson Planning: Pedagogical shift from science as fixed body of knowledge to process of constructing knowledge, scientific method: observation, enquiry, hypothesis, experimentation, data collection, generalization, unit and lesson planning: using constructivist approach taking examples from specific contents of science such as electric circuit, magnetic effects of current, physical and chemical changes.

Strategies of Learning: inquiry approach, experimentation, problem solving, concept mapping, collaborating learning and experiential learning in science, Facilitating learners for self-study in science.

Learning Resources: identification and use of learning resources in science from immediate environment such as natural pH indicators, common salts, fruits, lenses and mirrors, inter-conversion of one form of energy to other, exploring alternative sources of energy, improvisation of apparatus, audio-visual materials; multimedia–selection and designing; use of ICT in learning science.

Strengthening of Learning Science: organisation of practicals in laboratory, use of science kits, investigatory project, field trips, science clubs, science fairs, relationship between science and other subjects, scientific attitude, development of values through science education, concept mapping and its use, co-operative learning.

Unit III: Pedagogic Aspects in Teaching - Learning of Physical Science

Pedagogic aspects in teaching-learning of science concepts such asnature of matter: classification of matter based on chemical constitution elements, compounds and mixtures, types of mixtures- homogenous and heterogeneous solution, atoms and molecules, atomic theory of matter, atomic and molecular masses, concept of mole, chemical reactions, types of chemical reactions: combination, decomposition displacement reactions, electronic concept of oxidation reduction, oxidation number of redox reactions, elementary idea of electro chemical cell and dry cell.

Planning and Pedagogic Aspects for Teaching - Learning of Physical Science

Planning and pedagogic aspects– lesson planning and learning of scienceconcepts such as Charge, electrostatic force, quantization of charge, capacitance, potential and potential difference, Ohm's law, series and parallel connections of resistances and capacitances, electric power, magnetic effect, heating effect of current, Faraday's law of induction, Lenz Law, motor and generators, oscillations and waves, periodic and non-periodic motion, sound as wave motion, longitudinal and transverse waves.

Unit IV: Exploration of learning of Physical Science

Exploration of learning of scienceconcepts such asdisplacement, motion and its types, speed, velocity and acceleration, angular velocity and acceleration, force: magnitude and direction, addition and subtraction, resultant, balanced and unbalanced force, momentum, work: work done by force, dependence of work on relative orientation of force and displacement, energy (kinetic and potential) work - energy equivalence, power, conversion of K.E. into P.E. and vice-versa, law of conservation of energy and momentum, gravitation: Newton's laws of gravitation, acceleration due to gravity, factors affecting 'g'. Chemical reactions, type of chemical reactions-combination, decomposition, displacement reactions, endothermic and exothermic reactions, concept of oxidation, reduction, redox reactions, rate of reaction, factors affecting the rate like concentration, temperature, pressure and catalyst.

Evaluation in Science

Concept of CCE, modes of evaluation: oral, observation and written, objective and essay type questions, types of objective test items: short answer type, multiple choice type, fill-in-blank type, true-false, matching type, making of test items, achievement test, diagnostic test and their construction, preparation of blue print taking examples of concepts of science mentioned in unit III and IV, continuous and comprehensive evaluation for overall development of child.

Tools and Techniques of Assessment: development of learning indicators, Performance-based assessment, learners' records of observations, field diary, oral presentation of learners work, portfolio, assessment of project work, construction of test items and administration of tests, exploring content and assessments of learning based on content mentioned in unit III and IV.

Modes of Learning Engagement:

Constructivist approach: Activity based learning experimentation, Interactive learning, Group work, Peer learning, Project work, Assignments followed by presentation, Discussion, Inquiry approach, Concept mapping etc.

Practicum:

Activities based on Science syllabus of classes IX and X

- Preparation of one working model.
- Preparation of a model lesson plan followed by seminar /presentation before the whole group.
- Preparation of kit for teaching learning of a topic along with write up (name of unit, name of the theme/topic, material used, procedure, learning outcomes).
- Construction of an achievement test, its administration on one section of a class and analysis of results.

