

B. Sc. Part-I

CHEMISTRY

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 M.M. 33

(paper code - 0795)

UNIT-1 A. ATOMIC STRUCTURE

Idea of de-Broglie matter-waves, Heisenberg Uncertainty principle, Schrodinger wave equation, significance of Ψ and Ψ^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 NH_3 , H_3O^+ , SF_4 , ClF_3 , Cl_2 and H_2O I - . 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, Wley
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 σ and π 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 KMnO_4 .

UNIT-5 ARENES AND AROMATICITY

A. Alkyl halides and Aryl Halides

Mechanism and stereochemistry of nucleophilic substitution reactions and alkylhalides and aryl halides with energy profile diagrams. SN_1 , SN_2 , 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, Wiley Eastern (New-Age).
5. Organic Chemistry, F.A. Carey, MC Graw Hill
6. Introduction to Organic Chemistry, Struwiweisser, 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. Carbanic Rasayan, Bhagchandani, Sahitya Bhawan Publication.
15. Rasayan Vigyan, Bhatnagar, Arun Prakashan.

PAPER - III
PHYSICAL CHEMISTRY
(paper code - 0797)

M.M.34

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, Liquefaction 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 & Palhanian, 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+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Ni^{2+} , Co^{2+} , Zn^{2+} , Mn^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+} , NH_4^+ , and Anions CO_3^{2-} , SO_4^{2-} , S^{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

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

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

iii. Determination of boiling points Ethanol = 78°, Cyclohexane 81.4°, Toluene 110.6°, Benzene 80°.

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 H₂SO₄ by studying the kinetics of hydrolysis of ethyl acetate To study kinetically the reaction between H₂O₂ & Iodide

(ii) Distribution Law

To study distribution of iodide between water & CCl₄ 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 % composition of a given mixture (Non interacting system) by viscosity method. To determine the viscosity of amyI alcohol in water at different 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. Vogel's qualitative analysis, revised Vogel, Orient Longman
2. Standard 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 inorganic 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. Tatchell, 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.

**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
(Paper Code - 0845)**

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-floury, solvent system and Lewis concepts of acids and bases.

N. NON-AQUEOUS SOLVENTS

06 HRS.

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.

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. Ucchattar Akarbanic Rasayan, Satya Prakash & G.D. Tuli, Shyamlal Prakashan
14. Ucchattar Akarbanic Rasayan, Puri & Sharma.
15. Selected topic in Inorganic Chemistry by Madan Malik, & Tuli, S. Chand.

PAPER - II
ORGANIC CHEMISTRY
 (Paper Code - 0846)

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 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 carbonyl group. Synthesis of aldehydes and ketones using 1,3 - dithianes, synthesis of ketones from nitriles. Mechanism of nucleophilic additions to carbonyl 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, LiAlH_4 and NaBH_4 reduction. Halogenation of enolizable ketones. An introduction to α, β unsaturated aldehydes and ketones.

UNIT-III A. CARBOXYLIC ACIDS

05 HRS.

Structure and bonding, Physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Hell-Volhard Zeilinsky 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 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, Struieweisser, 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

PHYSICAL CHEMISTRY
(Paper Code - 0847)

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. Elirchhoff'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, suplhur 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, trimethylaminewater 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- Onsagar (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 G , ΔH and ΔS 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 asolute (e.g. NaCl, Succinic acid) on the critical solution temperature of two partially miscible liquide (e.g. Phenol-water system and to determine the concentration of that solute in the fiven phenol-water system.
2. To construct the phose diagram of two component system (e.g. diphenylaminebenzophenone) by cooling curve method.

THERMO CHEMISTRY

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH 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 solld calclum chloride and calculate the lattice energy of calcoium ohiofide from ite enthaply data using Born Haber cycle.

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, TataMcGraw 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,
6. Rogers, P.W.G. Smith and A.R. Tatchel, ELBS.
7. Experiments in General Chemistry C.N.R.Rao & U.C. Agrawal.
8. Experiments in Physical Chemistry R.C. Das & B.Behra, Tata McGraw Hill.
9. 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**
2. 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 mark will be added to each of the experiments.

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 (Paper Code-0895)

INORGANIC CHEMISTRY

M.M. 33

UNIT-I METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES

Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters. Thermodynamic and kinetic aspects of metal complexes. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

UNIT-II MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Electronic spectra of Transition Metal Complexes. Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for d_1 and d_2 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

UNIT-III ORGANOMETALLIC CHEMISTRY

Definition, nomenclature and classification of organo metallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn, & Ti, A brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and nature of bonding in metal carbonyls.

UNIT-IV BIOINORGANIC CHEMISTRY

Essential and trace elements in biological processes, metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{2+} , nitrogen fixation.

