



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (I Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Inorganic Chemistry	Paper Code	: CH-101

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Atomic Structure: Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbital's, quantum numbers, Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals.

UNIT-II

Periodic Table: General principles of periodic table, effective nuclear charge, Slater's rules. and Atomic ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination or evaluation, trends in periodic table (s & p block elements).

UNIT-III

Covalent Bond: Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions (BeF₂, BF₃, CH₄, PF₅, SF₆, IF₇, SO₄⁻², ClO₄⁻¹) Valence shell electron pair repulsion (VSEPR) theory to NH₃, H₃O⁺, SF₄, ClF₃, ICl₂⁻ and H₂O. MO theory of heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

UNIT-IV

Ionic Solids: Ionic structures (NaCl, CsCl, ZnS (Zinc Blende), CaF₂) radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy (mathematical derivation excluded) and Born- Haber cycle, solvation energy and its relation with solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule.

Suggested books:

1. Inorganic Chemistry, by Malik, Tul, i Madan, S.Chand . & company.
2. A text book of Inorganic Chemistry, O P Tandon, G R Bathla Pulication pvt Ltd
3. Inorganic Chemistry, by James E. Huheey, E.A. Keiter, R. L. Keiter, O. K. Medhi
4. Concise Inorganic Chemistry, by J. D. Lee, Oxford



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B. Sc. I Year (I Semester)

Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Organic Chemistry	Paper Code : CH-103

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Structure and Bonding: Localized and delocalized chemical bond, vander Waals interactions, and resonance conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison.

Stereochemistry of Organic Compounds-I: Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

UNIT-II

Stereochemistry of Organic Compounds-II: Relative and absolute configuration, sequence rules, R & S systems of nomenclature, Geometric isomerism, determination of configuration of geometrical isomers, E & Z system of nomenclature, Conformational isomerism conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, Newman projection and Sawhorse formulae, Difference between configuration and conformation.

UNIT-III

Mechanism of Organic Reactions: Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates carbocations, carbanions, freeradicals, carbenes, arynes and nitrenes (formation, structure & stability). Assigning formal charges on intermediates and other ionic species.

UNIT-IV

Alkanes and Cycloalkanes: IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties. Cycloalkanes nomenclature, synthesis of cycloalkanes and their derivatives—photochemical (2+2) cycloaddition reactions, dehalogenation of dihalides, pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations, theory of strainless rings.



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Lectures	: 2 Hrs	
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Physical Chemistry	Paper Code : CH-105

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Gaseous States: Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path. Deviation of Real gases from ideal behaviour. Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Explanation of behavior of real gases using Vander Waal's equation.

UNIT-II

Critical Phenomenon: Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal's constants. Critical compressibility factor. The Law of corresponding states. Lequifaction of gases.

UNIT-III

Liquid States: Structure of liquids. Properties of liquids – surface tension, viscosity vapour pressure and optical rotations and their determination.

UNIT-IV

Solid State: Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements of crystals, Definition of unit cell & space lattice. Bravais lattices, crystal system. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl.

Liquid crystals: Difference between solids, liquids and liquid crystals, types of liquid crystals, Applications of liquid crystals.



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Schedule per week Practical: 6

Examination Time : 4 Hrs

Subject

: Chemistry Lab-I

Maximum Marks: 50 (20+30)

Paper Code : CH-107

UNIT-I (Inorganic)

Volumetric Analysis

1. **Redo titrations:** Determination of Fe^{2+} , $\text{C}_2\text{O}_4^{2-}$ (using KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$)
2. **Iodometric titrations:** Determination of Cu^{2+} (using standard hypo solution).
3. **Complexometric titrations:** Determination of Mg^{2+} , Zn^{2+} by EDTA.

UNIT-II (Physical)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To prepare arsenious sulphide sol and compare the precipitating power of mono, bi and trivalent anions.

UNIT-III (Organic)

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point
 - (i) Iodoform from ethanol (or acetone)
 - (ii) *m*-Dinitrobenzene from nitrobenzene (use 1:2 conc. HNO_3 H_2SO_4 mixture if fuming HNO_3 is not available)
 - (iii) *p*-Bromoacetanilide from acetanilide
 - (iv) Dibenzalacetone from acetone and benzaldehyde
 - (v) Aspirin from salicylic acid



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RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)
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B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time: 3 Hrs

Maximum Marks: 50(20+30)

Subject: Diversity of microbes and plant pathology

Paper Code: BOT-101

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Bacteria: Structure, nutrition, reproduction and economic importance