Practicals:

- Preparation of designs of ideal Laboratory/Herbarium/Aquarium/terrarium.
- Measuring the rates of water absorption and loss in plants and animals.
- To design and perform experiment to demonstrate that by product of Respiration in plants and animals is heat.
- To demonstrate oxygen consumption during respiration in plants and animals.
- Perform experiments to detect the presence of carbohydrates, lipids and proteins in food by qualitative chemical tests.
- Measurement of length, mass, time, temperature, current, voltage.
- Graphic manipulation like (a) distance-time graph (b) velocity – time graph (c) voltage – current graph (d) temperature – time graph.
- Study of motion under force (design and demonstration).
- Methods of preparation of common laboratory reagents.
- Separation of substances of a given mixture like (i) NaCl, NH_4Cl and sand and (ii) Sulphur, NaCl and Iron scrap.
- Demonstration of laws of electromagnetic induction.
- Study heating effect of current.
- Qualitative chemical test for some common food stuffs.
- Preparation of Chlorine (Cl_2) and Ammonia (NH_3) and Study of their properties.
- Study nature of soft and hard water.

Suggested Readings:

1. P.K.G.Nair, 1985 Principle of Environmental Biology, UNESCO training of science teachers and educators Bangkok UNESCO.
2. NCERT: 1978 Teacher Education curriculum framework, NCERT, New Delhi

3. Science Teaching in Schools by Das. R.C.(1985), Sterling publication.
4. Modern Science teaching by Heiss, E.d. Obourn, E.S. Hoffman, C.W (1961) MacMillian Publication, New York.
5. NCERT (2006) Science for Class IX & X. New Delhi. NCERT.
6. Lewis, 1. 1972 Teaching of school physic, Penguin Book, UNESCO,.
7. Anderson, Hans 0 and Koutnik Paul G. 1912 Towards More effective science instruction in secondary education. The Macmillan Co., New York and Courier Macmillan, London,:
8. Das; 'RC. 1984 Et a. Curriculum and Evaluation National Council of Educational research And Training New Delhi,.
9. Driver, R 1983 The pupil as scientist? Open University Press, Buckingham.
10. Saxena, A.B. 1988 Vigyan Shikshan KaAyonjan Har Prasad Bhargava& Sons, Agra.
11. NCERT (2006) Science for class IX and X, New Delhi. NCERT
12. NCERT (2005) National Curriculum Framework. New Delhi. NCERT.

GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)
III: Curriculum and Pedagogic Studies (CPS)
Semester VI
CPSPM 302: PEDAGOGY OF MATHEMATICS II

Time: 3 Hours | Max. Marks: 100
Credits- 4 | Theory: 80, Internal: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 16 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 16 marks each.

iv) All questions will carry equal marks.

Objectives: On completion of the course, the student teachers will be able to:

- Formulate instructional objectives for different topics of mathematics.
- Appreciate mathematics to strengthen the student's resource.
- Design the process of developing a concept.
- Appreciate the role of mathematics in day-to-day life.
- Channelize, explain, reconstruct and evaluate their thinking.
- Pose and solve meaningful problems.
- Appreciate the historical perspective and contribution of Indian mathematicians in development of the subject.
- Appreciate and explore Technology Integrated Mathematics Module (TIMM) based on different subject specific open source software on various concepts of Geometry at secondary stage; and
- Appreciate and develop dynamical digital applets with emphasis on process involved in teaching and learning of mathematics at secondary stage.
- Be conversant with the nature, values, structure and scope of Mathematics.
- Interpret the principles of child development for planning lessons;
- Understand the principles of learning

Course Contents

Unit I: Approaches of Teaching Mathematics

- Basic Principles of Methods of Teaching Mathematics
- Principles of Child Development and Learning
- Problem posing / solving in Mathematics
- Problem posing: Problem posing skill contextualised to recognition of pattern, Extension of pattern, Formulisation of conjecture and generalisation through several illustrations drawn from learners immediate environment, Skill development of Process Questioning can stimulate discussion of an idea, leading to further exploration and use of oral language to explain and justify a thought.