UNIT-V HARD AND SOFT ACIDS AND BASES (HSAB)

07 HRS.

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acidbase strength and hardness and softness. Symbiosis Silicones and Phosphazenes Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

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. McDaniel and J. Alexander, John Wiley
4. Inorganic Chemistry, D.E. Shriver, P.W. Attkins 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, Satyas Prakash.
9. Advanced Inorganic Chemistry, Agarwal & Agarwal.
10. Advanced Inorganic Chemistry, Puri & Sharma, S. Naginchand
11. Inorganic Chemistry, Madan, S. Chand & Co.
12. Adhunik Akarbanic Rasayan, A.K. Shrivastav & P.C. Jain, Goel Pub.
13. Ucchattar Akarbanic Rasayan, Satya Prakash & G.D. Tuli, Shyam Lal Prakashan
14. Ucchattar Akarbanic Rasayan, Puri & Sharma.

PAPER - II (Paper Code-0896)

UNIT-I A. ORGANOMETALLIC COMPOUNDS

Organomegnesium compounds : Grignard reagents-formation, structure and chemical reactions. Organozinc compounds : formation and chemical reactions. Organolithium compounds : formation and chemical reactions.

B. Organosulphur Compounds

Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

Organic Synthesis via Enolates

Active methylene group alkylation of diethylmalonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate : the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

UNIT-II BIOMOLECULES**A. Carbohydrates :**

Configuration of monosaccharides, threo and erythro diastereomers. Formation of glycosides ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+) glucose. Structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

B. Proteins and Nucleic acids

Classification and structure of protein levels of protein structure, protein denaturation / renaturation, Constituents of amino acids. Ribonucleosides and ribonucleotides, double helical structure of DNA.

UNIT-III A. Synthetic Polymers

Addition or chain growth polymerization. Free radical vinyl polymerization, Ziegler-Natta polymerization, Condensation or Step growth polymerization, Polyesters, polyamides, phenols-formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes, natural and synthetic rubbers.

B. Synthetic Dyes

Colour and constitution (Electronic Concept). Classification of Dyes. Chemistry of dyes. Chemistry and synthesis of Methyl Orange, Congo Red, Malachite Green, Crystal Violet, Phenolphthalein, fluorescein, Alizarine and Indigo.

UNIT-IV SPECTROSCOPY

A. Mass Spectroscopy : mass spectrum fragmentation of functional groups.

B. InfraRed Spectroscopy : IR absorption Band their position and intensity, Identification of IR spectra.

C. UV-Visible Spectroscopy : Beer Lambert's law, effect of Conjugation λ_{max} Visible spectrum and colour.

D. Anthocyanin as natural colouring matter (Introduction only)

E. Application of Mass, IR, UV-Visible Spectroscopy to organic molecules.

UNIT-V A. NMR Spectroscopy : Introduction to NMR. Shielding and Number of signal in PMR, Chemical shift and characteristic values, splitting of signals and Coupling constant. Application to organic molecules.

B. ^{13}C NMR Spectroscopy : Principal & Application.

C. Magnetic Resonance Imaging (MRI) - Introductory idea.

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, Streiweisser, 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 (Paper Code-0897)
PHYSICAL CHEMISTRY

M.M. 34

UNIT-I QUANTUM MECHANICS

Black body radiation, Plank's radiation law, photoelectric effect, Compton effect. DeBroglie's idea of matter waves, experimental verification Heisenberg's uncertainty principle, Sinoidal wave equation, Operators : Hamiltonian operator, angular momentum operator, laplacian operators postulate of quantum mechanics Eigen values, Eigen function. Schrodinger time independed wave equation physical significance of Ψ and Ψ_2 . Applications of schrodinger wave equation : particle in one dimensional box Hydrogenation (separation into three equation's) radial wave function and angular wave function.

UNIT-II QUANTUM MECHANICS-II

Quantum mechanical approach of molecular orbit theory; basic idea criteria for forming M.O and A.O, LCAO approximation, formation of H_2^+ ion, calculation of energy levels from wave functions bonding and antibonding wave functions concept of σ, σ^*, π and π^* orbitals and their characteristics, Hybrid orbital : SP, SP_2, SP_3 , Calculation of coefficients A_s used in these hybrid orbitals. Introduction to valence bond model of H_2 , Comparison of M.O. and V.B. model, Huckle theory, application of huckel theory to ethane propene etc.

UNIT-III SPECTROSCOPY-I

A. Introduction, characterization of electromagenetic radiation, regions of the spectrum, representation of spectra width and intensity of spectral transition, rotational spectra of calculated diatomic molecules, energy level of rigid rotator, selection rule, determination of bond length qualitative description of non - rigid rotator isotopic effect.
B. Vibrational spectra - Fundamental vibrational and their symmetry, vibrating diatomic molecules, enegy levels of simple harmonic oscillator. Selection Rule, Pure vibrational Spectrum, determination of force constant, diatomic vibrating operator. Anhormonic Oscillator.
C. Raman Spectra : Concept of polarizability, quantum theory of Raman spectra stokes and anti stokes lines pure rotational and vibrational Raman spectra, Application of Raman spectra stokes and anti stokes lines, pure rotational and vibrational Raman apectra, Applications of Raman spectra.

UNIT-IV SPECTROSCOPY-II

A. Electronic Spectra : Electronic Spectra of diatomic molecule, Frank London principle, types of electronic transitions. Applications of electronic spectra.
B. Photo-chemistry : Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry. Grothus-Drapper law, Stark-Elinstein law, Jablonski diagram depicting various process occurring in the excited state, qualitative description of fluorescence, occurring in the excited state, qualitative descripton of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield photosensitized reactions energy transfer processes (simple examples).