Cyanobacteria: General characters; life-history of *Nostoc* & *Oscillatoria*

Mycoplasma: Occurrence, Morphology, Reproduction and Importance

Viruses: General account of Viruses including structure of TMV and Bacteriophages

UNIT-II

Algae: General characters, classification (upto classes) and economic importance; General account of algal blooms. Important features and life-history (excluding development) of *Volvox*, *Oedogonium* (Chlorophyceae), *Vaucheria* (Xanthophyceae), *Ectocarpus* (Phaeophyceae) and *Polysiphonia* (Rhodophyceae)

UNIT-III

Fungi: General characters, classification (upto classes) and economic importance; Important features and life-history of *Phytophthora* (Mastigomycotina), *Mucor* (Zygomycotina), *Penicillium* (Ascomycotina), *Puccinia*, *Agaricus* (Basidiomycotina), *Colletotrichum* (Deuteromycotina)

UNIT-IV

Lichens: General characters, Habitat, Structure, Reproduction, Economic and Ecological importance of Lichens.

Plants diseases: Brief account, structure, importance and life history and/or disease cycle and control of the following: *Albugo* and White rust, *Sclerospora* and Downy mildew/Green ear disease of Bajra; *Aspergillus*; *Claviceps* and Ergot; *Peziza*.

SUGGESTED READINGS:

1. Clifton, A. 1958. Introduction to the Bacteria: McGraw Hill & Co., New York.
2. Dube, H.C. 1990. An Introduction to Fungi, Vikas Publishing House Pvt.Ltd., New Delhi.
3. Kumar, H.D. 1998. Introductory phycology, affiliated East-West Press, Ltd. New York.
4. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular, Cell Biology, W.H. Freeman and Co., New York., USA.
5. Smith, G.M. 1971. Cryptogamic Botany. Vol. I. Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.
6. Sharma, P.D. 1991. The Fungi. Rastogi & Co., Meerut.



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Schedule per week Lectures: 3

Examination Time: 3 Hrs

Maximum Marks: 50 (20+30)

Subject: Cell biology

Paper Code: BOT-103

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UNIT-I

An overview of Cell; The Cell Theory: a brief history; Emergence of modern Cell Biology; Internal organization of a Cell; Brief description of Cell membranes, cytoplasm (including cytoskeleton systems) and Nucleus; **The Cell Envelopes:** Structure and functions of Cell Wall, Plasma Membrane

UNIT II

Cell organelles: Golgi Apparatus, Endoplasmic Reticulum, Lysosomes, Peroxisomes and Vacuoles. **Ultra-structure and function:** Chloroplast, Mitochondria, Nucleus and Nucleolus

UNIT-III

Chromosome: Morphology, ultra-structure - kinetochore, centromere and telomere. **Chromosomal aberrations:** Structural and Numerical - deletions, duplications, translocations, inversions, aneuploidy, polyploidy, Sex chromosomes and Sex determination in Plants

UNIT - IV

Cell Cycle: General account and its Phases, Molecular basis of cell cycle control and checkpoints
Cell Division: Mitosis and Meiosis - Stages and Significance

SUGGESTED READINGS:

1. Alberts, B. Bray, D. Lewis, J., Raff, M., Roberts, K. and Watson. I.D. 1999. Molecular Biology of Cell. Garland Publishing Co., Inc., New York, USA.
2. Gupta, P.K. 1999. A text book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.

3. Kleinsmith, L. J and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd edition) Harper Collins College Publishers, New York, USA.
4. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular, Cell Biology, W.H. Freeman and Co., New York., USA.
5. Smith, G.M. 1971. Cryptogamic Botany. Vol.I. Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.



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Schedule per week Lectures: 3

Examination Time: 4 Hrs

Maximum Marks: 50 (20 +30)

Subject: Botany Lab-I

Paper Code: BOT-105

1. Identify, classify and write short morphological notes giving well-labelled relevant diagrams on the given specimens A, B, C and D from Algae. (4)
2. Identify, classify and write short morphological notes giving well-labelled relevant diagrams on the given specimens A, B, C and D from fungi. (4)
3. To prepare temporary mount of any plant pathological material. (6)
4. Any experiment designed by the examiner as per syllabus. (4)
5. Identify giving two important characters of identification of the given spots 1 and 2 (One each from mitosis and meiosis) (4)
6. Practical records (3)
7. Viva-voce (5)

IA.Lab exercise, Practical records, Field collection, Seminars, Assignments and projects