- Problem solving: Understanding of Problem, Splitting the Problem in known and unknown parts, Symbolisation and mathematical formulation, Solving problem with multiplicity of approaches- exploration of alternative methods through Probing questions and concrete analogies, Attitude build up of internal questioning – learn to ask themselves key questions before, during and after the solution process.
- Methods of Teaching Mathematics
- Induction and Deduction
- Analytic and Synthetic Methods
- Heuristic or Discovery Method

Unit II: Assessment and Evaluation

- Exploring ways of Assessment
- Presentation and communication skills in mathematics, Posing conceptual questions from simple situations, interpretation and analysis, Designing innovative learning situations, Performance in group activity, Laboratory/ Technological experiences, Reflective written assignment, Written test on conceptual understanding of specific topics and its pedagogy, A year and summative assessment by the university.
- Informal creative Evaluation
- Encouraging learner to examine a variety of methods of assessment in mathematics so as to assess creativity, problem solving and practical performance. Appreciating evaluation through overall performance of the child. Self and peer evaluation.
- Formal ways of Evaluation
- Variety of assessment techniques and practices. Assessing Product vs. Process, Knowing vs. Doing. In practice midterm / terminal examination, practicing continuous and comprehensive evaluation to test regular programs / achievement of learner.

Unit III: Construction of concepts and Techniques of Teaching Mathematics

- Trends in Organising Content
- Recall and consolidation of various concepts with varied examples and illustrations in teaching of Arithmetic, Algebra, Co-ordinate Geometry, Geometry, Trigonometry, Mensuration, Statistics and Probability using Inductive and Deductive, Analytic and Synthetic, Heuristic,Project and problem solving methods.
- Analysis of concepts coherently in graded way.
- Misconception and common errors
- Developing Blue print for designing question paper
- Identifying and organizing components for developing frame work of question paper at different stages of learning different types of questions and framing questions based on concepts and sub concepts so as to encourage critical thinking, promote logical reasoning and to discourage mechanical manipulation and rote learning. Framing of open ended questions providing the scope to learners to give responses in their own words. Framing of conceptual questions from simple questions.

Unit IV: Planning for Classroom Transaction

- Planning Classroom Strategies:
- Analysis of textual and supplementary print materials, connecting lab/field experiences and suitable planning for classroom interaction.
- Desirable Characteristics of a Good Instructional Programme in Mathematics
- Identifying desired outcome, designing essential questions guiding teaching/ learning.
- Determining acceptable evidences that show students understanding.

- Integrating learning experiences and instructions – sequence of teaching /learning experiences that enable students to develop / demonstrate desired understanding.
- Developing unit plan and lesson plan for teaching of mathematics:
- Learning Objectives
- Introduction of the topic
- Some thought-provoking questions
- Flow of chapter
- Examples
- Hands on activities
- Self exploratory experiments (if any)
- Daily life application
- Application (Problem Solving)
- Interdisciplinary Applications / Problems
- HOTS questions
- Extension activities
- External Web resources for the content
- Suggested Readings
- Thought-provoking questions that lead students to do more exploration
- Planning ICT Based Mathematics Lesson, Disticnt ways of using open source software in Mathematics Lesson (Exploratory way only- by giving already created ready-made document or file and invite them to explore it.), Thinking Geometrically (Dynamics in Mathematics using software) Technological Pedagogical Content Knowledge (TPCK)- Developing competencies required to make appropriate use of technology, learner teachers will be required to make pedagogical choices critically about when and where technology should be used.
- The role of cooperative learning in mathematics.
- Learning Styles, Learning Difficulties and Diagnostic Tests
- What are the learning styles in Mathematics? - Visual Learners, Auditory Learners and Kinesthetic Learners, Identification of learning difficulties, Error Patterns, Diagnostic and Remedial Teaching, Preparation of Diagnostic tests

Modes of Learning Engagement:

- Providing opportunities for group activities.
- Hands on experimentation within digital environment.
- Group/ individual presentation.
- Providing opportunity for sharing ideas.
- Exposing to exemplar constructivist learning situations in mathematics.
- Designing and setting up models, teaching aids and activities/ laboratory work.
- Visit to district, state and national level science exhibition.
- Digital presentation followed by its analysis and discussion.
- Reflective written assignments.
- Case studies.
- Providing opportunities for group activities.
- Group/ individual presentation.
- Providing opportunity for sharing ideas.
- Exposing to exemplar constructivist learning situations in mathematics.
- Designing and setting up models, teaching aids and activities/ laboratory work.

