

**PART - I**

**SULLABUS FOR ENVIRONMENTAL STUDIES" FOR UNDER GRADUATE**

1. "इन्वाहमेन्टल साईसेस" के पाठ्यक्रम को स्नातक स्तर भाग-एक की कक्षाओं में विश्वविद्यालय अनुदान आयोग के निर्देशानुसार अनिवार्य रूप से शिक्षा सत्र 2003-2004 (परीक्षा 2004) से प्रभावशील किया गया है। स्वशासी महाविद्यालयों द्वारा भी अनिवार्य रूप से अंगीकृत किया जाएगा।  
भाग 1, 2 एवं 3 में से किसी भी वर्ष में पर्यावरण प्रश्न-पत्र उत्तीर्ण करना अनिवार्य है। तभी उपाधि प्रदाय योग्य होगी।
2. पाठ्यक्रम 100 अंको का होगा, जिसमें से 75 अंकर सैद्धांतिक प्रश्नों पर होंगे एवं 25 अंक क्षेत्रीय कार्य (Field Work) पर होंगे।
3. सैद्धांतिक प्रश्नों पर अंक - 75 (सभी प्रश्न इकाई आधार पर रहेंगे जिसमें आंतरिक विकल्प रहेगा)  
(अ) लघु प्रश्नोंत्तीर - 25 अंक  
(ब) निबंधात्मक - 50 अंक
4. Field Work - 25अंकों का मूल्यांकन आंतरिक मूल्यांकन पद्धति से कर विश्वविद्यालय को प्रेषित किया जावेगा। अभिलेखों की प्रयोगिक उत्तर पुस्तिकाओं के समान संबंधित महाविद्यालयों द्वारा सुरक्षित रखेंगे।
5. उपरोक्त पाठ्यक्रम से संबंधित परीक्षा का आयोजन वार्षिक परीक्षा के साथ किया जाएगा।
6. पर्यावरण विज्ञान विषय अनिवार्य विषय है, जिसमें अनुत्तीर्ण होने पर स्नातक स्तर भाग-एक के छात्र/छात्राओं को एक अन्य विषय के साथ पूरक की पात्रता होगी। पर्यावरण विज्ञान के सैद्धांतिक एवं फील्ड वर्क में संयुक्त रूप से 33% (तैंतीस प्रतिशत) अंक उत्तीर्ण होने के लिए अनिवार्य होंगे।
7. स्नातक स्तर भाग-एक के समस्त नियमित/भूतपूर्व/अमहाविद्यालयीन छात्र/छात्राओं को अपना फील्ड वर्क सैद्धांतिक परीक्षा की समाप्ति के पश्चात 10 (दस) दिनों के भीतर संबंधित महाविद्यालय/परीक्षा केन्द्र में जमा करेंगे एवं महाविद्यालय के प्राचार्य/केन्द्र अधीक्षकों/परीक्षकों की नियुक्ति के लिए अधिकृत रहेंगे तथा फील्ड वर्क जमा होने के सात दिनों के भीतर प्राप्त अंक विश्वविद्यालय को भेजेगे।

**PART - I**

**SULLABUS FOR ENVIRONMENTAL STUDIES" FOR UNDER GRADUATE**

**M.M. 75**

**UNIT-I THE MULTI DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES :**

Definition, scope and importance

Need for public awareness.

**Natural Resources :**

**Renewable and nonrenewable resources :**

Natural resources and associated problems.

- (a) Forest resources : Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people.
- (b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- (c) Mineral resources : Use and exploitation, environmental effects of extracting and



- using mineral resources, case studies.
- (d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
  - (e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
  - (f) Land resources : Land as a resources, land degradation, man induced landslides, soil erosion and desertification.
    - Role of an individual in conservation of natural resources.
    - Equitable use of resources for sustainable life-styles.

(9 Lecture)

## UNIT-II : ECOSYSTEMS

**Concept of an ecosystems.**

**Structure and function of an ecosystem.**

- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :
  - a. Forest ecosystem
  - b. Grassland ecosystem
  - c. Desert ecosystem
  - d. Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, estuaries)

(9 Lecture)

## UNIT-III Biodiversity and its Conservation

- Introduction - Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as mega-diversity nation.
- Hot-spots of biodiversity
- Threats to biodiversity : habitat loss, poaching of wildlife, man/wildlife conflicts.
- Endangered and endemi species of India.
- Conservation of biodiversity : In situ and Ex-situ conservation of biodiversity

(9 Lecture)

## UNIT-IV Environmental Pollution

**Definition**

- Causes, effects and control measures of -
  - a. Air pollution



- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- g. Nuclear hazards.