List of practicals

Stain Bacterial cells; Identification and characterization of slides of following: **Cyno bacteria:** *Nostoc*, *Oscillatoria*; **Algae:** *Volvox*, *Oedogonium* (Chlorophyceae), *Vaucheria* (Xanthophyceae), *Ectocarpus* (Phaeophyceae), *Polysiphonia* (Rhodophyceae); **Fungi:** *Phytophthora* (Mastigomycotina), *Mucor* (Zygomycotina), *Penicillium* (Ascomycotina), *Puccinia*, *Agaricus* (Basidiomycotina), *Colletotrichum* (Deuteromycotina); Plant Cell, Cell Divisions: Mitosis-Stages, Meiosis - Stages



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B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Maximum Marks: 50(20+30)

Examination Time : 3 Hrs

Paper Code : ZOO-101

Subject : Life and Diversity from Protozoa to Helminthes

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1 - Phylum- Protozoa

- (1) General characters and classification upto order level
- (2) Biodiversity and economic importance of Protozoa
- (3) Parasitic Protozoans: Life history, mode of infection and pathogenicity of *Entamoeba*, *Plasmodium*, *Trypanosoma*, *Leishmania* and *Giardia*

UNIT 2 - Phylum- Porifera

- (1) General characters and classification up to order level
- (2) Biodiversity and economic importance of Porifera
- (3) Type study - *Sycon*
- (4) Canal system in sponges
- (5) Spicules in sponges

UNIT 3 - Phylum - Coelenterata

- (1) General characters and classification up to order level
- (2) Biodiversity, economic importance
- (3) Type Study - *Obelia*
- (4) Corals and coral reefs
- (5) Polymorphism in Siphonophores

UNIT 4 - Helminths

- (1) General characters and classification of Platyhelminthes
- (2) General characters and classification of Aschelminthes
- (3) Type study - *Fasciola hepatica* and *Ascaris*
- (4) Helminths parasites: Brief account of life history, mode of infection and pathogenicity of *Schistosoma*, *Taenia*, *Ancylostoma*, *Trichinella*, *Wuchereria* and *Oxyuris*
- (5) Parasitic adaptations



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B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs Maximum Marks: 50(20+30)

Subject : Cell biology & Genetics Paper Code : ZOO-103

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1

1. Ultrastructure of different cell organelles of animal cell
2. Plasma Membrane: Fluid mosaic model, various modes of transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis.
3. Endoplasmic reticulum (ER): types, role of ER in protein synthesis and transportation in animal cell
4. Goigi complex: Structure, Associated enzymes and role of golgi-complex in animal cell
5. Lysosomes: Structure, enzyme and their role; polymorphism

UNIT 2

1. Ribosomes: Types, biogenesis and role in protein synthesis
2. Mitochondria: Mitochondrial DNA; as semiautonomous body, biogenesis, mitochondrial enzymes (only names), role of mitochondria
3. Cytoskeleton: Microtubules, microfilaments, centriole and basal body. Cilia and Flagella
4. Nucleus: Nuclear membrane, nuclear lamina, nucleolus, fine structure of chromosomes, nucleosome concept and role of histones, euchromatin and heterochromatin, lampbrush and polytene chromosomes
5. Mitosis and Meiosis (Cell reproduction)

UNIT 3

1. Basic principles of Heredity, basic idea on extensions and modifications of basic principles
2. Linkage and recombination : coupling and repulsion hypothesis, crossing over and chiasma formation
3. Sex linked Inheritance: Chromosomal system of sex determination, Haemophilia and Colour blindness in man, Eye colour in *Drosophila*, Non-disjunction of sex chromosomes in *Drosophila*
4. Variation; types, sources of variation

UNIT 4

1. Mutation; chromosome and gene mutations, implications of mutation
2. Human genetics: Human Karyotype, genetic counselling and testing, Chromosomal abnormalities involving autosomes and sex chromosomes, monozygotic and dizygotic twins, Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, Sickle-cell anaemia), DNA fingerprinting, genetic compatibility
3. Applied genetics; genetic engineering, implications, transgenic animals, eugenics, euthenics and euphenics



RAFFLES
UNIVERSITY

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Schedule per week Lectures: 3

Examination Time : 4 Hrs

Maximum Marks: 50(20+30)

Subject : Zoology Lab-I

Paper Code : ZOO-105

(A) Classification up to orders with ecological note and economic importance of the following animal:

