

**ZOOLOGY (B.Sc.-I)**  
**PAPER - I (paper code - 0813)**  
**(CELL BIOLOGY & INVERTEBRATES)**

**M.M. 50**

- UNIT-1** The Cell (Prokaryotic & Eukaryotic)  
Methods in cell biology (Microscopy light & Electron) Organisation of cell extranuclear and nuclear (Plasma membrane, mitochondria, chromosomes, ER, Golgi bodies, Ribosomes)
- UNIT-2** Cell divisions (Mitosis & Meiosis)  
An elementary idea of cell transformation & Cancer Immunity (elementary idea)
- UNIT-3** General Characteristics & Classification of invertebrates upto orders with examples  
Protozoa - type study Paramecium, protozoa & disease  
Porifera - type study Sycon  
Coelenterata - type study Obelia
- UNIT-4** Helminths - type study Fasciola  
Annelida - type study Pheretima  
Arthropoda - type study Palaemon
- UNIT-5** Mollusca - type study Asterias (starfish)  
Protochordata - type study Balanoglossus

**PAPER - II (paper code - 0814)**  
**(VERTEBRATES & EMBRYOLOGY)**

**M.M. 50**

- UNIT-1** Origin and classification of Chordates.  
Protochordata - type study Amphioxus.  
A comparative account of Petromyzon & Myxine
- UNIT-2** Fishes - Skin and scales  
Migration in fishes  
Parental care  
Amphibia - Parental care  
Neoteny  
Reptilia - Poisonous & non poisonous snakes, Poison apparatus, snake venom.
- UNIT-3** Aves - Flight adaptation in birds  
Discuss - Birds are glorified reptiles  
Mammals- comparative account of Prototheria, Metatheria & Eutheria and Affinities.
- UNIT-4** Gametogenesis, Fertilization & Parthenogenesis.  
Development of frog upto formation of three germ layers
- UNIT-5** Development of Chick upto formation of three germ layer, Extra embryonic membranes.  
Placenta in mammals.  
Embryonic induction organisms & differentiation.

## PARACTICAL

M.M. 50

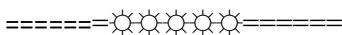
The practical work will, in general be based on the syllabus prescribed in theory and the candidates will be required to show a knowledge of the following.

1. Dissection of earth worm.
2. Dissection of Cockroach, Palaemon, Pila.
3. Minor Dissection- Appendages of Prawn & hastate plate, Mouth-parts of Insects, Radula of Pila.
4. Mounting-Setae, Spermatheca, Septal Nephridia, Nerve ring & ovary of earth worm/Parapodia of Nereis Salivary gland of Cockroach, ctenidium of pila, Malpighian tubules.
5. Cytological preparation- Onion root-tip "Squash Preparation" for mitosis/ Grasshopper testis squash for meiosis.
6. Osteology-Frog & Rabbit
7. Museum Specimen invertebrate & Vertebrate, frog embryology.
8. Slides-Chick embryology, Cytology, Mammal Histology, Bird feather & invertebrate Slides.

### Scheme of Practical Exam.

Time 3 Hrs,  
M.M. 50

- |  |          |
|--|----------|
| 1. Major Dissection                            | 8 Marks  |
| 2. Minor Dissection                            | 6 Marks  |
| 3. Mounting                                    | 5 Marks  |
| 4. Cytological Preparation                     | 5 Marks  |
| 5. Spots- 8 (Slides-4, Specimens-2, & Bones-2) | 16 Marks |
| 6. Sessional                                   | 10 Marks |