- Solid waste management : Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies
- Disaster management : floods, earthquake, cyclone and landslides.

#### **Human Population and the Environment**

- Population growth, variation among nations,
- Population explosion - Family Welfare Programme.
- Environment and human health.
- Human Rights.

**(9 Lecture)**

#### **UNIT-V Social Issues and the Environment**

- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people, its problems and concerns. Case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Public awareness.
- Value Education
- HIV/AIDS
- Women and Child Welfare.
- Role of Information Technology in Environment and Human Health.
- Case Studies.

**(9 Lecture)**

#### **FIELD WORK**

- Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain.
- Visit to local polluted site : Urban/Rural/Industrial/Agriculture.



Study of common plants, insects, birds.

Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

#### REFERENCES :

1. Agarwal K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, the Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad 380 013, India, Email : mapin@icenet.net(R)
3. Bruinner R.C., 1989, Hazardous Waste Incineration, Mc Graw Hill Inc. 480p.
4. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB).
5. Cuningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 200.
6. Dr A.K. Environmental Chemisry, Wiley Estern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gloick, H.P. 1993 Water in crisis, Pacific Institute for studies in Deve, Environment & Security. Stockholm Eng. Institute, Oxford Univ. Press. 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Mumbai (R).
10. Heywood, V.H. & Watson, R.T. 1995 Global Biodiversity Assessment, Cabridge Univ. Press 1140p.
11. Jadhav H. & Bhosale, V.H. 1995, Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
12. Mckinney M.L. & School R.M. 1996, Environmental Science systems & Solutions, Web enhanced editio, 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB).
14. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB).
15. Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA, 574p.
16. Rao M.N. & Datta, A.K. 1987, Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
18. Survey of the Environment, The Hidu (M).
19. Townsend C., Harper J., and Michael Begon, Essentials of Ecology, Blackwell Science (TB).
20. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelinès, Compliances and Standards, Vol. I and II, Environment Media (R).
21. Trivedi R.K., and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB).
22. Wagner K.D., 1998, Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.

(M) Magazine

(R) Reference

(TB) Textbook.



## आधार पाठ्यक्रम

प्रश्न पत्र - प्रथम

हिन्दी भाषा

पूर्णांक - 75

खण्ड-क निम्नलिखित 5 लेखकों के एक-एक निबंध पाठ्यक्रम में सम्मिलित होंगे -

अंक-30

1. महात्मा गांधी - सत्य और अहिंसा
2. विनोबा भावे - ग्राम सेवा
3. आचार्य नरेन्द्र देव - युवकों का समाज में स्थान
4. वासुदेव शरण अग्रवाल - मातृ-भूमि
5. भगवतशरण उपाध्याय - हिमालय की व्युत्पत्ति
6. हरि ठाकुर - डॉ. खूबचंद बघेल

खण्ड-ख हिन्दी भाषा और उसके विविध रूप

अंक-20

- कार्यालयीन भाषा
- मीडिया की भाषा
- वित्त एवं वाणिज्य की भाषा
- मशीनी भाषा

खण्ड-ग अनुवाद व्यवहार : अंग्रेजी से हिन्दी में अनुवाद

अंक-25

हिन्दी की व्यावहारिक कोटियाँ-

रचनागत प्रयोगगत उदाहरण, संज्ञा, सर्वनाम, विशेषण, क्रिया विशेषण, समास, संधि एवं संक्षिप्तियाँ, रचना एवं प्रयोगगत विवेचन।

## ENGLISH LANGUAGE

M.M. 75

The question paper for B.A./B.Sc./B.Com./B.H.Sc., English Language and cultural values shall comprise the following units :

UNIT-I

Short answer questions to be asked by (Five short answer questions of three marks each)

UNIT-II

(a) Reading comprehension of an unseen passage 15 Marks  
(b) Vocabulary 05 Marks

UNIT-III

Report-Writing 10 Marks

UNIT-IV

Expansion of an idea 10 Marks

UNIT-V

Grammar and Vocabulary based on the prescribed text book. 20+15 Marks

Note :

Question on all the units shall be asked from the prescribed text which will comprise specimens of popular creative/writing and the following in any

(a) Matter & technology

(i) State of matter and its structure

(ii) Technology (Electronics Communication, Space Science)

(b) Our Scientists & Institutions

(i) Life & work of our eminent scientist Arya Bhatt, Kaurd Charak Shusruta, Nagarjuna, J.C. Bose and C.V. Raman, S. Rmanujam, Homi J. Babha Birbal Sahani.