Protozoa : Lamination of cultures of *Amoeba*, *Euglena* and *Paramecium*; Permanent prepared slides: *Amoeba*, *Euglena*, *Trypanosoma*, *Noctiluca*, *Eimeria*, *Paramecium* (binary fission and conjugation), *Opalina*, *Verticella*, *Balantidium*, *Nyctotherus*, radiolarian and foraminiferan ooze. Parazoa (Porifera): Specimens: *Sycon*, *Grantia*, *Euplectella*, *Hyalonema*, *Spongilla*, *Euspongia*. Coelenterata : Specimens: *Porpita*, *Varella*, *Physalia*, *Aurelia*, *Rhyzostoma*, *Metridium*, *Millipora*, *Alcyonium*, *Tubipora*, *Zoanthus*, *Madrepora*, *Favia*, *Fungia*, and *Astrea*, Permanent prepared slides: *Hydra* (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Sertularia*, *Plumularia*, *Tubularia*, and *Bougainvillea*, *Aurelia* (sense organs and stages of life history). Platyhelminthes : Specimens: *Dugesia*, *Fasciola*, *Taenia*, *Echinococcus*, Permanent prepared slides: *Miracidium*, *sporocyst*, *redia*, *cercaria*, *scolex* and *proglottids*; *Taenia* (mature and gravid). Aschelminthes : Specimens: *Ascaris* (male & female), *Trichinella*, *Ancylostoma*, *Meloidogyne*.

(B) Study of the following permanent stained preparations:

L.S. and T.S. *Sycon*; gemmules, spicules and sponging fibres of *Sycon*, canal system of sponges, T.S. *Hydra* (testis and ovary region). T.S. *Fasciola* (different regions). T.S. *Ascaris* (male and female). Temporary preparation of *Volvox*, *Paramecium*, Gemmules and spicules of *Sycon*, Preparation of permanent stained whole mounts of *Hydra*, *Obelia*, *Sertularia*, *Plumularia* and *Bougainvillea*, Pathogenic protozoans: Plasmodium, *Giardia* or as available, Pathogenic Helminthes: *Ancylostoma*; *Wuchereria* or as available

(C) Cell biology and Genetics:

Cell division: Prepared slides of stages of mitosis and meiosis, Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain, Salivary gland and polytene chromosomes of *Drosophila/Chironomus*, Exercise based on Mendel's law

(E) Project:

1. Parasitic adaptations (Protozoa to helminthes)
2. DNA: types, structure and its model preparation
3. Survey: Diversity of particular family/taxa in your surrounding area
4. Microscopy: principles and its significance
5. Staining techniques and their significance

Suggested readings

1. Barnes, R.D. Invertebrate zoology. W.G. Saunders, Philadelphia.
2. P.S. Verma, E.L. Jordan. Invertebrate Zoology 25th Edition, 2001. S. Chand Publications, New Delhi.
3. Stephen A. Miller, John B. Harley, Zoology, 6th Edition 2005 [The McGraw-Hill Companies](#).
4. D. T. Anderson. Invertebrate Zoology. Second Edition, 1999 Oxford University Press

5. [E. D. De Robertis](#), 1987. Cell and Molecular Biology 8th Edition. Lippincott Williams & Wilkins
6. [Benjamin A. Pierce](#). Genetics: A Conceptual Approach, 2014. W.H. Freeman & Co Ltd;
7. [Janet Moore](#). An Introduction to the Invertebrates. 2006. Cambridge University Press
8. Ahluwalia KB. Genetics. Wiley Eastern Ltd., New Delhi.
9. Jonathan, Slack. Genes. Oxford University Press, New Delhi.

SUGGESTED READINGS:

1. Atherly, A.G., Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics, Saunders College Publishing, Fort Worth, USA.
2. Gupta, P.K. 1999. A text book of Cell and Molecular Biology. Rastogi Publications, Meerut, India
3. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd edition). Harper Collins College Publishers, New York, USA.
4. Lodish, H., Berk, A., Zipursky, S.L., Matudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular, Cell Biology, W.H. Freeman and Co., New York, USA.
5. Russel, P.J. 1998. Genetics, The Benjamin/Cummings Publishing Co. Inc., USA.
6. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics. John Wiley and Sons, Inc. USA.
7. Smith, G.M. 1971. Cryptogamic Botany, Vol.II, Bryophytes & Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
8. Sharma, O.P. 1992. Text Book of Thallophytes, McGraw Hill Publishing Co.
9. Sharma, O.P. 1990. Text Book of Pteridophyta, Mc Millan India Ltd.
10. Puri, P., 1980, Bryophyta, Atma Ram & Sons, Delhi.
11. Russel, P.J. 1998. Genetics, The Benjamin/Cummings Publishing Co. Inc., USA.