UNIT-V A. Thermodynamics

Energy referred to absolute zero, third law of thermodynamics Test of III law of thermodynamics Nerst heat theorem application and limitation of Nerst heat theorem.

B. Physical properties and molecular structure : polarization of molecules, (Classius-Mosotti equation. orientation of dipoles in an electric field. Dipol moment, induced dipole moment, measurement of dipole moment. Temperature methods and refractivity methods. Dipole moment and molecular structure.

C. Magnetic Properties : Paramagnetism diamagnetism, ferromagnetism. Determination of magnetic susceptibility, elucidation of molecular structure.

REFERENCE BOOKS :

1. Physical Chemistry, G.M. Barrow, International student edition, McGraw Hill
2. Basic programming with application, V.K. Jain, Tata McGraw-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 & S. Dogra, Wiley Eastern
8. Physical Chemistry, B.D. Khosla
9. Physical Chemistry, Puri & Sharma
10. Bhoutic Rasayan, Puri & Sharma
11. Bhoutic Rasayan, P.L. Soni
12. Bhoutic Rasayan, Bahl & Tuli

PAPER-IV LABORATORY COURSE

180 Hrs.

Inorganic Chemistry

Synthesis Analysis

- (a) Preparation of Sodium trioxalato ferrate (III), $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$ and determination of its composition by permanganometry.
- (b) Preparation of Ni-DMG complex, $[\text{Ni}(\text{DMG})_2]$
- (c) Preparation of copper tetraammine complex, $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$.
- (d) Preparation of cis-and trans-bioxalato diaqua chromate (III) ion.

Gravimetric Analysis

Analysis of Cu as CuSCN or CuO , Ni as $\text{Ni}(\text{DMG})_2$, Ba as BaSO_4 and Fe as Fe_2O_3

Organic Chemistry

Laboratory Techniques

A Steam Distillation

Napthalene from its suspension in water
Clove oil from cloves Separation of
ortho and para-nitrophenols.

B Column Chromatography

Separation of fluorescein and methylene blue
Separation of leaf pigments from spinach leaves
Resolution of racemic mixture of (+,-) mandelic acid.

Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, NaHCO_3 , NaOH for separation and preparation of suitable derivatives.

Synthesis of Organic Compounds

- (a) Acetylation of salicylic acid, aniline, glucose and hydroquinone. Benzoylation of aniline and phenol.
- (b) Aliphatic electrophilic substitution- Preparation of iodoform from ethanol and acetone.
- (c) Aromatic electrophilic substitution-Nitration-Preparation of m-

- dinitrobenzene, p-nitroacetanilide Halogenation- Preparation of p-bromoacetanilide, 2,4,6 tribromophenol
- (d) Diazotization/Coupling- Preparation of methyl orange and methyl red
- (e) Oxidation- Preparation of benzoic acid from toluene
- (f) Reduction- Preparation of aniline from nitrobenzene, m-nitroaniline from m-dinitrobenzene.

Physical Chemistry

Electrochemistry

- (a) To determine strength of given acid conductometrically using standard alkali solution.
- (b) To determine solubility and solubility product of a sparingly soluble electrolyte conductometrically.
- (c) To study saponification of ethyl acetate conductometrically.
- (d) Determine the ionization constant of a weak acid conductometrically.
- (e) To titrate potentiometrically the given ferrous ammonium sulphate using KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ as titrant and calculate the redox potential $\text{Fe}^{2+}/\text{Fe}^{3+}$ system on the hydrogen scale.

Refractometry and Polarimetry

- (a) To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's

refractometer.

- (b) To determine the specific rotation of a given optically active compound.

Molecular Weight Determination

- (a) Determination of molecular weight of a non-volatile solute by Rast method/Beckmann freezing point method.
- (b) Determination of the apparent degree of dissociation of an electrolyte (e.g., NaCl) in aqueous solution at different concentrations by ebullioscopy.

Colorimetry

To verify Beer-Lambert law for KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given solution of the substance.

REFERENCE BOOKS :

1. Vogel's qualitative Analysis, revised, Svehla, Orient Longman
2. Standard methods 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. Smith 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 & Behra, Tata McGraw Hill
8. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.

8 Hrs.

PRACTICAL EXAMINATION

M.M. 50.

Five experiments are to be performed.

1. Inorganic - Two experiments to be performed.
Gravimetric estimation compulsory carrying 08 marks. (Manipulation 3 marks).
Anyone experiment from synthesis and analysis carrying 04 marks.
2. Organic-Two experiments to be performed.
Qualitative analysis of organic mixture containing two solid components.
compulsory carrying 08 marks (03 marks for each compound and two marks for separation). One experiment from synthesis of organic compound (Single step) carrying 04 marks
3. Physical-One physical experiment carrying 12 marks.
4. Sessional 04 marks.
5. Viva Voce 10 marks.

In case of Ex-Students one mark each will be added to Gravimetric analysis and Qualitative analysis of organic mixture and two marks in Physical experiment.

Head
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