(iii) Indian Scientific Institutions (Ancient & Modern)

Books Prescribed :

Foundation English for U.G. Second Year - Published by M.P. Hindi Granth Academy, Bhopal.

B.Sc.-II



**NEW CURRICULUM OF B.SC. PART II  
CHEMISTRY**

The new curriculum will comprise of three papers of 33, 33 & 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**

**M.M. 33**

**UNIT-I CHEMISTRY OF ELEMENTS OF FIRST TRANSITION SERIES**

Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

**UNIT-II CHEMISTRY OF ELEMENTS OF SECOND & THIRD TRANSITION SERIES**

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

**UNIT-III A. OXIDATION AND REDUCTION**

Use of redox potential data analysis of redox cycle, redox stability in water-Frost, Latimer & Pourbaix diagrams. Principles involved in the extraction of the elements.

**B. COORDINATION COMPOUNDS**

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

**UNIT-IV A. CHEMISTRY OF LANTHANIDE ELEMENTS**

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

**B. CHEMISTRY OF ACTINIDES**

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium, similarities between the later actinides and the later lanthanides.

**UNIT-V A. ACID AND BASES**

Arrhenius, Bronsted-Lowry, the Lux-flood, solvent system and Lewis concepts of acids and bases.

**N. NON-AQUEOUS SOLVENTS**

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide.

**06 HRS.**

**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. Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield. Addison - Wesley.
6. Inorganic Chemistry. A.G. Sharp, ELBS.
7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Stayas Prakash.
9. Advanced Inorganic Chemistry, Agarwal & Agarwal.
10. Advanced Inorganic Chemistry, Puri & Sharma, S. Naginchand
11. Inorganic Chemistry, Madan, S, Chand
12. Aadhunik Akarbanic Rasayan, A.K. Shrivastav & P.C. Jain, Goel Pub.
13. Uchattar Akarbanic Rasayan, Satya Prakash & G.D. Tuli, Shyamal Prakashan
14. Uchattar Akarbanic Rasayan, Puri & Sharma.
15. Selected topic in Inorganic Chemistry by Madan Malik, & Tull, S. Chand.

## PAPER - II

### ORGANIC CHEMISTRY

60 Hrs. MM. 33

#### UNIT-I ALCOHOLS

- A. Dihydric alcohols - nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [ $\text{Pb}(\text{OAc})_4$  and  $\text{HIO}_4$ ] and pinacol - pinacolone rearrangement.
- B. Trihydric alcohols - nomenclature and methods of formation, chemical reactions of glycerol.

#### PHENOLS

- A. Structure and bonding, in phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols, acylation and carboxylation.
- B. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben - Hoesch reaction, Lederer - Manasse reaction and Reimer-Tiemann reaction.

#### EPOXIDES

Synthesis of epoxides. Catalysed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides. Anti 1,2 dihydroxylation of alkenes via epoxides. Crown ethers.

#### UNIT-II ALDEHYDES AND KETONES

- A. Nomenclature and Structure of the carbonyls group. Synthesis of aldehydes and ketones using 1,3 - dithianes, synthesis of ketones from nitriles. Mechanism of nucleophilic additions to carbonyls group Benzoin, Aldol, Perkin and Knoevenagel condensations. Condensations with ammonia and its derivatives, Wittig reaction, Mannich reaction.



- B. Use of acetate as protecting group, Oxidation of aldehydes, Baeyer - Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen Condensation, Wolff-Kishner reaction,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  reduction. Halogenation of enolizable ketones.

An introduction to  $\alpha,\beta$  unsaturated aldehydes and ketones.

05 HRS.

### UNIT-III A. CARBOXYLIC ACIDS

Structure and bonding, Physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Hell-Volhard Zillinsky reaction. Reduction of carboxylic acids. Mechanism of Decarboxylation.