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B. Sc. I Year (II Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Inorganic Chemistry	Paper Code	: CH-102

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Hydrogen Bonding & Vander Waals Forces: Hydrogen Bonding-Definition, Types, effects of hydrogen bonding on properties of substances, application Brief discussion of various types of Vander Waals Forces. Metallic Bond and Semiconductors Metallic Bond- Brief introduction to metallic bond, band theory of metallic bond Semiconductors- types and applications.

UNIT-II

s-Block Elements: Comparative study of the elements including, diagonal relationships, salient features of hydrides (methods of preparation excluded), solvation and complexation tendencies including their function in biosystems.

Chemistry of Noble Gases: Chemical properties of the noble gases with emphasis on their low chemical reactivity, chemistry of xenon, structure and bonding of fluorides, oxides & oxyfluorides of xenon.

UNIT-III

p-Block Elements: Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th gp): Diborane-properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazine-chemical properties and structure Trihalides of Boron – Trends in few is acid character structure of aluminium (III) chloride.

Carbon Family (14th group): Catenation, p– d bonding (an idea), carbides, fluorocarbons, silicates (structural aspects), silicons – general methods of preparations, properties and uses.

UNIT-IV

Nitrogen Family (15th group): Structures of oxides of N, P. oxyacids–structure and relative acid strengths of oxyacids of N and P. Structure of white, yellow and red phosphorus

Oxygen Family (16th group): Oxyacids of sulphur – structures and acidic strength H₂O₂ structure, properties and uses.

Halogen Family (17th group): Basic properties of halogen, interhalogens, types, properties, hydro and oxyacids of chlorine – structure and comparison of acid strength



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Lectures : 2 Hrs

Examination Time : 3 Hrs

Subject : Organic Chemistry

Maximum Marks: 50(20+30)

Paper Code : CH-104

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Alkenes: Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes and mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercurationreduction, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 ,

UNIT-II

Arenes and Aromaticity: Nomenclature of benzene derivatives, Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, antiaromatic and non aromatic compounds. Aromatic electrophilic substitution general pattern of the mechanism, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams ; Activating , deactivating substituents and orientation.

UNIT-III

Dienes and Alkynes: Nomenclature and classification of dienes isolated, conjugated and cumulated dienes. Structure of butadiene, Chemical reactions 1, 2 and 1, 4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation of alkynes,

UNIT-IV

Alkyl and Aryl Halides: Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams. Methods of formation and reactions of aryl halides, The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (II Semester)

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Subject	: Physical Chemistry	Paper Code	: CH-106

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Kinetics-I: Rate of reaction, rate equation, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst. Order of a reaction, integrated rate expression for zero order, first order, second and third order reaction. Half life period of a reaction. Methods of determination of order of reaction,

UNIT-II

Kinetics-II: Effect of temperature on the rate of reaction-Arrhenius equation. Theories of reaction rate –Simple collision theory for unimolecular and bimolecular collision, Transition state theory of Bimolecular reactions.

UNIT-III

Electrochemistry-I: Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only) Transport number, definition and determination by Hittorfs methods, (numerical included),

UNIT-IV

Electrochemistry-II: Kohlrausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it. Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution. Applications of conductivity **Measurements:** determination of degree of dissociation, determination of K_a of acids determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pKa, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (II Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Subject : Chemistry Lab-II

Maximum Marks: 50 (20+30)

Paper Code : CH-108

UNIT-I (Inorganic)

Volumetric Analysis

Complexometric titrations: Determination of Hardness of Water by EDTA

Paper Chromatography

Qualitative Analysis of the any one of the following Inorganic cations and anions by paper chromatography (Pb^{2+} , Cu^{2+} , Ca^{2+} , Ni^{2+} , Cl^- , Br^- , I^- and PO_4^{3-} and NO_3^-).

UNIT-II (Physical)

1. To determine the surface tension of a given liquid by drop number method.
2. To determine the viscosity of a given liquid.
3. To determine the specific refractivity of a given liquid

UNIT-III (Organic)

To study the process of sublimation of camphor and phthalic acid,



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Diversity of Archegoniate	Paper Code : BOT-102

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Bryophyta: General characters, Origin and evolution of Bryophytes classification (upto classes), alternation of generations, evolution of sprophytes and economic importance

UNIT -II

Bryophyta: Structure and reproduction (excluding development) of *Riccia* and *Marchantia* (Hepaticopsida), *Anthoceros* (Anthocerotopsida) and *Funaria* (Bryopsida)

UNIT-III

Pteridophyta: General characters, classification (upto classes), alternation of generations, heterospory, apospory, apogamy and economic importance; General account of stelar evolution

