MARWARI COLLEGE, RANCHI

(AN AUTONOMOUS UNIT OF RANCHI UNIVERSITY FROM 2009)

DEPARTMENT OF CHEMISTRY

COURSES OF STUDY FOR CHEMISTRY HONOURS

Number of Papers: 20

(14 Theory papers & 06 Practical Papers)

Full Marks: 1600

Theory: 1200, Practical: 400

Number of Semesters: 6

B. Sc. Hons. Part - I: 400 Marks

(Theory: 300, Practical: 100)

B. Sc. Hons. Part - II: 400 Marks

(Theory: 300, Practical: 100)

B. Sc. Hons. Part - III: 800 Marks

(Theory: 600, Practical: 200)

DISTRIBUTIONS OF MARKS IN CHEMISTRY HONS.											
ACADEMIC YEAR	SEMESTER	THEORY PAPER	FULL MARKS			PASS MARKS	DURATION	PRACTICAL PAPER	FULL MARKS	PASS MARKS	DURATION
			MSE	ESE	TOTAL						
FIRST YEAR	I	1	25	50	75	34	2½ HRS.	3	50	23	4 HRS.
		2	25	50	75	34	2½ HRS.				
	II	4	25	50	75	34	2½ HRS.	6	50	23	4 HRS.
		5	25	50	75	34	2½ HRS.				

DISTRIBUTIONS OF MARKS IN CHEMISTRY HONS.											
ACADEMIC YEAR	SEMESTER	THEORY PAPER	FULL MARKS			PASS MARKS	DURATION	PRACTICAL PAPER	FULL MARKS	PASS MARKS	DURATION
			MSE	ESE	TOTAL						
SECOND YEAR	III	7	25	50	75	34	2½ HRS.	9	50	23	4 HRS.
		8	25	50	75	34	2½ HRS.				
	IV	10	25	50	75	34	2½ HRS.	12	50	23	4 HRS.
		11	25	50	75	34	2½ HRS.				

DISTRIBUTIONS OF MARKS IN CHEMISTRY HONS.											
ACADEMIC YEAR	SEMESTER	THEORY PAPER	FULL MARKS			PASS MARKS	DURATION	PRACTICAL PAPER	FULL MARKS	PASS MARKS	DURATION
			MSE	ESE	TOTAL						
THIRD YEAR	V	13	30	70	100	45	3 HRS.	16	100	45	6 HRS.
		14	30	70	100	45	3 HRS.				
		15	30	70	100	45	3 HRS.				
	VI	17	30	70	100	45	3 HRS.	20	100	45	6 HRS.
		18	30	70	100	45	3 HRS.				
		19	30	70	100	45	3 HRS.				

CHEMISTRY

B.Sc. Part - I

SEMESTER – I

Paper: 1, Physical & Inorganic (54 lectures)

Full Marks: 25 (MSE) **+ 50 (ESE) = 75Time: 2½ Hrs. Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

Group A : Out of three, any two to be answered, i.e., 2 x 8½ = 17.

Group B : Out of five, any three to be answered, i.e., 3 x 11 = 33.

GROUP - A (PHYSICAL)

1) GASEOUS STATES (12)

Van der Waals equation of state Critical phenomena pv isotherms of real gases, continuity of states the isotherms of van der Waals equation, relationship between critical constants and Van der Waals constant, the law of corresponding states, reduced equation of state, Molecular velocities: root mean square, average and most probable velocities, Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquification of gases (based on Joule-Thomson effect).

2) LIQUID STATE (8)

Intermolecular forces, structure of liquids- a qualitative description Structural differences between solids, liquids and gases, Liquid crystals: difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases, Thermography and seven segment cell. Swang theory.

GROUP – B (INORGANIC)

1) ATOMIC STRUCTURE (10)

Black body radiation, Plank's radiation, Photoelectric effect, Heat capacity of solids, Compton effect, De-broglie hypothesis, Heisenberg's uncertainty principle, Postulates of quantum mechanics, Schrodinger wave equation-time dependent and time independent equations normalization orthogonality. Effective nuclear charge, Significance of ψ and ψ^2, Quantum numbers, Radial and Angular wave functions, probability distribution curves, shapes of s,p, and d,orbitals, Aufbau and Pauli's exclusion principles, Hund's multiplicity rule.