Methods of formation and chemical reactions of unsaturated mono carboxylic acids. Di carboxylic acids : methods of formation and effect of heat and dehydrating agents.

### B. SUBSTITUTED CARBOXYLIC ACIDS

Hydroxy and Halo-substituted Acids.

### C. CARBOXYLIC ACID DERIVATIVES

Structure of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Mechanisms of acid and base catalyzed esterification and hydrolysis.

### UNIT-IV ORGANIC COMPOUNDS OF NITROGEN

- A. Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium.

- B. Reactivity, Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel - phthalimide reaction, Hofmann bromamide reaction, Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

### UNIT-V HETEROCYCLIC COMPOUNDS

#### A. Introduction

Molecular orbital picture and aromatic character of pyrrole, furan, thiophene and pyridine, methods of synthesis and chemical reactions with emphasis on the mechanism of electrophilic substitution. Mechanism and nucleophilic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine. Piperidine and pyrrole.

- B. Preparation and reaction of Indole, quinoline and isoquinoline and with special reference to Fisher Indole synthesis and skraup synthesis and Bisher-Napieralski synthesis, Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.



### Amino acids and Peptides :

- A. Classification, Structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reaction of  $\alpha$ -amino acids.
- B. Structure and nomenclature of peptides. Peptide synthesis, solid - phase peptide synthesis.

### REFERENCE BOOKS :

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, Wiley-Eastern (New-Age)
5. Organic Chemistry, F.A. Carey, McGraw 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 & Bahl
11. Carbanic Rasayan, R.N. Singh, S.M.I. Gupta, M.M. Bakodia & S.K. Wadhwa
12. Carbanic Rasayan, Joginder Singh

### PAPER - III

### PHYSICAL CHEMISTRY

60 Hrs. M.M. 34

- UNIT-I**     **A. Thermodynamics - I**     **12 Hrs.**
- Fundamental of thermodynamics system, surroundings etc. Types of systems, intensive and extensive properties, state and path functions thermodynamic operations Internal energy, enthalpy, Heat capacity of gases at constant volume and at constant pressure and their relationship.
- First Law of Thermodynamics limitation of first law. Joule-Thompson expansion, inversion temperature of gases. Calculation of  $w, q, dU$  &  $dH$  for the liquification expansion of ideal gases under isothermal and adiabatic conditions.
- B. Thermo chemistry**
- Standard state, Hess's law of heat summation. Enthalpy of reaction at constant pressure and constant volume. Enthalpy of neutralizations. Enthalpy of combustion, Enthalpy of formation, Calculation of Bond enthalpy. Eilrichhoff's equation.
- UNIT-II**     **A. Thermodynamics-II**
- Second Law of Thermodynamics : Spontaseous process need of second law, statements of Carnot cycle and efficiency of heat engine, Carnot theorem. Thermodynamic state of temperature.
- Concept of entropy : entropy change in a reversible and irreversible process, Entropy change in insothermal reversible expansion of an ideal gas, Entropy



- change in isothermal mixing of ideal gases, physical signification of entropy.
- B. Gibbs and Helmholtz free energy variation of G and A with pressure, volume temperature, Gibbs Helmholtz equation.

### UNIT-III PHASE EQUILIBRIUM

- A. Gibbs Phase rule, Phase components and degree of freedom, Limitation of phase rule.  
Applications of phase rule to one component system - water system, sulphur system.  
Application of phase rule to two component systems : pb-Ag system, Zn, Mg system, ferric chloride-water system, desilverization of \_\_\_\_ congruent and incongruent, melting point, eutectic point.  
Three component systems : solid solution liquid pairs.  
Liquid liquid mixture : (Partially miscible liquids) : phenol-water, trimethylamine-water nicotine systems, constant temperature, azeotrops.
- B. Nerst distribution law, Henry's law, application, solvent extraction.

### UNIT-IV ELECTROCHEMISTRY-I

10 HRS.

- A. Electrolytic Conductance : Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch's law; application of Kohlrausch's law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titration.
- B. Theories of strong electrolytes : limitations of Ostwald dilution law, weak and strong electrolyte, Debye-Huckel-Onsager (DHO) equation for strong electrolyte, relaxation and electrophoretic effect.
- C. Migration of ions : Transport number, definition and determination by Hittorf method and moving boundary method.