# **BOTANY (B.Sc.-I)**

## **PAPER - I**

**(GENERAL DIVERSITY OF MICROBES AND CRYPTOGRAMS)**

**M.M. 50**

**(paper code - 0811)**

- UNIT-1** Viruses and Bacteria: General account of viruses and mycoplasma; bacteria structure; nutrition, reproduction and economic importance; general account of cyanobacteria. **12 Hrs.**
- UNIT-2** Algae: General characters, classification and economic importance; important features and life history of Chlorophyceae-Volvox, Oedogonim, Coleochaete; Xanthophyceae- Vaucheria; Phaeophyceae- Ectocarpus, Sargassum; Rhodophyceae- Polysiphonia. **12 Hrs.**
- UNIT-3** Fungi: General characters, classification and economic importance; important features and life history of Mastigomycotina- Pythium, Phytophthora; Zygomycotina- Mucor, Ascomycotina-Saccharomyces, Eurotium, Chaetomium, Peziza; Basidiomycotina- Puccinia, Agaricus; Deuteromycotina-Cercospora, Colletotrichum; general account of Lichens. **12 Hrs.**
- UNIT-4** Bryophyta: Amphibians of plant kingdom displaying alternation of generations; structure, reproduction and classification of Hepaticopsida (e.g. Riccia Marchantia); Anthocerotopsida (e.g. Anthoceros), Bryopsida (e.g. Funaria) **12 Hrs.**
- UNIT-5** Pteridophyta: The first vascular plants; important characteristics of Psilopsida, Lycopsidea, Sphenopsida and Pteropsida; structure, Reproduction in Rhynia, Lycopodium Selaginella, Equisetum, Pteris and Marsilea.

## **PAPER - II**

**CELL BIOLOGY AND GENETICS**

**(paper code - 0812)**

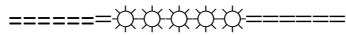
- UNIT-1** The cell envelope: Plasma membrane; bilayer lipid structure; functions; the cell wall. Ultra structure and function of nucleus: nuclear membrane; nucleolus and other organelles: Golgi bodies, ER, peroxisomes, Vacuoles. **12 Hrs.**
- UNIT-2** Chromosome organization: Morphology; centromere and telomere; chromosome alterations; deletions, duplications, translocations, inversions; variations in chromosome number aneuploidy, polyploidy; sex chromosomes. Cell division : Mitosis; meiosis **12 Hrs.**
- UNIT-3** DNA the genetic material: DNA structure; replication; DNA- protein interaction; the nucleosome model; genetic code; satellite and repetitive DNA. Extranuclear genome: Presence and function of mitochondrial and plastid DNA; plasmids. **12 Hrs.**
- UNIT-4** Gene expression: Structure of gene; transfer of genetic information; transcription, translation, protein synthesis; tRNA; ribosomes; regulation of gene expression in prokaryotes and eukaryotes; proteins, 1D, 2D and 3D structure. **12 Hrs.**
- UNIT-5** Genetic Variations: Mutations, spontaneous and induced; transposable genetic elements; DNA damage and repair: Genetic inheritance: Mendelism; laws of segregation and independent assortment: linkage analysis; allelic and non allelic interactions. **12 Hrs.**

## BOTANY PRACTICAL

Time : 3 Hrs Marks-50

1. Algae/Fungi	10
2. Bryophyta/ Pteridophyta	10
3. Disease Symptoms/Gram's Staining	05
4. Cytology/Genetics	05
5. Spots (1-5)	10
6. Viva Voce	05
7. Sessionals	05

Total : 50



## CHEMISTRY (B.Sc.-I)

The new curriculum will comprise of Three papers of 33.33 and 34 marks each and practical work of 50 marks. The curriculum is to be completed in 180 working days as per the UGC norms & conforming to the directives of the Govt. of Chhattisgarh. The theory papers are of 60 hrs. each duration & the practical work of 180 hrs. duration.

### PAPER-I INORGANIC CHEMISTRY (paper code - 0795)

M.M. 33

#### UNIT-1 A. ATOMIC STRUCTURE

Idea of de-Broglie matter-waves, Heisenberg Uncertainty principle, Schrodinger wave equation, significance of  $\Psi_1$  and  $\Psi_2$ , radial & angular wave functions and probability distribution curves, Atomic orbital and shapes of s, p, d orbital's, Aufbau and Pauli exclusion principles, Hund's Multiplicity rule, electronic configuration of the elements, effective nuclear charges.

#### B. PERIODIC PROPERTIES

Ionization energy, electron gain enthalpy and electro negativity, trend in periodic table and applications in predicting and explaining the chemical behavior.

