

**Semester V**

**Group C: Core Course (CC) 1 (V)**

**PHY 301: PHYSICS: KINETIC THEORY AND THERMODYNAMICS**

Time: 3 Hours

Max. Marks: 100

Credit- 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:

- Comprehend the key points of thermodynamics.
- Apply the concepts in understanding the various transport phenomena.
- Solve the problems related to the thermodynamics.
- Understand and appreciate the application of thermodynamics in engines of motor vehicles.
- Perform the experiments related to thermodynamics.

**Course Contents**

**Unit I: Ideal and real gas**

**Ideal gas:** kinetic model, deduction of boyle's law, interpretation of temperature, estimation of rms speeds of molecules, brownian motion, estimate of the Avogadro number, equipartition of energy, specific heat of monoatomic gas, extension to di- and triatomic gases, behaviour at low temperatures, adiabatic expansion of an ideal gas, applications to atmospheric physics.

**Real gas:** Van der Waals' equation of state, nature of Van der Waals' forces, comparison with experimental P-V curves, the critical constants, gas and vapour, Joule expansion of ideal gas and of a Van der Waals' gas, Joule coefficient, Joule-Thomson effect.

**Unit II: Liquefaction of gases**

Boyle temperature and inversion temperature, principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium, refrigeration cycles, meaning of efficiency.

**Transport phenomena in gases:** molecular collisions, mean free path and collision cross sections, estimates of molecular diameter and mean free path, transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure

**Unit III: Thermodynamics**

**The laws of thermodynamics:** The zero<sup>th</sup> law, various indicator diagrams, work done by and on the system, First law of thermodynamics, internal energy as a state function, reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, different versions of the second law, practical cycles used in internal combustion engines, entropy, principle of increase of entropy, the thermodynamic scale of temperature, its identity with the perfect gas scale, impossibility of attaining the absolute zero temperature, third law of thermodynamics.

**Unit IV: Thermodynamic relationships**

thermodynamic variables- extensive and intensive, Maxwell's general relationships, application to Joule-Thomson expansion and adiabatic cooling in a general system, Van der Waals' gas, Clausius-Clapeyron heat equation, thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables, cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

**Blackbody radiation:** pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, spectral distribution of blackbody radiation, Wein's displacement law, Rayleigh-Jean's law, Planck's quantum postulates, Planck's law, complete fit with experiment, interpretation of behaviour of specific heats of gases at low temperature.

**Textbooks and references**

1. M W Zemansky, Heat and Thermodynamics (Mcgraw-Hill Book Company)
2. M NSaha, BNSrivastava, a Treatise on Heat (The Indian Press, (Publication) pvt. Ltd. Allahabad)
4. M NSaha, BNSrivastava, a Textbook of Heat (Science Book Agency, Calcutta)
6. A N Matveev, Molecular Physics (Mir Publishers, Moscow, 1986)
6. Joseph OHirschfelder et al, Molecular Theory of Gases and Liquids (John Wiley & Sons, NewYork)
6. K SPitzer, I. Brewer, Thermodynamics (Mcgraw Hill Book Company)
7. S CGarg, RMBansal, CKGhosh, Thermal Physics (Tata Mcgraw Hill Publishing Company Ltd.)
8. Samuel Glasston, Thermodynamics for Chemists (Affiliated East West Press Pvt. Ltd., New Delhi)
9. YU. B. Rumer, M. Sh. Ryvkin, Thermodynamics, Statistical Physics and Kinetics (Mir Publishers, Moscow)
10. S S Singhal, J P Agarwal, Satyaprakash, Heat and Thermodynamics (Pragati Prakashan, Meerut).
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**Practicals**

<b>Distribution of Marks for End Semester Practical Examination</b>	
<b>Activity</b>	<b>Marks</b>
Experiments	10
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>20</b>

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

1. To determine the thermal conductivity of bad conductor by lee's method.
2. To determine the melting point of wax using platinum resistance thermometer.
3. To find 'j' by call ender and barne's method.
4. To study the temperature dependence of resistance for thermistor and find temperature coefficient of resistance and material constant.
5. To study the temperature dependence of resistance of a torch bulb's filament.
6. Determine the heat capacity of a brass.

**GROUP C: CORE COURSE (CC) 2 (V)**

**Semester V**

**CHM 301: CHEMISTRY: PHYSICAL CHEMISTRY**

Time: 3 Hours

Max. Marks: 100

Credit- 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 learn the basic principles of phase equilibrium, Electrochemistry and phase equilibrium, chemical equilibrium and its relationship with thermodynamic quantities, basic concepts of electrochemistry and its applications, chemical bonding from the valence bond model and molecular orbital theory, the limitations of classical mechanics at molecular length scales, the differences between classical and quantum mechanics, the connection of quantum mechanical operators to observables, probabilities, amplitudes, averages, expectation values, and observables. The connection between common approximation methods and standard chemical frameworks (Born-Oppenheimer approximation, molecular orbitals).

**Course Contents**

**Unit I: Electrochemistry**

- Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of

conductivity measurements; determination of degree of dissociation, determination of  $K_a$  of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

- Types of reversible electrodes-gas-metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$ , and  $K$ ), polarization, over potential and hydrogen overvoltage. Concentration cell with and without, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Definition of pH and  $pK_a$  determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Handerson-hazel equation. Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

#### **Unit II: Chemical Equilibrium**

- **Chemical Equilibrium:** Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore – Clapeyron equation and Clausius – Clapeyron equation, applications.
- **Phase Equilibrium:** statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water,  $CO_2$  and S systems. Phase equilibria of two component system – solid – liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ( $NaCl-H_2O$ ), ( $FeCl_3-H_2O$ ) system. Freezing mixtures, acetone-dry ice. Liquid-liquid mixtures-Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes- $HCl-H_2O$  and ethanol – water systems. Partially miscible liquids – Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation, applications.