### UNIT-V ELECTROCHEMISTRY-II

10 HRS.

- A. Electrochemical cell or Galvanic cell : reversible and irreversible cells conventional representation of electrochemical cells, EMF of the cell, effect of temperature on EMF of the cell, Nernst equation, calculation of  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  for cell reaction.
- B. Single electrode potential : standard hydrogen electrode, calomel electrode quinhydrone electrode, redox electrodes, electrochemical series.
- C. Concentration cells with & without transport, liquid junction potential, application of concentration cell in determining valency of ions, solubility product, activity coefficient.
- D. Determination of pH and pKa using hydrogen and quinhydrone electrode potentiometric titrations, buffer solutions; Henderson-Hasselbalch Equation, Hydrolysis of salts, Corrosion : type theories and prevention.

### REFERENCE BOOKS :

1. Physical Chemistry, G.M. Barrow, International student edition-McGraw Hill
2. University general chemistry, C.N.R. Rao, Macmillan.



3. Physical Chemistry, R.A. Alberty, Wiley Eastern.
4. The elements of Physical Chemistry, Eastern.
5. Physical Chemistry through problems, S.K. Dogra & S. Dogra, Wiley Eastern.
6. Physical Chemistry, B.D. Khosla.
7. Physical Chemistry, Puri & Sharma
8. Bhoutic Rasayan, Puri, Sharma & Pathania, Vishal Publishing Company.
9. Bhoutic Rasayan, P.L. Soni
10. Bhoutic Rasayan, Bahl & Tuli
11. Physical Chemistry, R.L. Kapoor, Vol. I-IV

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

180 Hrs.

**Inorganic Chemistry**

Calibration of fractional weights, pipettes and burettes. Preparation of standard solutions, Dilution-0.1 M to 0.01 M. solutions.

**Quantitative Analysis**

Volumetric Analysis

- (a) Determination of acetic acid in commercial vinegar using NaOH.
- (b) Determination of alkali content-antacid tablet using HCl.
- (c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- (d) Estimation of hardness of water by EDTA.
- (e) Estimation of ferrous & ferric by dichromate method.
- (f) Estimation of copper using thiosulphate.

**Instrumentation**

Colorimetry

- (a) Job's method
- (b) Mole-ratio method

Adulteration-Food Stuffs.

Effluent analysis, water analysis

**Solvent Extraction**

Separation and estimation of Mg (H) and Fe (H).

**Ion Exchange Method**

Separation and estimation of Mg (H) and Zn (H).

**Organic Chemistry**

Laboratory Techniques

**A. Thin layer Chromatography**

Determination of  $R_f$  values and identification of organic compounds.

- (a) Separation of green leaf pigments (spinach leave may be used)
- (b) Preparation and separation of 2, 4-dinitrophenyl hydrazones of acetone, 2-butanone, hexan-2 and 3-one using toluene and light petroleum (40:60)
- (c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).



## **B Paper Chromatography : Ascending & Circular.**

Determination of  $R_f$  values and identification of organic compounds.

- (a) Separation of mixture of phenylalanine and glycine. Alanine and aspartic acid, Leucine and glutamic acid, Spray reagent-ninhydrin.
- (b) Separation of mixture of D, L-alanine, glycine, and L-Leucine using n-butanol : acetic acid : water (4:1:5), Spray reagent-ninhydrin.
- (c) Separation of monosaccharides- a mixture of D-galactose and d-fructose using n-butanol : acetone : water (4:5:1), Spray reagent-aniline hydrogen phthalate.

### **Qualitative Analysis**

Identification of an organic compound through the functional group analysis, determination of M.Pt. and preparation of derivatives. (Aliphatic and Aromatic)

## **Physical Chemistry**

### **Transition Temperature**

Determination of the transition temperature of the given substance by thermometric/dilatometric method (e.g.  $MnCl_2 \cdot 4H_2O/SrBr_2 \cdot 2H_2O$ ).

### **PHASE EQUILIBRIUM**

1. To study the effect of a solute (e.g. NaCl, Succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. Phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
2. To construct the phase diagram of two component system (e.g. diphenylamine-benzophenone) by cooling curve method.