- Visit to district, state and national level science exhibition.
- Audio visual presentation followed by its analysis and discussion.
- Reflective written assignments.
- Case studies.

Practicum:

- Preparation of lesson plans on different approaches on selected content matter.
- Preparation of teaching aid (software based applets and concerte materials based).
- Designing of mathematics kits (software based and concerte materials based) for secondary classes.
- Identification and analysis of common errors.
- Study of learning difficulties at Secondary level.
- Development of a working model on a topic of Mathematics.
- Critical analysis of CBSE/Any Board Secondary School Syllabus in Mathematics.
- Development of plan of mathematics resource (concrete and digital) room.
- Preparation and analysis of achievement test.
- Action Research on a Mathematical topic.
- Any innovative activity perform during internship in teaching program

Suggested Readings:

1. Teaching of Mathematics (ES-342), Indira Gandhi National Open University, School of Education, New Delhi
2. Roy Dubisch (1963). The Teaching of Mathematics, John Wiley and Sons INC, New York and London
3. Butler and Wren, (1960). Teaching of Mathematics, Mc-Graw Hill Book Company, INC, New York and London
4. Claude H. Brown, (1953). The Teaching of Secondary Mathematics, Harper & Brothers, Publishers, New York
5. George Polya, 1962 (I), 1965 (II). Mathematical Discovery (Volume I and II), John Wiley & Sons, INC, New York and London
6. C. G. Corle, (1964). Teaching Mathematics in Elementary School, The Ronalal Press Company, New York
7. NCTM, USA, (1999) Activity for Junior High School and Middle School Mathematics, Volume – II, NCTM, USA,
8. J.L. Heilborn, (2000). Geometry - History, Culture and Techniques, Oxford University Press,
9. NCERT (2010) - A textbook of Content-cum-Methodology of teaching Mathematics, NCERT, New Delhi.
10. NCERT (2005)- Position Paper of NFG on Teaching of Mathematics , NCERT, New Delhi.
11. Johnston-Wilder, S. &Pimm, D. (Eds.) (2004). Teaching Secondary Mathematics with ICT, London: Open Univer- sity Press / McGraw-Hill.
12. Capel, S., Leask, M. & Turner, T. (Eds.) (2009). Learning to Teach Mathematics in Secondary School., NY: Routledge. New York.
13. Law, N., Pelgrum, W.J., &Plomp, J. (Eds.) (2008). Peda- gogy And ICT Use In Schools Around The World Findings From The IEA Sites 2006 Study: Springer. New York
14. Joubert, M. (2012). ICT in mathematics. Mathematical knowledge in teaching: seminar series. Cambridge, UK: University of Cambridge. Available online at www. maths-ed.org.uk/mkit/Joubert_MKiT6.pdf

15. Glazer, E. M. (2001). Using Internet Primary Sources to Teach Critical Thinking Skills in Mathematics. Santa Bar- bara, CA: Libraries Unlimited Press
16. Prichard, A. (2007). Effective Teaching with Internet Technologies Pedagogy and Practice. Thousand Oaks, CA: Sage Publications.
17. S. K. Mangal, Teaching of Mathematics, Prakash Brothers, Ludhiana.
18. A. B. Bhatnagar, New dimensions in the teaching of Mathematics, Modern Publishers, Meerut.
19. K. S. Sindhu, Teaching of Mathematics, Sterling Publications, New Delhi.
20. UNESCO: Trends in Mathematics Teaching.

GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)
III: Curriculum and Pedagogic Studies (CPS)
Semester VI
CPSPBS 302: PEDAGOGY OF BIOLOGICAL SCIENCE

Time: 3 Hours Max. Marks: 100
Credits- 4 Theory: 80, Internal: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 16 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 16 marks each.

iv) All questions will carry equal marks.