#### **Unit III: Chemical Kinetics**

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half-life

and mean life, Determination of the order of reaction – differential method, method of integration, method of half-life period and isolation method.

- Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis), Expression for the rate constant based on equilibrium constant and thermodynamic aspects.
- Characteristics of catalyzed reactions, classification of catalysis homogeneous and heterogeneous catalysis, enzyme catalysis, miscellaneous examples.

#### **Unit IV: Elementary Quantum Mechanics**

De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

#### **Suggested Readings:**

1. S Lewis and D Gladstone, Elements of Physical Chemistry, Macmillan.
2. Moudgil, H. K. Textbook of physical chemistry second edition, PHI
3. B S Bahl, G D Tuli & Arun Bahl, Guide to Essentials of Physical Chemistry S. Chand Publishing.
4. Alberty & Bawendi Silbey, Physical Chemistry 4th Economy Edition, Wiley.
5. Christopher M. A. Brett, Ana Maria Oliveira Brett, Electrochemistry: Principles, Methods, and Applications, Oxford science publications
6. Keith J. Laidler, Chemical Kinetics, 3rd Edition, Prentice Hall
7. Michael J. Pilling and Paul W. Seakins, Reaction Kinetics 2<sup>nd</sup> Edition, Oxford Science Publications.
8. Puri, Sharma & Pathania, Principles of Physical Chemistry.
9. Ira N Levine, Physical Chemistry 6 edition McGraw-Hill Higher Education.
10. A K Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill Education.
11. Ira N Levine 7 edition Quantum Chemistry Pearson.

**Practical**

<b>Distribution of Marks for End Semester Practical Examination</b>	
<b>Activity</b>	<b>Marks</b>
Experiments	10
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>20</b>

**Note: The students should be given exposure of any research labs and instrumentation center/ reputed university lab/ industry/ government labs of northern region.**

**1. Electrochemistry**

- pH metric: Acid-Base Titration.
- To determine the strength of the given acid conductometrically using standard alkali solution.
- To determine the solubility and solubility product of a sparingly solubility product of a sparingly soluble electrolyte conductometrically.
- To determine the ionization constant of a weak acid conductometrically.
- To titrate potentiometrically the given ferrous ammonium sulphate solution using  $\text{KMnO}_4/ \text{K}_2\text{Cr}_2\text{O}_7$  as titrant and calculate the redox potential of  $\text{Fe}^{2+}/\text{Fe}^{3+}$  system on the hydrogen scale.

**2. Chemical Kinetics**

- To study the saponification of ethyl acetate kinetically.
- To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To compare the strength of  $\text{HCl}$  and  $\text{H}_2\text{SO}_4$  by studying the kinetics of hydrolysis of ethyl acetate.
- To study kinetically the reaction rate of decomposition of iodide by  $\text{H}_2\text{O}_2$

**GROUP C: CORE COURSE (CC) 3(V)**

**Semester V**

**ZOO 301: ZOOLOGY: DEVELOPMENTAL BIOLOGY**

Time: 3 Hours

Max. Marks: 100

Credit- 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 comprehend the modern concepts of developmental biology to understand the developmental sequences in vertebrates; to compare the developmental of organs and systems.

**Course Contents**

**Unit I: Developmental Biology**

- Concepts and scope of developmental biology
- Gametogenesis: i) structure and types of spermatozoa, spermatogenesis.ii) structure and types of eggs, oogenesis
- Fertilization: types, mechanism and significance
- Cleavage: types and patterns of cleavage, fate map.
- Gastrulation: morphogenetic movements and significance.

**Unit II: Metamorphosis and Embryogenesis**

- Development up to the end of neurulation
- Metamorphosis of tadpole larva, hormonal control of metamorphosis
- Development of frog up to formation of advance tadpole.
- Embryogenesis of chick: development up to neurulation, tabulation.

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- Development of chick according to the hours of incubation – 18 hours, 21 hours, 24 hours, 33 hours, 48 hours, 56 hours, 72 hours, and 96 hours.
- Extra embryonic membranes of chick – development and functions.

**Unit III: Parthenogenesis**

- Placenta and placentation in mammals.
- Parthenogenesis: natural and artificial
- Regeneration mechanism in animals, steps of limb regeneration in amphibians.
- Stem cells and their significance.

**Unit IV: Teratogenesis**

- Elementary idea of the following developmental process
  - i) Embryonic induction
  - ii) Organizer concept
  - iii) Differentiation
- Teratogenesis : genetic and environmental teratogenesis
- Ageing and senescence.