### **THERMO CHEMISTRY**

1. To determine the solubility of benzoic acid at different temperatures and to determine  $\Delta H$  of the dissolution process.
2. To determine the enthalpy of neutralisation of a weak acid / weak base versus strong base / strong acid and determine the enthalpy of ionisation of the weak acid weak base.
3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

### **Reference Book -**

1. Vogel's qualitative Analysis, revised Svehla, Orient Longman.
2. Standard method of chemical analysis, W.W.Scott, the Technical press.
3. Experimental Organic Chemistry, Vol. I & II, P.R.Singh, D.S. Gupta and K.S.Bajpai, Tata McGraw Hill.
4. Laboratory Manual in Organic 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. S----ith and A.R. Tatchel, ELBS.
6. Experiments in General Chemistry C.N.R.Rao & U.C. Agrawal.
7. Experiments in Physical Chemistry R.C. Das & B.Behra, Tata McGraw Hill.
8. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.



5 Hrs.

## PRACTICAL EXAMINATION

M.M. 50

Three Experiments are to be Performed.

1. Inorganic - One experiment from synthesis and analysis by preparing the standard solution be given. 12 marks
- OR One Experiment from instrumentation either by colorimetry / solvent extraction/ion exchange method.
2. (a) Identification of the given organic compound & determine its M.Pt./B.Pt. 6 marks  
(b) Determination of  $R_f$  value and identification of organic compounds by paper chromatography. 6 marks
3. Any one physical experiment that can be completed in two hours including calculations. 12 marks
4. Viva 10 marks
5. Sessional 04 marks

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

-----



## BOTANY

### PAPER - I

#### DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS

M.M. : 50

- UNIT-I.** 1. Characteristics of seed plants ; evolution of the seed habit ; seed plants with (angiosperms) and without (gymnosperms) fruits ; fossil and living seed plants.
2. General features of gymnosperms and their classification ; evolution and diversity of gymnosperms ; geological time scale, fossilization and fossil gymnosperms.
- UNIT-II** 3. Morphology of vegetative and reproductive parts ; anatomy of roots, stem and leaf, reproduction and life cycle of Pinus, Cycas and Ephedra.
- UNIT-III** 4. Angiosperms : origin and evolution, some examples of primitive angiosperms.
- UNIT-IV** 7. Classification of angiosperms ; salient features of the systems proposed by Bentham and Hooker and Engler and Prantl.
8. Major contributions of cytology, phytochemistry and taxometrics to taxonomy.
- UNIT-V** 9. Diversity of flowering plants : General account of the families Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae and Poaceae.

### PAPER - II

#### STRUCTURE DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS

M.M. 50

- UNIT-I.** 1. The basic body plan of a flowering plant : modular type of growth.
2. Diversity in plant form in annuals, biennials and perennials ; convergence of evolution of tree habit in gymnosperms, monocotyledons and dicotyledons ; trees-largest and longest-lived organisms.
- UNIT-II** 3. The shoot system : the shoot apical meristem and its histological organization ; vascularization of primary shoot in monocotyledons and dicotyledons ; formation of internodes, branching pattern ; monopodial and sympodial growth ; canopy architecture ; cambium and its functions ; formation of secondary xylem, a general account of wood structure in relation to conduction of water and minerals ; characteristics of growth rings, sapwood and heart wood ; role of woody skeleton ; secondary phloem - structure-function relationships, periderm.
- UNIT-III** 4. Leaf : origin, development, arrangement and diversity in size and shape ; internal structure in relation to photosynthesis and water loss ; adaptations to water stress ; senescence and abscission.
5. The root system : the root apical meristem ; differentiation of primary and secondary tissues and their roles ; structural modification for storage, respiration, reproduction and for interaction with microbes.
- UNIT-IV** 6. Flower : a modified shoot ; structure, development and varieties of flower, functions, structure of anther and pistil, the male and female gametophytes ; types of pollination ; attractions and rewards for pollinators ; pollen-pistil inter-



action, self incompatibility, double fertilization, formation of seed-endosperm and embryo ; fruit development and maturation.

- UNIT-V**
7. Significance of seed : suspended animation ; ecological adaptation ; unit of genetic recombination and replenishment, dispersal strategies.
  8. Vegetative reproduction : vegetative propagation, grafting, economic aspects.

### PRACTICAL SCHEME

Time : 4 Hrs.