UNIT IV

Pteridophyta: Structure and reproduction (excluding development) of *Rhynia* (Psilopsida), *Selaginella* (Lycopsida), *Equisetum* (Sphenopsida) and *Pteris* (Pteropsida)

SUGGESTED READINGS:

1. Gilford. L.M. and Foster. A.S. 1998. Morphology and evaluation of vascular plants. W.H. Preeman and Compony. New York.
2. Sharma. O.P. Pteridophytes. 2000. Total and tomorrow Publicatios.
3. Surbhai.R.C. and Saxena. R.C. 1990. A text book of Botany. Rastogi & Co., Meerut.
4. Sporne. K. R. 2002. The Morphology of Gymnosperms.B.I. pub. Pvt. Ltd., Mumbai, Kolkata,
5. Whilson, N.S. and rothewall. G.W. 1993 Paleobotany and evaluation of plants. (II Ed.). Cambridge university press.U.K.
7. Singh, V.P. Pandey, P.C. & Jain, D.K. 2013. A text book of botany (IV Ed). Rastogi.



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Genetics and Plant breeding	Paper Code : BOT-104

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Genetic Material: DNA - the genetic material, DNA structure and replication, DNA-Protein interaction, The Nucleosome Model, Genetic Code, Satellite and Repetitive DNA.

Genetic Inheritance: Mendelism: Laws of Segregation and Independent Assortment; Linkage Analysis; Allelic and non-allelic interactions.

UNIT - II

Extra-nuclear Inheritance: Presence and function of Mitochondrial and Plastid DNA; Plasmids.

Genetic Variations: Mutations - spontaneous and induced; transposable genetic elements; DNA damage and repair.

UNIT-III

Gene Expression: Modern concept of gene; RNA; Ribosomes; Transfer of genetic information - transcription and translation; Structure of proteins; Regulation of gene expression in prokaryotes and eukaryotes.

UNIT -IV

Plant Breeding: introduction and objectives of plant breeding, general methods of plant breeding in self pollinated, cross pollinated, and vegetatively propagated crop plants. Introduction and acclimatization, selections, hybridizations, hybrid vigour and inbreeding impression. Role of mutation and polyploidy in plant breeding. Famous Indian and international plant breeders and their contribution. National and international agricultural research institutes. Plant breeding work done on wheat and rice in India, Green revolution.

SUGGESTED READINGS:

1. Choudhary, H.K. (1989). Elementary Principles of Plant breeding. Oxford and IBM Publishing Co., New Delhi.
2. Gupta, P.K. (2009). Cytology, Genetics, Evolution and Plant Breeding, Rastogi Publications, Meerut.
3. Miglani, G.S. (2000). Advanced Genetics, Narosa Publishing House, New Delhi.
4. Russel, P.L. (1998). Genetics. The Benejamins/Cumming Publishing House, Co., Inc.U.S.A.
5. Shukla, R.S. and Chandel, P.S. (2000). Cytogenetics, Evolution and plant Breeding, S. Chan & Co. Ltd., New Delhi.
6. Sing, R.B. (1999). Text Book of Plant Breeding, Kalyani Publishers, Ludhiana.
7. Dnyansagar, V.R. (1986). Cytology and Genetics, Tata McGraw-Hill Pub. Co. Ltd. New Delhi.



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Botany Lab-II	Paper Code : BOT-106

1. To prepare suitable stain slide and draw labeled diagram of any given (Bryophytes) material and Identify giving reasons of identification (3)
 2. Cut the section of given material 'I' (Pteridophyte) and prepare a double-stained permanent mount. Identify giving reasons of identification along with relevant diagram and show it to the examiner. (3)
 3. Prepare smear/squash and find out two different stages of mitosis. Identify giving characters of identification along with relevant diagram and show it to the examiner. (6)
 4. Two numericals regarding genetics (Mendelian inheritance and gene interaction) as per syllabus. (3)
 5. Any experiment designed by the examiner as per syllabus. (3)
 6. Identify giving two important characters of identification of the given spots 1 and 2 (One each from mitosis and meiosis) (4)
 7. Practical records. (3)
 8. Viva-voce (5)
- IA. Lab exercise, Practical records, Field collection, Seminars, Assignments and project.

List of Experiments

Identification and characterization of the following: **Bryophyta:** *Riccia*, *Marchantia* (Hepaticopsida), *Anthoceros* (Anthocerotopsida), *Funaria* (Bryopsida); **Pteridophyta:** *Rhynia* (Psilopsida), *Selaginella* (Lycopsida), *Equisetum* (Sphenopsida).