**Suggested Readings:**

1. Development Biology by SFGilbert, 10<sup>th</sup> , (Sinnauerassciate , 2014)
2. Development Biology by K.V. Sastry&Vinita Shukla – (Rastogi publications 2008)
3. Introduction to Embryology by B.I. Balinskly – (W.B. Saunders, Philadelphia, 1976)
4. Foundations of Embryology by B.M. Paten and B.M. Carison.
5. Foundations of Animal Development by A.F. Hopper and N.H. Hart ( Oxford University Press, New York, 1980)
6. Vertebrate Embryology by R.S. McEwen ( Oxford &I.B.MPublishing co., New Delhi)
7. Development Biology by J.W. Brook Bank.
8. Patterns and Principles of Animal Development by J.W. Saunders.Jr
9. Embryology by Barth IG (1966) – Holt Rinehart & Winston
10. Embryology by Berril N&Karp G ( 1960) -Holt Rinehart & Winston
11. Fundamentals of Comparative Embryology of Vertebrates by Huettner AF (1967) – McMillan co.
12. Chordate Embryology by Mohan Arora (1985) – Atma Ram &Sons
13. Laboratory Manual of Vertebrate Embryology by Rugh R-Allied Pacific P.Ltd
14. Chordate Embryology by Verma PS & Agarwal VK –Chand &Co.
15. Modern Development Biology, KCSONI Hindi Edition, College Book Centre, Chaura Rasta Jaipur,
16. KCSONI Hindi Edition, College Book Centre, Chaura Rasta, Jaipur

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**Practicals**

<b>Distribution of Marks for End Semester Practical Examination</b>	
<b>Activity</b>	<b>Marks</b>
Experiments	10
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>20</b>

**Course Contents**

1. Study of types of sperm smears preparation.
2. Study of different types of eggs (insect, frog, hen)
3. Study of life cycle of *Drosophila*.
4. Study of eggs, cleavage, blastula, gastrula, neurula, tail bud, hatching, mature, tadpole larval metamorphic stages of tadpole / froglet.
5. Study of embryological slides of various stages of frog.
6. Study of embryological slides of various stages of chick.
7. Study of development of chick with the help of charts /CD/s /video/ multimedia etc.
  - i) Whole mounts: 18 hrs, 24 hrs, 33 hrs, 48 hrs, 56hrs, 72hrs, and 96 hrs, of incubation period embryos.
  - ii) Study of primitive streak stage in living embryo after removal of the blastoderm from the egg or through multimedia film etc.
  - iii) Study of the embryo at various stages of incubation in vivo by making a window in the egg shell.
8. Frog embryology – study of spawn, identification of different stages through model / charts / multimedia etc.

**GROUP C: CORE COURSE (CC) 1 (V)**

**Semester V**

**BOT 301: BOTANY: CELL BIOLOGY AND GENETICS**

Time: 3 Hours

Max. Marks: 100

Credit- 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;

- Understand the structural complexity of eukaryotic cell.
- Understand the functioning of cell organelles.
- Understand the structure, significance of nucleus and chromosomes.
- Review Mendelian inheritance in the light of gene interactions and gene expression.

### **Course Contents**

#### **Unit I: Cell Biology**

- Basic principles of microscopy – Light, fluorescent, phase contrast, UV and electron microscope.
- Ultrastructure of prokaryotic and eukaryotic cells.
- Cell-organelles: Ultrastructure and functions of cell wall, plasma membrane, Golgi complex, Endoplasmic reticulum, Mitochondrion.

#### **Unit II: Cell Organisation**

- Ultrastructure and functions of chloroplast, ribosome, lysosome and microbodies.
- Nucleus – Ultrastructure of eukaryotic nucleus.
- Chromosomes – Brief account of morphology and organization of prokaryotic and eukaryotic chromosome; Nucleosome model, concept of karyotype and ideogram (brief).

#### **Unit III: Cytogenetics**

- Chromosomal alterations: (i) Structural variations – Deletion, Duplication, Translocation and Inversion. (ii) Numerical Variations – Aneuploidy and euploidy.
- Mutations – spontaneous and induced, transposable genetic elements.
- Cell Division: Cell-cycle, events of cell division, karyokinesis, cytokinesis, cell-cycle; Mitosis, Meiosis and their significance.

#### **Unit IV: Genetics**

- Mendelism – Review of Mendel's laws of inheritance, solving problems related to Mendel's laws.
- Inheritance of genes: Incomplete dominance, complementary gene action (flower colour in sweet pea), supplementary gene action (coat colour in mice), epistasis (fruit colour in summer squash), multiple factor inheritance (ear size in maize). Linkage and crossing over.
- Sex determination in plants.
- Cytoplasmic inheritance: Presence and functioning of mitochondrial and plastid DNA, cytoplasmic male sterility.

#### **Suggested Readings:**

1. Snustad D.P. and M.J. Simmons 2000, Principles of Genetics, John Wiley & Sons, Inc. USA.
2. Gupta, P.K. 1999, A Textbook of Cell and Molecular Biology, Rastogi 10(3254)

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- Publications, Meerut.
3. Wolfe, S.L. 1993, Molecular and Cell Biology, Wadsworth Publishing Co., California, USA.
  4. Harris, N. and K.J. Oparka, 1994, Plant Cell Biology: A Practical Approach, IRL Press, Oxford Univ. Press, Oxford, UK.
  5. Singh, S.P. and B.S. Tomar, 2006, Cell Biology, Rastogi Publications, Meerut.
  6. Gupta, P.K. 2005, Elements of Genetics, Rastogi Publications, Meerut.
  7. Gardner, A., 1990, Principles of Genetics (6th Ed.), John Wiley & Sons Inc., USA.
  8. Gupta P.K. 2000, Cytology, Genetics and Evolution, Rastogi Publications, Meerut.
  9. Atherly, A.G. J.R. Girton and J.F. MacDonald, 1999, The Science of Genetics, Saunders College Publishing, Fortworth, USA.
  10. Russel, P.J. 1998, Genetics, The Benjamin/Cummings Publishing Co. Inc., USA.
  11. Gunning, B.E.S. and M.W. Steer 1999, Plant Cell Biology, Structure and Function, Jones & Bartlett Publishers, Boston, Massachusetts.