M.M. : 50

1. Plant Description	08
2. Gymnosperm	07
3. Anatomy	07
4. Embryology	04
5. Spotting (1-5 Spots)	10
6. Field Report (Local Flora : Rainy/Winter/Summer Season)	04
7. Viva-Voce	05
8. Sessional	05

Total Marks : 50

### BOTANY (PRACTICAL) SUGGESTED LABORATORY EXERCISES

#### ANGIOSPERMS

The following species are suitable for study. This list is only indicative. Teachers may select plants available in their locality.

1. Ranunculaceae : Ranunculus, Delphinium
2. Brassicaceae : Brassica, Alyssum, Iberis, Coronopus
3. Malvaceae : Hibiscus, Abutilon
4. Rutaceae : Murraya, Citrus
5. Fabaceae : Faboideae : Lathyrus, Cajanus, Melilotus, Trigonella, Caesalpinioideae : Cassia, Caesalpinia ; Mimosoideae : Prosopis, Mimosa, Acacia.
6. Apiaceae : Coriandrum, Foeniculum, Anethum
7. Acanthaceae : Adhatoda, Peristrophe
8. Apocynaceae : Vinca, Thevetia, Nerium
9. Asclepiadaceae : Calotropis
10. Solanaceae : Solanum, Withania, Datura
11. Euphorbiaceae : Euphorbia, Phyllanthus
12. Lamiaceae : Ocimum, Salvia
13. Chenopodiaceae : Chenopodium, Beta
14. Liliaceae : Asphodelus, Asparagus
15. Poaceae : Avena, Triticum, Hordeum, Poa, Sorghum

#### GYMNOSPERMS

#### CYCAS

- i. Habit, armour of leaf bases on the stem (if specimen is not available show photograph), very young leaf (circinate vernation) and old foliage leaves, scale leaf, bulbils, male cone (specimen), microsporophyll, megasporophyll, mature seed.
- ii. Study through permanent slides - normal root (T.S.), stem (T.S.) (if sections are not



available show photographs), ovule (L.S.).

- iii. Study through hand sections or dissections - coralloid root (T.S.), rachis (T.S.), leaflet (V.S.), microsporophyll (V.S.), pollen grains (W.M.).

### **PINUS**

- i. Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cone, 1<sup>st</sup> year, 2<sup>nd</sup> year female cones, winged seed.
- ii. Study through permanent slides - root (T.S.), female cone (L.S.), ovule (L.S.), embryo (W.M.) showing polycotyledonous condition.  
Study through hand sections or dissections - young stem (T.S.), old stem (wood) (T.L.S. and R.L.S.), needle (T.S.), male cone (L.S.), male cone (T.S.), pollen grains (W.M.).

### **EPHEDRA**

- i. Habit and structure of whole male and female cones.
- ii. Permanent slides - female cone (L.S.)
- iii. Hand sections/dissections - node (L.S.), internode (T.S.), macerated stem to see vessel structure, epidermal peel mount of vegetative parts to study stomata, male-cone (T.S. and L.S.), pollen grains.

### **SUGGESTED LABORATORY EXERCISES :**

Embryology, Anatomy and Vegetative Propagation etc.

1. Study of commonly occurring dicotyledonous plant (for example *Solanum nigrum* or *Kalanchoe*) to understand the body plan and modular type of growth.
2. Life forms exhibited by flowering plants (by a visit to a forest or a garden), study of tree like habit in cycads, bamboos, banana, traveller's tree (*Ravenala madagascariensis*) or yucca and comparison with true trees as exemplified by conifers and dicotyledons.
3. L.S. shoot tip to study the cytohistological zonation and origin of leaf primordia.
4. Monopodial and Sympodial types of branching in stems (especially rhizomes).
5. Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides), structure of secondary phloem and xylem, Growth rings in wood, Microscopic study of wood in T.S., T.L.S. and R.L.S.
6. Field study of diversity in leaf shape, size, thickness, surface properties, internal structure of leaf, structure and development of stomata (using epidermal peels of leaf).
7. Anatomy of the root, Primary and secondary structure.
8. Examination of a wide range of flowers available in the locality and methods of their pollination.
9. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts), pollen viability using in vitro pollen germination.
10. Structure of ovule and embryo sac development (using serial sections)
11. Test of self-incompatibility (using *Petunia axillaris*, *Brassica campestris*, *B. oleracea* or suitable available material) using field pollinations.
12. Nuclear and cellular endosperm, embryo development in monocots and dicots (using slides/dissections).
13. Simple experiments to show vegetative propagation (leaf cuttings in *Bryophyllum*, *Sansevieria*, *Begonia*, stem cuttings in rose, salix, money plant, sugarcane and *Bougainvillea*).
14. Germination of non-dormant and dormant seeds.