SUGGESTED READINGS:

1. Sharma. O.P. Pteridophytes. 2000. Total and tomorrow Publications.
2. Gupta, P.K. (2009). Cytology, Genetics, Evolution and Plant Breeding, Rastogi Publications, Meerut.
3. Miglani, G.S. (2000). Advanced Genetics, Narosa Publishing House, New Delhi.
4. Shukla, R.S. and Chandel, P.S. (2000). Cytogenetics, Evolution and plant Breeding, S. Chan & Co. Ltd., New Delhi.
5. Dnyansagar, V.R. (1986). Cytology and Genetics, Tata McGraw-Hill Pub. Co. Ltd. New Delhi.



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Zoology
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B. Sc. I Year (II Semester)

Schedule per week Lectures: 3
Examination Time : 3 Hrs

Maximum Marks: 50(20+30)
Paper Code : ZOO-102

Subject : Life and Diversity of Annelida to Hemichordata

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1- Phylum – Annelida

1. General characters and classification up to order level
2. Biodiversity and economic importance of Annelida
3. Type study - *Pheretima* (Earthworm)
4. Metamerism in Annelida
5. Trochophore larva:. Affinities, evolutionary significance

UNIT 2 - Phylum - Arthropoda

1. General characters and classification up to order level
2. Biodiversity and economic importance of insects
3. Type study – *Periplaneta*

UNIT 3- Phylum – Mollusca

1. General characters and classification up to order level
2. Biodiversity and economic importance
3. Type study - *Pila*
4. Torsion and detorsion in gastropoda
5. Respiration and foot

UNIT 4- Phylum - Echinodermata

1. General characters and classification up to order level
2. Biodiversity and economic importance
3. Type Study -*Asteries* (Sea Star)
4. Echinoderm larvae
5. Aristotle's Lantern

Phylum – Hemichordata

1. General characters and classification, Type study: *Balanoglossus*



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Zoology
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B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Developmental Biology

Paper Code : ZOO-104

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1

1. History and basic concepts : Epigenesis, preformation, mosaic and regulative development
2. Discovery of induction, cell-cell interaction, differentiation and growth
3. Differential gene expression, cytoplasmic determinants and asymmetric cell division
4. Reliability of development: Redundancy and negative feed back

UNIT 2

1. Early Embryonic development: gametogenesis, oogenesis, types of eggs, egg membranes, fertilization, changes in gametes, monospermy and polyspermy, planes and patterns of cleavage, early development of frog and chick up to gastrulation, fate maps, embryonic induction and organizers
2. Late Embryonic development: fate of germ layers, extra-embryonic membranes in birds, implantation of embryo in humans, placenta structure, types and functions of placenta

UNIT 3

Post embryonic development

1. Metamorphosis; changes, hormonal regulations in amphibians,
2. Regeneration; modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each),
3. Ageing; concepts and models

UNIT 4

Implications of developmental biology

1. Cloning of animals; nuclear transfer technique, embryo transfer technique, Teratogenesis; teratogenic agents and their effects on embryonic development
2. In- vitro fertilization
3. Stem cells; types, applications, stem cell culture



SCHOOL OF BASIC AND APPLIED SCIENCES
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B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Zoology Lab-II

Paper Code : ZOO-106

(A) Classification up to orders with ecological note and economic importance of the following group of animals:

1. Annelida Specimens: Pheretima, Heteronereis, Aphrodite, Chaetopterus, Arenicola, Tubifex and Pontobdella.
2. Arthropoda Specimens: Peripatus, Palaemon (Prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Poecilocerus (ak-hopper), Gryllus (cricket), Mantis (praying mantis), Cicada, Forticula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (honeybee), Bombyx (silk moth), Cimex (bedbug), Pediculus (body louse). Millipedes, Scolopendra (centipedes), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab).
3. Mollusca Specimens: Mytilus, Ostrea, Cardium, Pholas, Solen (razor fish), Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium.
4. Echinodermata Specimens: Asterias, Echinus, Cucumara, Ophiothrix, Antedon and Asterophyton.
5. Hemichordata: Balanoglossus

(B) Study of the following permanent stained preparations:

1. T.S. Pheretima (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of Pheretima.
2. Trachea and mouthparts of cockroach.
3. Statocyst of Palaemon.
4. Glochidium larva of Anodonta; radula and osphradium of Pila.
5. T.S. Star fish (arm)
6. T.S. Balanoglossus (through various regions)

(C) Demonstration by C. D.:

1. Mouth parts and trachea of Periplaneta (cockroach), radula of Pila; pedicellarae of Asterias.
2. Setae of earthworm, and mouth parts of Honey bee, House fly and cockroach.