### PRACTICALS

Distribution of Marks for End Semester Practical Examination	
Activity	Marks
Experiments	10
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>20</b>

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

- Comparative study of cell structure in onion cells, *Hydrilla* and *Chara/Spirogyra*. Study of cyclosis in *Tradescantia* staminal cells.
- Study of plastids to examine pigment distribution in plants (e.g. *Cassia*, *Lycopersicon* and *Capsicum*)
- Examination of electron micrographs of virus, bacteria, Cyanobacteria. and eukaryotic cells with special reference to organelles;
- Study of various stages of mitosis and meiosis by preparing slides of suitable plant materials (onion root tips and onion flowerbuds).
- Working out the laws of inheritance using seeds/beads.

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- Working out genetic problems related to Mendelian laws of inheritance and interaction of genes.

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**GROUP C: CORE COURSE (CC) 3(V)**

**Semester V**

**MTH 301: MATHEMATICS: REAL ANALYSIS**

Time: 3 Hours

Max. Marks: 100

Credit- 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:**

By the end of the semester the students will be able to develop understanding of Differentiability, Riemann integral and real sequences & series.

**Course Contents**

**Unit I: Real Numbers and continuous functions**

Real Numbers system: completeness axiom, densities of rational/irrational, properties of real numbers, least upper bound axiom of a function, Basic properties of the limits, Continuous functions and classification of discontinuities, properties of continuous functions: boundedness of a continuous function on a closed interval  $[a,b]$ , existence of a maximum of a continuous function on  $[a,b]$ , uniform continuity.

**Unit II: Differentiability**

Differentiability, chain rule, Mean value theorems and their geometrical interpretations, Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders.

**Unit III: Integral Calculus**

Riemann integral, Integrability of continuous and monotonic functions, The fundamental theorem of integral calculus, Mean value theorems of integral calculus.

**Unit IV: Sequence and Series**

Real sequence, Definition, Theorems on limits of sequences, Bounded and Monotonic sequences, Sequential Continuity, Cauchy's convergence criterion, Infinite series of non-negative terms, Comparison tests, Cauchy's integral test, Ratio tests, Raabe's test, Logarithmic test, De Morgan and Bertrand's tests, Alternating series, Leibnit'z theorem, Absolute and conditional convergence, Uniform convergence of series of function.

**Suggested Readings:**

1. Mathematical Analysis: S.C. Malik, New Age International, New Delhi, 2004.
2. Real Analysis: T.M. Apostol, Narosa Publishing House, New Delhi 1985.
3. Real Analysis: H.L. Royden, Macmillan, 4<sup>th</sup> edition 1993.
4. Principles of Mathematical Analysis: W. Rudin, McGraw Hill, 3<sup>rd</sup> edition 1976.

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**GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)**

**II: Enhancing Professional Capacities (EPC)**

**Semester V**

**EPCAA 301: ARTS AND AESTHETIC EDUCATION**

Time: 2 Hours

Max. Marks: 50

Credit- 2

Theory: 40, Internal: 10

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.

v) ***In examination the material required for the components of Unit 3 and Unit 4 ( if any) are arranged by the students at their own.***

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

- Express freely their ideas and emotions about different aspects of life through different art forms.
- Learn to appreciate different art forms and distinguish them.
- Develop an insight towards sensibility and aesthetic appreciation and become more creative and conscious about the good and beautiful in their environment, including classroom, school, home and community through an integrated learning approach.
- Integrate the knowledge of art with daily life through learning with different media and techniques by using creative expression and making objects of common use.
- Make learners conscious of rich cultural heritage of their own region as well as that of the nation.
- Get acquainted with the life and work of artists.

**Course Components:** This course as part of the eight semesters B.Sc. B. Ed. programme should consist of theory, practical, project work and workshop. Also, the arts need to be applied in day to day life from designing classroom materials to notice board, cultural festivals, theme based celebrations, national days, festivals etc. These

occasions will be a forum for students' activities wherein all the art forms will be integrated.

### **Unit 1**

- Concepts and forms of arts and crafts- an introduction: Meaning of arts and crafts, visual and plastic art forms, performing art forms, and heritage crafts.
- Significance of art in education: Importance of art forms in learning.
- Integrating arts and crafts in school curriculum as a pedagogical support/ resource: education through arts and crafts.

### **Unit 2**

- Different ways/methods to integrate arts in education: during the curriculum transaction.
- NCF-2005 and position paper on Arts on Aesthetics.
- Knowing about local art and craft forms: the diversity of India's arts and crafts and its integration in the curriculum.

### **Unit 3**

- Drawing: - Application of point, line, hatching, shading to create different tones - Textures, patterns, decorative effects - Structures (shapes, forms...) - Illustration - Perspective techniques - Use of various media (pastels, charcoal, ink, pencils...)
- Painting: - Theoretical and practical knowledge of colour theory - Use of basic tools - mix and apply colour (shade, tint, tone, hue) in a transparent and opaque manner, and create flat or textured surfaces with paint
- Printing: - Use of stencils, relief and engraving techniques to print and repeat shapes

### **Unit 4**

- Collage: - Use of prefabricated and self-made materials
- Various media: - some experience of modern media techniques e.g. still and video camera, computer graphics, manipulation of images, animation, performance, installation, light shows
- 3D work: - Use of: - additive method: modelling (solid and hollow forms) - subtractive method: carving (soft materials: plaster, polystyrene...) - constructive method: montage: simple 3D forms (paper, wire, wooden profiles, puppets, props for theatre)

### **\*Workshops:**

A workshop for half a day for one week of working with an artist or a group to learn basics of art or craft forms and understand its pedagogical aspects is required for student teacher in each year. The forms learnt during the course should help student teacher in his/her profession, as a means of exploring different media and creative expression in drawing, painting, rangoli, clay-work/pottery, collage-making, wood-work, toy-making, theatre, puppetry, dance,

music etc. including regional/ folk forms of arts and crafts, which will be helpful in imparting quality education among school children. The focus of the workshops should be on how art forms can be used as tool/ method of teaching-learning.