**ZOOLOGY**  
**PAPER - I**  
**ANATOMY & PHYSIOLOGY**

M.M. : 50

- UNIT-I** Comparative Anatomy of various organ systems of vertebrates.
1. Integument and its derivatives : structure of scales, hair and feathers.
  2. Alimentary canal and digestive glands in vertebrates.
  3. Respiratory Organs  
Gills and lung, Air-Sae in birds
- UNIT-II**
1. Endoskeleton-Limbs, girdles and vertebrae.
  2. Circulatory System - Evolution of heart and aortic arches.
  3. Urinogenital System - Kidney and excretory ducts.
- UNIT-III**
1. Nervous System - General plan of brain and spinal cord.
  2. Endocrine glands - classification and histology.
  3. Gonads and genital ducts.
- UNIT-IV**
1. Digestion and absorption of dietary components.
  2. Physiology of heart, Cardiac cycle and ECG.
  3. Blood Coagulation.
  4. Respiration-Mechanism and control of breathing.
- UNIT-V**
1. Excretion-Physiology of excretion, Osmoregulation.
  2. Physiology of Muscle contraction.
  3. Physiology of nerve impulse, Synaptic transmission.
  4. Ear and Eye - structure and function.

**LIST OF RECOMMENDED BOOKS :**

1. Conn, Stumpy RK, Bruening and D.C. : Outlines of Biochemistry.
2. Gaviong : Review of Medical Physiology.
3. Eckest, R. : Animal Physiology (W.H. Freeman)
4. Hildbrand : Analysis of Vertebrate structure
5. Kingsley : Outlines of Comparative Anatomy (Central Book Depot)
6. Rouer & Parsons : The Vertebrate Body, (Saunders)
7. Walta & Gyles : Biology of the Vertebrates (Macmillan)

**PAPER - II**

**VERTEBRATE ENDOCRINOLOGY, REPRODUCTIVE BIOLOGY BEHAVIOUR,  
EVOLUTION AND APPLIED ZOOLOGY**

- UNIT-I**
1. General Characters of Hormones.
  2. Hormone Receptor
  3. Biosynthesis and secretion of thyroid, Adrenal ; Ovarian and testicular hormones.
  4. Endocrine disorder due to hormones and other gland.
- UNIT-II**
1. Reproductive cycle in vertebrate.
  2. Menstruation, Lactation and pregnancy.
  3. Mechanism of parturition.
  4. Hormonal regulation of gametogenesis.
  5. Extra embryonic membrane.



- ✓
- UNIT-III**
1. Evidences of organic evolution.
  2. Theories of organic evolution.
  3. Variation, Mutation, Isolation and Natural selection.
  4. Evolution of Horse.
- UNIT-IV**
1. Introduction to Ethology.
  2. Patterns of Behaviour Taxes, Reflexes, Drives and Stereotyped Behaviour.
  3. Reproductive Behavioural Patterns.
  4. Hormones, Drugs and Behaviour.
- UNIT-V**
1. Aquaculture
  2. Sericultural
  3. Apiculture
  4. Pisciculture
  5. Poultry keeping
  6. Elements of Pest Control -
    1. Chemical control
    2. Biological Control

### PRACTICAL WORK

The practical work in general shall be based on the syllabus prescribed in theory. The students will be required to show the knowledge of the following.

1. Study of the representative examples of the different chordates (Classification and character)
2. Dissection of various systems of scoliodon-Afferent and Efferent branchial vessels, cranial nerves, internal ear.
3. Simple microscopic technique through unstained or stained permanent mounts.
4. Study of prepared slides histological, as per theory papers.
5. Study of limb girdles and vertebrae of frog, varanus, fowl and Rabbit.
6. Identification of species and individuals of honey bee.
7. Life cycle of honey bee and silkworm.

### PRACTICAL WORK - DISTRIBUTION OF MARKS

1.	Major dissection (Cranial nerves/Efferent branchial vessel)	12
2.	Minor dissection (Afferent branchial/Internal ear)	08
3.	Permanent mount	09
4.	Spotting-8 (Slides-4, bones-2, specimens-2)	16
5.	Viva	05
6.	Sessional marks	Total : 50