(D) Preparation of models of the different systems of the following animals:

1. Earthworm: Digestive, reproductive and nervous systems.
2. Grasshopper/ cockroach: Digestive, reproductive and nervous systems.
3. Pila: Pallial complex, digestive and nervous systems

(E) Embryology:

1. Histological slides of frog: cleavage, blastula, gastrula, neurula and tailbud stage
2. Chick developmental study (slides): 18 hrs, 21 hrs, 33 hrs, 72 hrs and 96 hrs of incubation, primitive streak stage in embryo and study of various foetal membranes in a 10-12 day old chick embryo.

Suggested readings:

1. Barrington, EJW. Invertebrate structure and function. East West Press Pvt. Ltd. New Delhi.
2. Parker and Haswell. Text book of zoology: invertebrates. Vol. 1. Lowpriced textbook. The Macmillan press Ltd.
3. [R. L. Kotpal](#) Modern Text Book of Zoology: Invertebrates, 2009. Rastogi Publications
4. P S Verma, E L Jordan . Chordate Zoology, 2009. S. Chand Publications, New Delhi.
5. [Scott F. Gilbert](#), [Susan R. Singer](#). Developmental Biology, 2010. Sinauer Associates.
6. Balinsky, BI. An introduction to Embryology. Saunders, Philadelphia.
7. Lewis, Wolpert. Development Biology. Oxford University Press, Delhi.

Open Elective paper

Lectures : 2 Hrs

Examination Time : 3 Hrs

Paper Title : **Geology**

Maximum Marks: 50(20+30)

Paper Code : **GEO-102**

Unit-I: Earth and its spheres: atmosphere, hydrosphere, lithosphere, biosphere and Man; Earth Material.

Unit-II: Energy budget: Solar radiation; Global environments: coastal, riverine, desertic, tropical, cold, polar; Concept of global warming and climate change.

Unit-III: Geological hazards: Earthquakes, volcanism, landslides, avalanches, floods, droughts; Hazard mitigation.

Unit IV: Resource Management: Energy resources (Conventional and non-conventional), watershed management, land use planning, management of water resources, land reclamation.

Books Recommended:

1. Verma, V.K., 1986. Geomorphology Earth surface processes and form. McGraw Hill.
2. Chorley, R. J., 1984. Geomorphology. Methuen.
3. Selby, M.J., 1996. Earths Changing Surface. Oxford University Press UK.
4. Thornbury W. D., 1997. Principles of Geomorphology Wiley Eastern Ltd., New Delhi.
5. Valdiya, K. S., 1987. Environmental Geology - Indian Context. Tata McGraw Hill New Delhi.
6. Keller, E. A., 2000. Environmental Geology. Shales E. Merrill Publishing Co., Columbus, Ohio.
7. Montgomery, C., 1984. Environmental Geology. John Wiley and Sons, London.
8. Bird, Eric, 2000. Coastal Geomorphology: An Introduction. John Wiley & Sons, Ltd. Singapore.
9. Liu, B.C., 1981. Earthquake Risk and Damage, Westview

Lectures : 2 Hrs
Examination Time : 3 Hrs
Paper Title : Geography

Maximum Marks: 50(20+30)
Paper Code :GEG-102

Unit – I Geomorphology

1. Basic concepts in Geomorphology
2. Major land forms of the earth : plains, plateaus and mountains
3. Geomorphic processes; weathering and erosion
4. Earth's movements: orogenic and epeirogenic
5. Earthquakes and volcanoes
6. Earth's interior; Wegener's continental drift theory

Unit – II Climatology Marks

1. Weather and climate : Definition, elements and factors
2. Atmospheric temperature : Horizontal and Vertical distribution ; Insolation and heat budget
3. Atmospheric pressure ; Global pressure System and wind belts
4. Concept of air masses and fronts ; their classification ; cyclones and anticyclones

Unit – III Oceanography Marks

1. Introduction to ocean floor topography
2. Salinity and composition of sea water
3. Ocean currents : Atlantic, Pacific and Indian oceans
4. Ocean deposits

RECOMMENDED TEXT BOOKS:

1. Singh S.,: Geomorphology
2. Gautam, A. : Geomorphology
3. Singh, S. : Physical Geography
4. Lal, D.S. : Climatology
5. Lal, D.S. : Oceanography

REFERENCE BOOKS:

1. Strahler, A.N.1969: Physical Geography, 3rd Edition, Wiley International.
2. Ahmed, E., 1985: Geomorphology , Kalyani Publiser, New Delhi.
3. Lal, D.S. : Physical Geography