**Modes of Learning Engagement:**

- Classroom environment should be interactive and discussions should take place where student teachers can document each other's experiences as an artist and connoisseur both.
- Attending exhibitions and performances, interacting with artists and craft persons, watching and listening art related films, audio and video materials available on different performers, regional/ folk art forms etc. may also be shown from time to time.
- Workshops may be conducted at least once in each year where student teachers can get a first- hand experience of working with artists, handle different materials and media, learn about different aspects of an art form on how it relates to the society and community and can be used as pedagogical tool to transact.

**Practicum/ Tutorials:**

- Activities related to doing arts, including application of arts in the immediate environment.
- Small activities which enhances the skills including the communication and presentation skills, brings in imagination, creativity and aesthetic sensibility among the student teachers.
- Application of aesthetic and design sensibility in the day to day life, in their profession and environment are some of the practical aspects, which needs to be taken care of. During the celebrations of festivals, functions, special days etc. this should be reflected.

**Modes of Internal Assessment:**

The engagement of teacher- learners in the above set of experiences should be quantitatively and qualitatively evaluated, based on observations and submissions of projects and assignments that cover: a) submission of work b) participation c) creative potential displayed d) application of aesthetic and design sensibility in campus events or in other course work mentioned in unit 3 and unit 4.

**Suggested Readings:**

1. Arnold Berleant (2012).Aesthetics beyond the Arts. New and Recent Essays.Ashgate Publishing.
2. Goldblatt D. (2010).Aesthetics- A Reader in Philosophy of the Arts. New Delhi.Pearson Education (Singapore).
3. Dennis Atkinson D Atkinson (2003). Art in Education: Identity and Practice. Springer.
4. Parul Dave- Mukherji (2015).Arts and Aesthetics in a Globalizing World. UK. Bloomsbury Publishing.
5. Perry Ellen (2005). The Aesthetics of Emulation in the Visual Arts of Ancient Rome. Cambridge University Press.
6. Saxena, S. K. (2010). Aesthetics. Approaches Concepts and Problems. D.K. Printworld (P) Ltd.
7. S. S. Barlingay. (2007).Modern Introduction of Indian Aesthetic Theory. D. K. Printworld.

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8. Weitz Morris (2005).Philosophy of the Arts: An Introduction to Aesthetics Routledge Chapman & Hall.

**GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)**

**III: Curriculum and Pedagogic Studies (CPS)**

**CPSPS 301: PEDAGOGY OF PHYSICAL SCIENCE**

Time: 3 Hours

Max. Marks: 100

Credit- 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 student teacher will be able to:

- Gain insight about the nature of science and its curriculum.
- Comprehend the approaches and strategies of learning science at secondary level.
- Apply pedagogic aspects in teaching-learning of 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 the knowledge and comprehend the principles of curriculum and analyse the organization of science content at secondary level.
- Select and use the relevant methods, strategies and approaches in science class and laboratory.
- Develop skills in organizing, using and maintaining the available resources in teaching science.
- Transfer the fundamental experimental skills to the pupils and organize different activities related with science processes/skills to the pupils.

**Course Contents**

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**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, development of scientific attitude and values through science education.

**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 Science**

**Lesson Planning:** Instructional objectives, identification of teaching points, organising the content, designing learning experiences, 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, animal and plant kingdom.

**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 and strengthening 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, audio-visual materials; multimedia–selection and designing; use of ICT in learning science.

**Instructional resources:** Multimedia, computer, charts, models, improvised apparatus and their role and functions.

**Strengthening of Learning Science:** Organisation of practicals in laboratory, use of science kits, investigatory project, field trips, science clubs, science fairs, use of worksheets.

**Unit III: Planning and Pedagogic Aspects in Teaching - Learning of Science**

Lesson Planning and learning concepts of science such as Newton's laws of motion, universal law of gravitation, heat as energy, temperature, transfer of heat, reflection, refraction and total internal reflection of light.

Mole concept and Avogadro's number, structure of atom, periodicity of elements, acid, base & salt and pH scale, carbon and its compounds.

Nutrition in amoeba and. hopper, digestive and respiratory system in animals, control and coordination in animals, reproduction in animals.

Photosynthesis, factors affecting the process of photosynthesis, respiration in plants, transportation in plants, asexual and sexual reproduction, pollination, fertilization and partheno-genesis in plants. Heredity and variations, structure of chromosome, RNA & DNA.

#### **Unit IV: Exploring Learning of Science**

Exploring learning of science concepts such as electric circuits, series and parallel combination of circuits, electric current, measurement of current and potential difference, ohm's law, resistance, factors effecting resistance, electrical energy, elementary ideas about A.C. and D.C. motors, characteristics of metals, metallurgical operations-dressing of the ore, calcinations, roasting, smelting and refining, concept of electrode potential and electrochemical series, reactivity of metals and non-metals, extraction of metals like iron, copper and aluminium.

Types and structure of cell, brief account of functions of various cell organelles, cell division, elementary idea of mitosis and meiosis. Structure and function of meristems (apical meristems), permanent tissue (complex, secretory) structure and functions of epithelial, connective, muscular and nervous tissues, feeding mechanism, nutrients, balance diet and nutrition deficiency diseases, communicable and non-communicable diseases.