#### UNIT-2 CHEMICAL BONDING

Covalent Bond : Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization & shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to  $\text{NH}_3, \text{H}_3\text{O}^+, \text{SF}_4, \text{ClF}_3, \text{ICl}_2^-$  and  $\text{H}_2\text{O}$ . M.O. Theory, homonuclear & heteronuclear bond strength & bond energy, percentage ionic character from dipole moment & electronegativity difference.

#### UNIT-3 CHEMICAL BONDING

Ionic Solids- Ionic structures, radius ratio & co-ordination number, limitation of radius, ratio rule, lattice defects, semiconductors, lattice energy Born- Haber cycle, Solvation energy and solubility of ionic solids, polarising power & polarisability of ions, Fajans rule, Metallic bond-free electron, Valence bond & band theories.

#### UNIT-4 A. s-BLOCK ELEMENTS

Comparative study, salient features of hydrides, solvation & complexation tendencies including their function in biosystems and introduction to alkyl & aryls, Derivatives of alkali and alkaline earth metals.

#### B. CHEMISTRY OF NOBLE GASES

Chemical properties of the noble gases, chemistry of xenon, structure binding in xenon compounds.

#### UNIT-5 A. p-BLOCK ELEMENTS

Halides hydrides, oxides and oxyacids of Boron, Aluminum, Nitrogen and Phosphorus, boranes, borazines, fullerenes and silicates, interhalogens and pseudohalogens.

#### B. INORGANIC CHEMICAL ANALYSIS

Chemical principles involved in the detection of acids and basic radicals including interfering radicals.

## REFERENCE BOOKS :

1. Basic Inorganic Chemistry, F.A Cotton, G. Wilkinson and P.L. Gaus, Wiley
2. Concise Inorganic Chemistry, J.D. Lee, ELBS
3. Concepts of models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J Alexander, John Wiley.
4. Inorganic Chemistry, D.E. Shriver, P.W. Atkins and C.H.L. Angford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield, Addison- Wesley.
6. Inorganic Chemistry, A.G. Sharp, ELBS.
7. Inorganic Chemistry, G.L. Micssels and D.A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash
9. Advanced Inorganic Chemistry, Agarwal & Agarwal
10. Advanced Inorganic Chemistry, Puri & Sharma, S. Naginchand
11. Inorganic Chemistry, Madan, S. Chand
12. Aadhunik Akarbnic Rasayan, R.K. Shrivastav & P.S. Jain, Goel Publication.
13. Uchchattar Akarbnic Rasayan, Satya Prakash & G.D. Tuli, Shyamal Prakashan.
14. Uchchattar Akarbnic Rasayan, Puri & Sharma
15. Akarbnic Rasayan, Bhagchandni, Sahitaya Publication.
16. Rasayan Vigyan, Bhatnagar, Arun Publication.

## PAPER - II ORGANIC CHEMISTRY (paper code - 0796 )

M.M. 33

### UNIT-I ELECTRONIC STRUCTURE & BONDING

A. Resonance, Hyperconjugation, Inductive and other field effects, Aromaticity, hydrogen bonding.

#### B. MECHANISM OF ORGANIC REACTIONS

Homolytic & heterolytic bond breaking, types of reagents-electrophiles & nucleophiles. Structure and reactivity of reaction intermediates- Carbocation, carbanions free radicals, carbenes and nitrenes.

### UNIT-2 STEREOCHEMISTRY OF ORGANIC COMPOUNDS

A. Optical Isomerism - enantiomers, diastereomers, threo and erythro meso compound, resolution of enantiomers, inversion, retention and racemization, Relative and absolute configuration, Sequence rules, D and L and R & S systems of nomenclature.

B. Geometrical isomerism - Syn and anti forms, E & Z system of nomenclature, properties of cis-trans isomers.

### UNIT-3 ALIPHATIC AND AROMATIC RING COMPOUNDS

A. Cycloalkanes- Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

B. Mono-nuclear and polynuclear aromatic ring. Structure of benzene & naphthalene. Molecular formula and Kekule structure. Aromatic electrophilic substitution. General pattern of the mechanism, role of  $\sigma$  and  $\pi$  complexes. Electrophilic substitution in naphthalene.