Objectives of the Course: On completion of the course, the students will be able to:

- Identify and relate approaches of teaching-learning of biological science with social relevance;
- Explore the process skill in science and develop competency to organise laboratory facilities and equipment in teaching– learning of biological sciences;
- Use effectively different activities – ICT, excursion, visits, research methodology etc for teaching–learning of biological science;
- Examine different pedagogical issues in learning biological science;
- Construct appropriate assessment tools for evaluating learning of biological science;
- Develop ability to use biological science concepts for life skills; and
- Develop professional competencies for teaching, learning of biological science.
- Appreciate that science is a dynamic and expanding body of knowledge

Course Contents

Unit I: Planning for Teaching-Learning of Biological Science

- Identification and organization of concepts for teaching-learning of biology;
- Determining acceptable evidences that show learners' understanding.
- Understanding Constructivist Approach
- Instructional materials required for planning teaching-learning of biological science and learners' participation in developing them; Identifying and designing teaching-learning experiences;
- Planning field visits, Zoo, Sea shore life, Botanical garden, etc.;
- Organizing activities, laboratory experiences, making groups, planning ICT applications in learning biology.
- Behavioural, physical and mental changes during Adolescence.

Unit II: Learning Resources in Biological Science

- Identification and use of learning resources in biological science from immediate environmental, exploring alternative sources;
- Developing and designing science kit and biological science laboratory; Planning and organizing field observation; Collection of materials, etc.;
- Textbooks, audio-visual materials, multimedia-selection and designing;
- ICT introduction, Use of ICT in teaching and learning, ICT resources to support Biology teaching and learning;
- E- learners introduction, e-learning and changing nature of classroom, challenges and drawbacks of e-learning.
- Using community resources for biology learning; Pooling of learning resources in school complex/block/ district level; Handling hurdles in utilization of resources.

Unit III: Tools and Techniques of Assessment for Learning in Biological Science

- Performance-based assessment; Developing indicators for performance assessment in biological sciences; Learners record of observations;
- Field diary, herbarium;
- Oral presentation of learners work in biological science, Portfolio; Assessment of project work in biology (both in the laboratory and in the field), Assessment of participation in collaborative learning;
- Construction of test items (open-ended and structured) in biological science and administration of tests;
- Developing assessment framework in biological science;
- Assessment of experimental work in biological science- Evidences of evolution, fitness and heredity, role of environment in day to day life.
- Exploring content areas in biological science not assessed in formal examination system and their evaluation through various curricular channels;
- Encouraging teacher-learners to examine a variety of methods of assessments in biological science;
- Continuous and comprehensive evaluation.

Unit IV: Biological Science – Lifelong Learning and Professional Development of Biology Teacher

- Nurturing natural curiosity of observation and drawing conclusion; Facilitating learning progress of learners with various needs in biology;
- Ensuring equal partnership of learners with special needs;
- Stimulating creativity and inventiveness in biology; Organising various curricular activities, such as debate, discussion, drama, poster making on issues related to science/biology;
- Organizing events on specific day, such as Earth Day, Environment Day, AIDS Day, Science Day etc.
- Planning and organizing field experiences, Science club, Science exhibition; Nurturing creative talent at local level and exploring linkage with district/state/central agencies.

Professional development programmes for science/biology teachers:

- Participation in seminar, conferences, online sharing membership of professional organization; Teachers as a community of learners;
- Collaboration of school with colleges, universities and other institutions;
- Journals and other resource materials in biology education;
- Role of reflective practices in professional development of biology teachers;

- Teacher as a researcher: Learning to understand how children learn science – action research in biological science.

Modes of Learning Engagement:

Constructivist approach, Activity based learning experimentation, Interactive learning, Group work, Peer learning, Project work, Assignments followed by presentation, Discussion, Inquiry approach, Concept mapping etc.

Practicum: Activities based on Science syllabus at secondary level.