#### **Evaluation in Science**

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, construction 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:** learning indicators, performance-based assessment, learners' records of observations, field diary, oral presentation of learner's work, portfolio, assessment of project work, assessment 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, demonstration method, 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 teaching aids: charts, models, Preparation of one working model.
- Preparation of a model lesson plan followed by seminar/ presentation before the whole group.

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- 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).
- Preparation of blue print and construction of an achievement test, its administration on one section of a class and analysis of results.

**Practicals:**

- Study of laws of reflection and refraction.
- Verification of Ohm's law.
- Demonstration of Magnetic effect of current.
- Determination of given resistance and specific resistance of a material using wheat stone bridge and post office box.
- Preparation of crystals of copper sulphate.
- Study of exothermic and endothermic, combination and decomposition reactions.
- Preparations of gases (H<sub>2</sub>, O<sub>2</sub>& CO<sub>2</sub>) and study of their properties.
- Study nature of soft and hard water from a given water sample and its removal.
- Preparation of blood film/blood group testing.
- Study of diffusion and osmosis.
- Study of evolution of CO<sub>2</sub> and heat in respiration.
- Study of evolution of O<sub>2</sub> in photosynthesis.
- Check adulteration in food items.
- Demonstration of interaction between a magnet and current.
- Examine bacteria from curds and milk under microscope.

**Suggested Readings:**

1. Lewis, J. 1972 Teaching of School Physics, Penguin Book, UNESCO.
2. Anderson, Hans O and Koutnik, Paul G, 1972.Towards More effective science Instruction in secondary education.The MacMillan Co., New York and Courier MacMillan, London,.
3. Das, RC. 1984 Curriculum and Evaluation.National Council of Educational Research and Training, New Delhi,.
4. Driver, R.The pupil as scientist, Open University Press, Buckingham, 1983.
5. Saxena A.B. 1988. Vigyan Shikshan Ka AyonjanHar Prasad Bhargava & Sons, Agra,
6. Science for Class IX and X, NCERT Publication.
7. National Curriculum Framework 2005, NCERT Publication.2006
8. NCERT (2005) National Curriculum Framework. New Delhi. NCERT
9. Science Teachers and Educators 1985. UNESCO Bangkok
10. NCERT: Teacher Education Curriculum Framework 1978NCERT, New Delhi.
11. Teaching Life Sciences, J.K. Sood, Kohli Publication.
12. Science Teaching In Schools by Du RC (1985) Sterling Publication.
13. Science for Class IX and X, NCERT Publication New Delhi
14. R.C.Sharma Modern Science Teaching, Dhanpat Rai& Sons, Delhi.
15. Teaching Technology for College Teachers, Sterling Publishers. New Delhi

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16. Food and Nutrition by E.P.G Arya Book Depot. New Delhi.

**GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)**  
**III: Curriculum and Pedagogic Studies (CPS)**  
**Semester V**  
**CPSPM 301: PEDAGOGY OF MATHEMATICS I**

Time: 3 Hours  
Credit- 4

Max. Marks: 100  
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 student teachers will be able to:

- Acquire a clear perspective of the nature of mathematics
- Gain insight on the meaning, nature, scope and objective of mathematics education
- Appreciate the changes in curriculum and evolve new approaches to teaching
- Understand the principles, processes relationships and to design appropriate strategies for teaching.
- Design appropriate activities for developing a concept.
- Design mathematics laboratory.
- Develop competencies in designing appropriate diagnostic and remedial tests.
- Construct appropriate assessment tools for evaluating mathematics learning.
- Appreciate the importance of mathematics lab in learning mathematics.
- Develop the competencies in preparation of appropriate teacher aids unit plan lesson plan and test items.
- Construct appropriate assessment tools for evaluating mathematics learning.
- Understand and develop Technology Integrated Mathematics Module (TIMM) using on different subject specific open source software on various concepts of Geometry at secondary stage and
- Understand and develop dynamical digital applets with emphasis on process involved in teaching and learning of mathematics at secondary stage.

- Explain the meaning of evaluation
- Infer the effect of evaluation on students

### **Course Contents**

#### **Unit I: Nature of Mathematics**

- Human Needs as a Basis of Growth in Mathematics
- Mathematical Statements are Unambiguous, Truth Criteria, Use of Symbols
- The role of Intuition and Logic in Mathematical Thinking
- Axiomatic Framework of Mathematics: Axioms, Postulates, Undefined Terms, Defined Terms, Reasoning, Type of Reasoning, Proofs - Types of Proofs.
- Language of Mathematics

#### **Unit II: Exploring learners**

- Cultivating learner's sensitivity like listening, encouraging learner for probing, raising queries, appreciating dialogue among peer group, promoting the student's confidence.
- Exploring ways of Learning Engagements
- Providing opportunities for group activities, Group/individual presentation, Providing opportunity for sharing ideas, Exposing to exemplar constructivist learning situations in mathematics, Visit to district, state and national level science exhibition/ field visit, Audio visual presentation followed by its analysis and discussion, Reflective written assignments, Case studies.

#### **Unit III: Aims and objectives of Mathematics**

- Need and Importance of Mathematics in School Curriculum
- Social Aspects
- Mathematical Aspects
- Applications of Mathematics
- Aims, objectives and scope of mathematics at the secondary stage.
- Writing of objectives for each stage (Primary, Secondary and Sr. Secondary).
- Writing objectives in behavioral terms for each stage. Piaget's operational thinking.
- Emphasis on the use of mathematics in daily life situations
- Role of mathematics in other subject areas – Interdisciplinary approaches.
- Developing Skills in learners - Problem solving, Logical thinking, Drawing inferences, Handling abstraction, Visualising etc. in learner's personality
- History of development of mathematics and contributions of Indian mathematicians.