### UNIT-4 ALKENES, DIENES AND ALKYNES

A. Mechanism of dehydration of alcohols.

**B.** Chemical reactions of alkenes- Mechanisms involved in electrophilic and free radical additions, hydroboration-oxidation, oxymercuration- reduction. epoxidation. Substitution at the allylic and vinylic positions of alkenes. Structure of allenes and butadiene, chemical reaction- 1,2 and 1,4 addition, Diel-Alder reaction. Chemical reactions of alkynes and acidity of alkynes. Electrophilic and nucleophilic addition reactions, hydroboration and oxidation with ozone and  $\text{KMnO}_4$ .

#### **UNIT-5 ARENES AND AROMATICITY**

**A.** Alkyl halides and Aryl Halides

Mechanism and stereochemistry of nucleophilic substitution reactions and alkyl halides and aryl halides with energy profile diagrams.  $\text{SN}_1$ ,  $\text{SN}_2$ ,  $\text{SN}_i$  mechanisms.

**B.** Mechanisms and stereochemistry of elimination reaction and alkyl halides. Elimination Vs Substitution.

#### **REFERENCE BOOK :**

1. Organic Chemistry, Morrison and Boyd, Prentice- Hall
2. Organic Chemistry, L.G. Wade Jr, Prentice-Hall
3. Fundamentals of Organic Chemistry, Solomons, John Wiley
4. Organic Chemistry, Vol. I, II, III, S.M. Mukherjee, S.P. Singh and R.P. Kapoor, wileyeastern (New-Age).
5. Organic Chemistry, F.A. Carey, MC Graw Hill
6. Introduction to Organic Chemistry, Struikweisser, Heathcock and Kosover, Macmillan.
7. Organic Chemistry, P.L.Soni.
8. Organic Chemistry, Bahi & Bahl
9. Organic Chemistry, Joginder Singh.
10. Carbanic Rasayan, Bashi & Bahi
11. Carbanic Rasayan, R.N. Singh, S.M.I. Gupta, M.M. Bakodia & S.K. Wadhwa.
12. Carbanic Rasayan, Joginder Singh.
13. Carbanic Rasayan, P.L. Soni.
14. Corbanic Rasayan, Bhagchandani, Sahitya Bhawan Publication.
15. Rasayan Vigyan, Bhatnagar, Arun Prakashan.

### **PAPER - III**

#### **PHYSICAL CHEMISTRY**

**M.M.34**

(paper code - 0797)

#### **UNIT-1 MATHEMATICAL CONCEPTS FOR CHEMIST AND COMPUTER**

**A.** Logarithmic relations, curve sketching linear graphs, Properties of straight line, sloped and intercept, Differentiation of functions, Partial differentiation, Integration of some useful and relevant functions, Maxima and minima, Permutation and combination, Probability.

**B.** General introduction to computers, components of computer, hardware and software, input and output devices; binary numbers, Introduction to computer languages, Programming, Operation systems.

#### **UNIT-2 A. MOLECULAR VELOCITIES :**

Root mean square velocity average and most probable velocities, Maxwell's law of distribution of molecular velocities of gases, (Graphical interpretation), effect of temperature on distribution of molecular velocities, collision frequency, mean free path, Joule- Thompson effect, Liquification of gases.

B. Deviation from ideal behavior, Real gases, Vander Waal equation of state, Relationship, Vander waal constant and critical constants, Law of corresponding state.

#### **UNIT-3 A. LIQUID STATE**

Inter molecular forces, magnitude of intermolecular force, structure of liquids, Properties of liquids, viscosity and surface tension.

B. Ideal and non ideal solutions, modes of representing concentration of solutions, activity and activity coefficient. Dilute solution : Colligative Properties, Lowering of vapor pressure of solvent, Raoult's law, Osmosis, Vant Hoff Theory of dilute solutions, measurements of Osmotic pressure, relationship between lowering of vapour pressure and osmotic pressure. Elevation of boiling point, Depression in freezing point, abnormal molar masses, Degree of dissociation and association of solutes, Vant Hoff factor.