- Preparation of one working model.
- Preparation of a model lesson plan followed by seminar/presentation before the whole group.
- Preparation of a kit for teaching learning of a topic along with write-up (name of unit, theme/topic, material used, procedure, learning outcomes).
- Construction of an achievement test, its administration on one section of a class and analysis of results.
- Study of heredity and evolution.
- Preparation of Herbarium and Herbarium techniques
- Establishment of Science Laboratory
- Respiration in plants and animals
- Nutrition in plants and animals
- Excretion in plants and animals
- Movements in Plants and animals
- Techniques of formulating science project in laboratories as per curriculum
- Evidences of evolution
- Principle of working of Human eye.

Suggested Readings:

1. NCERT (2005). National Curriculum Framework. New Delhi. NCERT.
2. NCERT (2005). Position Paper of NFG on Teaching of Science. New Delhi. NCERT.
3. NCERT (2005). Position Paper of NFG on Habitat and Learning. New Delhi. NCERT.
4. N. Vaidya, Science Teaching for 21st Century (1999). New Delhi.Deep & Deep Publications.Dat Poly, (2004).Encyclopaedia of Teaching Science. New Delhi. Sarup& Sons.
5. Their, DH, (1973). Teaching Elementary School Science.A Laboratory Approach, Sterling Publication Pvt. Ltd.
6. Science Teacher. (Peer reviewed journal for science teachers).
7. Journal of Research in Science Teaching. (Wiley-Blackwell).
8. Turner Tony and Wendey Di Macro. Learning to Teach School Experience in secondary school teaching.London and New York.Routledge.
9. P. Ameeta, (2008). Methods of Teaching Biological Science. Educational Publishers edition or later ed.
10. Sharma R.C., (1987). Modern Science Teaching or later edition. New Delhi. Dhanpatarai& Sons.
11. Teaching of Science Today and Tomorrow. New Delhi Docba House.

Web Sites

- http:/www.tc.columbia.edu/mst/science.ed/courses.asp.
- http:/www.edu.uwo.ca

GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)
IV: Engagement with the field (EF)
Semester VI
EFSE 302: SCHOOL EXPOSURE AND RELATED ACTIVITIES

Credits: 4 **Marks: 100**

Contact hours: 04 weeks

Distribution of Marks for the School Exposure and Related activities		
Activity	**Max. Marks**	**Min. Pass Marks**
Content Analysis in each teaching subject	20	10
Preperation and use of learning resources during peer teaching in each teaching subject (two)	10+10 =20	10
Observation record • Five classes of regular classroom teacher • Five classes of peer	10+10=20	10
Actual classroom teaching (Two lesson in each teaching subject)	40	20
Total	**100**	**50**

Objectives of the Course: On completion of the Course, the students will be able to:

- Understand about the activities to be carried out during school internship programme.
- Observe classroom teaching, various school activities and gain a feel of the multiple roles of a teacher.
- Develop skill in content analysis, preparing TLM and observing classroom processes.
- Plan and implement teaching learning activity for peers and actual classroom.

Pre-Internship Tasks:

(The Internship Committee formulated by the Institute will prepare a Schedule for execution of Pre- Internship Tasks)

During the four week duration, the student teachers are oriented to the school internship programme.

For the first two weeks, they will be provided training in core teaching skills, content analysis, preparing Teaching Learning Material (TLM), writing observation records, Reflective Journals, conducting Action Research and Case Study, organizing school activities and their reporting, developing Achievement Tests, administering and analyzing. Student teachers will also write lesson plans and take up peer teaching.

For the next two weeks, student teachers will be placed in the schools. They will observe the classes being handled by the regular teachers as well as their peers. Every student teacher will teach at least one lesson in each teaching subject and reflect on the teaching.

Modes of Learning Engagement:

Pre internship will be carried out both in the Institute and the School.

First two weeks they will be exposed to theoretical knowledge about internship and receive information on various activities that are required to be carried out by the student teachers.

Student teachers will get hands on experience on performing certain tasks which they are expected to perform in the school.

In the beginning they learn to teach in a simulated condition by teaching their peers.

Next two weeks, student teachers are attached to the school on full time basis, observe the teaching by the regular classroom teacher, teach at least one lesson in each teaching subject, involve in all the activities of the school and learn to understand the school.
Student teachers keep a record of all the work carried out by them in the school (Details to be worked out).