#### **Unit IV: Integration of mathematical content with activities through Mathematics Laboratory**

- Designing and setting up models,
- Teaching aids and activities/ laboratory work -using open source software in Mathematics Lesson (Expressive way- to create their own from scratch, as they

express themselves with contentment by means of a more open application or resource)

- Identifying activity in several content areas at secondary level conducive to the comprehension level of learner, Inculcating skills in Designing, Demonstrating, Interpreting and drawing inference of digital applets/concrete models.

**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.
- Audio visual presentation followed by its analysis and discussion.

**Practicum:**

- Preparation of lesson plans on different approaches on selected content matter.
- Preparation of teaching aid (software based applets and concrete materials based).
- Designing of mathematics kits (software based and concrete 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

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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). Pedagogy And ICT Use In Schools Around The World Findings From The IEA Sites 2006 Study: Springer. New York
14. Glazer, E. M. (2001). Using Internet Primary Sources to Teach Critical Thinking Skills in Mathematics. Santa Bar- bara, CA: Libraries Unlimited Press
15. Prichard, A. (2007). Effective Teaching with Internet Technologies Pedagogy and Practice. Thousand Oaks, CA: Sage Publications.
16. S. K. Mangal, Teaching of Mathematics, Prakash Brothers, Ludhiana.
17. A. B. Bhatnagar, New dimensions in the teaching of Mathematics, Modern Publishers, Meerut.
18. K. S. Sindhu, Teaching of Mathematics, Sterling Publications, New Delhi.
19. UNESCO: Trends in Mathematics Teaching.

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

Time: 3 Hours

Max. Marks: 100

Credit- 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 student teachers will be able to:

- Develop insight on the meaning, nature, and effective use of different activities/experiments/demonstrations/ laboratory experiences for determining aims and strategies of teaching-learning of biological science;
- Prepare and use of lesson plans and unit plans required for instructional purposes;
- Integration with other school subjects and to identify and relate everyday experiences with learning of biological science;
- Explore the curricular processes and skills in science at secondary level and laboratory in teaching-learning;
- Formulate meaningful inquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, stages during teaching-learning of biological science

**Course Contents**

**Unit I: Aims, Objectives, its Nature and Scope**

- Developing scientific attitude and scientific temper : Nurture the natural curiosity, aesthetic senses and creativity in biology,
- Acquire the skills to understand morphology, taxonomy, genetics, cell biology, development biology etc.
- Understanding biology in relation to society and human welfare,
- Imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment;
- Solving problems of everyday life;
- Know the facts and principles of biology and its applications consistent with the stages of cognitive development of learners;
- Specific objective of different content areas in biology.
- Science as a domain of enquiry, dynamic body of knowledge and as a process of constructing knowledge;
- Biological Science for environment and health, History of biological science, its nature and knowledge of biological science independent of human application;
- Origin of life and evolution, biodiversity, observations and experiments in biological sciences;
- Biological sciences and society.

**Unit II: Exploring Biology**

- Motivating learner to bring his/her previous knowledge in science/biology gained through classroom/environment/parents and peer group;
- Cultivating in teacher-learner the habit of listening to child;

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- Generating discussion, involving learners in teaching-learning process;
- Encouraging learners to raise questions,
- Appreciating dialogue amongst peer groups,
- Encouraging learners to collect materials from local resources and to develop/fabricate suitable activities in biological science (individual or group work);
- Understanding the role of learners in negotiating and mediating learning in biology.

**Unit III: School Science Curriculum (Biological Science)**

- Trends in Science curriculum; Consideration in developing learner- centred curriculum in biology
- Concept of curriculum, historical background of Biology curriculum and its studies. Biological sciences curriculum study project.
- Principles of curriculum construction, curriculum development process, techniques of structuring and restructuring of curriculum, trends in curriculum development in Biology, analysis of existing Biology syllabi and study of recent trends/innovations in biological sciences.
- Pedagogical analysis of – different types of natural resources; food resources and enriched food habits; diversity in plants and animals; hierarchical organization of life.

**Unit IV: Approaches and Strategies of Learning Biological Science**

- Pedagogical shift from science as fixed body of knowledge to process of constructing knowledge, scientific method - observation, enquiry, hypothesis, experimentation, data collection, generalization (teacher- educator will illustrate taking examples from different stage-specific content areas keeping in mind the variation, e.g. structure and function, interaction between living and non-living, biodiversity etc.).
- Communication in biological sciences;
- Problem solving, investigatory approach, concept mapping, collaborative learning, and experiential learning in biological science (teacher-learner will design learning experiences using each of these approaches);
- Facilitating learners for self- study
- Lesson plan format for learning objectives, preparation and use of teaching aids, time management, recapitulation and evaluation strategies for learners and presentation of lesson plan in biological sciences in class-room transaction.

**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.

**Language across the Curriculum Activities:** As an integral part of teaching-learning process, relevant activities should be carried out to enhance and promote language skills (LSRW) and proficiency based on the rationale of Language Across Curriculum. The activities in this regard are language centered and, therefore, the focus of learning and teaching activities should be on language skills not necessarily on the content. The activities in this regard may be designed/improvised according to the context. Some of the exemplar activities may include:

- Presentation (Oral and Written) based on themes from the content area
- Debate on themes from the content area
- Panel discussion/Seminar/ discussion etc.
- Group discussion/group work
- Question-answer sessions
- Role play/dramatization
- Extempore speech/Elocution
- Organization of reading/reflection activities beyond the textbooks

**Practicum:**

Activities based on Science syllabus at secondary level.