#### **UNIT-4 A. LIQUID CRYSTALS :**

Difference between liquid Crystal, solids and liquids, Classification, Structure of nematic and cholesteric phases, Thermography, Seven segment cell, applications of liquid Crystals.

#### **B. COLLOIDAL STATE :**

Classification, Optical, Kinetic, and Electrical Properties of colloid, Coagulation, Hardy Schulze law, flocculation value, Protection, Gold number, Emulsion, micelle. Gel, Syneresis and thixotropy, Application of colloid.

#### **C. SOLID STATE**

Space lattices, unit cells, Elements of Symmetry in crystallize solids, X-rays diffraction, Miller indices, identification of unit cell by Bragg's Spectrometer, Powder method, Neutron and electron diffraction (Elementary idea only)

#### **UNIT-5 A. CHEMICAL KINETICS**

Rate of reaction, Factors influencing rate of reaction, rate constant, Order and molecularity of reactions, Zero, first and second order reaction, methods of determining order of reaction, Complex reactions : Consecutive, opposing and side reactions, Chain reactions. Temperature dependence of reaction rate, Arrhenius theory, Physical significance of Activation energy, collision theory, demerits of collision theory, non mathematical concept of transition state theory.

#### **B. CATALYSIS :**

Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristic of Catalyst, Enzyme Catalysed reactions, Micellar catalysed reactions, Industrial applications of Catalysis.

#### **REFERENCE BOOKS :**

1. Physical chemistry, G.M. Barrow, International student edition, MC Graw Hill
2. Basic programming with application, V.K. Jain, Tata Mc Graw-Hill
3. Computers & Common sense, R. Hunt & Shelly, Prentice-Hall
4. University general chemistry, C.N.R. Rao Macmillan.
5. Physical Chemistry, R.A. Alberty, Wiley Eastern.
6. The elements of Physical Chemistry, P.W. Atkins, Oxford.
7. Physical Chemistry through problems, S.K. Dogra & Dogra, Wiley Eastern.
8. Physical Chemistry, B.D. Khosla



9. Physical Chemistry, Puri & Sharma
10. Bhoutic Rasayan, Puri, Sharma & Palhania, Vishal Publishing Company.
11. Bhoutic Rasayan, P.L. Soni
12. Bhoutic Rasayan, Bahi & Tuli.
13. Bhoutic Rasayan, I. R. Gambin
14. Bhoutic Rasayan, Bhagchandani, Sahitya Bhawan Publication.
15. Rasayan Vigyan, Bhatnagar, Arun Prakashan.

**PAPER - IV**  
**LABORATORY COURSE**

**180 Hrs.**

The following experiments are to be conducted during the curriculum

**1. Inorganic Chemistry**

Semimicro Analysis - cations analysis, separation and identification of ions from  $Pb^{2+}$ ,  $Bi^{3+}$ ,  $Cu^{2+}$ ,  $Cd^{2+}$ ,  $Sb^{3+}$ ,  $Sn^{2+}$ ,  $4+$ ,  $Fe^{3+}$ ,  $Al^{3+}$ ,  $Cr^{3+}$ ,  $Ni^{2+}$ ,  $Co^{2+}$ ,  $Zn^{2+}$ ,  $Mn^{2+}$ ,  $Ba^{2+}$ ,  $Sr^{2+}$ ,  $Ca^{2+}$ ,  
 $Mg$ ,  $NH_4^{+}$ , and Anions  $CO_3^{2-}$ ,  $SO_3^{2-}$ ,  $S^{2-}$ ,  $SO_4^{2-}$ ,  $NO_2^-$ ,  $NO_3^-$ ,  $Cl^-$ ,  $Br^-$ ,  $I^-$ ,  $CH_3COO^-$ ,  
 $C_2O_4^{2-}$ ,  $BO_3^{3-}$ ,  $F^-$

**2. Organic Chemistry**

**i. Calibration of Thermometer**

80o- 82o (Naphthalene), 113.5o- 114o (Acetanilide), 132.5o- 133o (Urea), 100o (Distilled Water)

**ii. Determination of Melting Point**

80o- 82o (Naphthalene), Benzoic acid 121.5o- 122o, Urea 132.5o- 133o, Succinic acid 184.5o- 185o, Cinnamic acid 132.5o- 133o, Salicylic acid 157.5o- 158o, Acetanilide 113.5o- 114o, m- Dinitrobenzene 90o, p- Dichlorobenzene 52o Aspirin 135o.