- Preparation of teaching aids: charts, models, Preparation of one working model.
- Preparation of a model lesson plan followed by seminar/ presentation before the whole group.

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- 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.
- Tools and Technique in Biological Science
- Perform experiments to detect presents of carbohydrates, lipids and proteins in food by qualitative test
- Different types of Microscopes and their principle
- Experiments on Diffusion and osmosis
- Evolution of CO<sub>2</sub> and heat in respiration
- Evolution of O<sub>2</sub> in photosynthesis
- Observation of stages of mitosis and meiosis/animal tissues.

**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. Vaidya, N. (2004) Science Teaching for 21<sup>st</sup> Century, Deep & Deep Publications.(1999). Dat Poly, Encyclopedia of Teaching Science.New Delhi. Sarup & Sons.
5. Sutton, CR and Hayson J.H. (1974). The Art of the Science Teacher. McGraw Hill Book Company Ltd.
6. Their, DH. (1973) Teaching Elementary School Science.A Laboratory Approach, Sterling Publication Pvt. Ltd.
7. Science Teacher. (Peer reviewed journal for science teachers).
8. Journal of Research in Science Teaching. (Wiley-Blackwell).
9. Ameeta, P. (2008) Methods of Teaching Biological Science.Neelkamal Publications Pvt. Ltd. Educational Publishers.
10. Sharma, R.C. (1987) Modern Science Teaching. New Delhi. Dhanpatarai& Sons.

**Web Sites**

1. <http://www.tc.columbia.edu/mst/science.ed/courses.asp>.
2. <http://www.edu.uwo.ca>

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**GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)**  
**III: Curriculum and Pedagogic Studies (CPS)**  
**Semester V**

**CPSLA 301: LEARNING ASSESSMENT**

Time: 3 Hours

Max. Marks: 100

Credit- 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 student teacher will be able to:

- Gain a critical understanding of issues in assessment and evaluation
- Become cognizant of key concepts such as test, measurement, examination, formative and summative assessment, and evaluation
- Understand different kinds and forms of assessment that aid student learning
- Use a wide range of assessment tools, learn to select and construct them appropriately
- Evolve realistic, comprehensive and dynamic assessment procedures that are able to keep the whole student in view
- Understand the use of action research in solving problems

**Course Contents**

**Unit I: Overview of Assessment and Evaluation**

- Perspective on assessment and evaluation of learning in a constructivist paradigm
- Distinction between 'assessment of learning' and 'assessment for learning'
- Purposes of assessment in a 'constructivist' paradigm:
  - engage with learners' minds in order to further learning in various dimensions
  - promote development in cognitive, social and emotional aspects
- Meaning and Objectives of :
  - test, measurement, examination, and evaluation
  - formative and summative evaluation
  - continuous and comprehensive evaluation
  - grading and its types

**Unit II: School- Based Assessment and Evaluation: Policies, Practices and Possibilities**

- Impact of examination-driven schooling
- On Pedagogy: content-confined, information focused testing; memory- and activity centric teaching and testing
- De-linking school-based assessment from examinations: some possibilities and alternative practices  
Contexts of assessment: subject- related and person- related

**Unit III: Efforts towards Examination Reforms**

- Efforts towards examination reforms in India based on: NPE,1986; POA, 1992; NCF, 2000 and 2005 and National Focus Group Position Paper on Examination Reforms (Discussion should cover analysis of recommendations, implementations and the emerging concerns)

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- Management of Examination in Schools
- Role of ICT in examination
- Action Research in improving classroom practices, concept, need and steps of action research, action research as an approach to improve class and school practices. Development of an Action Research Plan.

**Unit IV: Teacher competencies in evolving appropriate assessment tools, Data Analysis, Feedback and Reporting**

- Teacher competencies
- Visualizing appropriate assessment tools for specific contexts, content, and student
- Achievement test: meaning, need, steps and blue print.
- Evolving suitable criteria for assessment
- Organizing and planning for student portfolios and developing rubrics for portfolio assessment
- Statistical tools- percentage, graphical representation, frequency distribution, central tendency, variation, normal distribution
- Feedback as an essential component of formative assessment
  - use of assessment for feedback; for taking pedagogic decisions
  - Types of teacher feedback (written comments, oral); peer feedback
  - Place of marks, grades and qualitative descriptions
- Developing and maintaining a comprehensive learner profile
- Purposes of reporting: to communicate
  - progress and profile of learner
  - basis for further pedagogic decisions
- Reporting a consolidated learner profile

**Modes of Learning Engagement:** Some suggested modes of learning engagement are:

- Lecture-cum-discussion
- Readings and presentations
- Group discussions
- Analysis of a range of assessment tools
- Developing worksheets and other tasks for learning and assessment in one's specific subject area
- Maintaining a portfolio related to the course-work and devising rubrics for assessment
- Constructing a test or an examination paper in one's subject area; critical review of these
- Observing, interviewing and writing comprehensive profile of a student
- Simulated exercises in 'marking' and giving feedback to fellow student-teachers (on a written task); critical review of feedback
- Simulated exercise in marking an examination paper in one's subject area; critical review of marking

**Practicum:**

- Compare different forms of assessment.
- Presentation of different kinds of grading with advantages and disadvantages.
- Focus group discussion on examination driven teaching and learning.
- Critical evaluation of examination reforms suggested and implemented based on NPE-1986; POA-1992; NCF-2000; and NCF-2005.
- Developing Action Research proposal following the established steps of Action Research.
- Organizing student Portfolio assessment and developing rubrics for portfolio assessment.
- Developing Achievement Test and practicing method of finalizing the test.

**Suggested Readings:**

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