**iii. Determination of boiling points**

Ethanol = 78o, Cyclohexane 81.4o, Toluene 110.6o, Benzene 80o.

**iv. Mixed Melting point Determination**

Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

**v. Distillation (Demonstration)**

Simple distillation of ethanol- water mixture using water condenser.  
 Distillation of nitrobenzene and aniline using air condenser.

**vi. Crystallization**

Phthalic acid from hot water (using fluted filter paper and stemless funnel).  
 Acetanilide from boiling water  
 Naphthalene from ethanol  
 Benzoic acid from water.

**vii. Decolorisation and crystallisation using charcoal**

Decolorisation of brown sugar with animal charcoal using gravity filtration  
 Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of congo red using 1g of decolorising carbon) from ethanol.

**viii. Sublimation**

Camphor, Naphthalene, Phthalic acid and Succinic acid

**ix. Qualitative Analysis**

Detection of elements (N, S and halogens) and functional groups (Phenolic, Carboxylic, Carbonyl, Esters, Carbohydrates, Amines, Amides, Nitro and Anilide) in simple organic compounds.

**3. Physical Chemistry**

**(i) Chemical Kinetics**

To determine the specific rate of hydrolysis of methyl/ ethyl acetate catalysed by hydrogen ions at room temperature.

To study the effect of acid strength on the hydrolysis of an ester

To compare the strengths of HCl &  $H_2SO_4$  by studying the kinetics of hydrolysis of ethyl acetate

- To study kinetically the reaction between  $H_2O_2$  & Iodide
- (ii) Distribution Law  
To study distribution of iodide between water &  $CCl_4$   
To study distribution of benzoic acid between benzene & water.
- (iii) Colloids  
To prepare arsenious sulphide sol & compare the precipitating power of mono-, bi, & tri valent anions.
- (iv) Viscosity & Surface Tension  
To determine the of % composition of a given mixture (Non interacting system) by viscosity mehtod.  
To determine the viscosity of amyI alcohol in water at differnt concentrations & calculate the excess viscosity of these solutions.  
To determine the % composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

**BOOK :**

1. ogeps qualitive analysis, revised svehla, orient longman
2. Standered methods of chemical analysis, W.W. scott, The Technical Press
3. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta & K.S. bajpai, Tata Mc Graw Hill
4. Manual ingorganic chemistry, R.K. Bansal Wiley Eastern
5. vogel's text book of practical organic chemistry, B.S. Furnis A.J. Hannaford, V. Rogers, P.W.G. Smith & A.r. Tatchel, ELBS
6. Experiments in general chemistry, CNR Rao & U.C. Agarwal
7. Experiments in physical chemistry, R. C. Das & B. Behara Tata Mc Graw Hill
8. Advanced practical physical chemistry, . J.B. Yadav, Goel publishing house

**PRACTICAL EXAMINATION**

**05 Hrs.**

**Three experiments are to be performed**

**M.M. 50**

1. Inorganic Mixture Analysis, four radicals two basic & two acid (insoluble, Interfering & combination of acid radicals) any one to be given. **12 Marks.**
  2. Detection of functional group in the given organic compound and determine its MPt/BPt. **8 marks**
- O R**  
Crystallization of any one compound as given in the prospectus along with the determination of mixed MPt.
- O R**  
Decolorisation of brown sugar along with sublimation of camphor/ Naphthlene.
3. Any one physical experiment that can be completed in two hours including calculations. **14 marks**
  4. Viva **10 marks**
  5. Sessionals **06 marks**

In case of Ex-Students two marks will be added to each of the experiments.