2) PERIODIC PROPERTIES (6)

Atomic and ionic radii, ionization energy, electron affinity and electro negativity definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behavior.

3) CHEMICAL BONDING (10)

Covalent bond-valence bond theory and its limitation directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, Valence shell electron pair repulsion (VSEPR) theory with reference to XeF_2, XeF_4, $XeOF_4$, PO_4^{3-}, ClO_4^- etc. NH_3 H_3O^+, SF_4 CIF_3 and H_2O NH_3 molecules Molecular Orbital (MO) theory- homonuclear and heteronuclear, (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

4) STRUCTURAL ASPECTS OF SOLIDS (8)

Types of solids, properties of Ionic solids, Ionic Solids-Ionic structures, Radius ratio effect and Coordination number, limitation of radius ratio rule, Lattice defects(stoichiometric and non stoichiometric), Semiconductors, Lattice Energy and Born-Haber cycle, Solvation energy and solubility of ionic solids Polarizing power and Polarizbility of ions, Fajan's rule Metallic bond-free electron, valence bond and band theories, Weak interactions-Hydrogen, Van-der Waal's, forces.

Books Recommended:

1. Physical Chemistry ----- E. Glass-Stone.
2. Physical Chemistry ----- P.C. Rokshit.
3. Physical Chemistry ----- Sharma, Puri and Pathania.
4. Physical Chemistry ----- Vol. I --- Pradeep Publication.
5. Advanced Physical Chemistry ----- D.N. Bajpai.
6. Advanced Inorganic Chemistry ----- Cotton & Will Kingson.
7. Concepts in Inorganic Chemistry ----- Madan, Malik and Tuli.

8. Inorganic Chemistry ----- Vol. I – Pradeep Publications.
9. Inorganic Chemistry ----- Sharma, Puri & Kalia.
10. Inorganic Chemistry ----- Vol. I , II & III – Ravi Prasad & Sons.

CHEMISTRY

B.Sc. Part - I

SEMESTER – I

Paper: 2, Physical & Organic (54 lectures)

Full Marks: 25 (MSE) + **50 (ESE) = 75** **Time: 2½ Hrs.** **Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

Group A : Out of three, any two to be answered, i.e., 2 x 8½ = 17.

Group B : Out of five, any three to be answered, i.e., 3 x 11 = 33.

GROUP - A (PHYSICAL)

1) CHEMICAL KINETIC AND CATALYSIS (20)

Chemical Kinetic and its scope, rate of a reaction, factors influencing the rate of a reaction —concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions. Zero order, first order, second order, pseudo order reactions, half life and mean life.

Determination of the order of reactions – differential method, method of integration, methodof half life period and isolation methods of chemical kinetics : conductometric, potentiometric, optical methods, polarimetry and spectrophotometry, Theories of chemical kinetics: effect of temperature on rate of reaction. Arrhenius equation. Concept of activation energy, Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects, Catalysis, miscellaneous examples.

GROUP - B (ORGANIC)

1) STRUCTURE AND BONDING (6)

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonds, Van der Waal's interactins, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bondings.

2) MECHANISM OF ORGANIC REACTIONS (8)

Curved arrow notation drawing electron movements with arrows, half-headed and double-headed arrows, hemolytic and heterolytic bond breaking, Types of reagents, electrophiles and nucleophiles, Types of organic reactions Energy considerations Reactive intermediate-carbocations, carbanions, free radicals, carbenes, arynes and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereo chemical studies).

3) STEREO CHEMISTRY OF ORGANIC COMPOUNDS (8)

Concept of isomerism Types of isomerism, Optical isomerism-elements of symmetry, molecular chirality, enatiomers, stereogenic centre, optical activity, properties of enantiomers, threo and erythro diastereomers, meso compounds, resolution of enantiomer, inversion, retention and racemizatin Relative and absolute configuration, sequence rule D & L and R & S system of nomenclature, geometric isomerism in oximes and alicyclic compound. Conformational isomerism-conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer and flying wedge, formulae, Difference between configuration and conformation.

4) ALKANES AND CYCLOALKANES (12)

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, Classification of carbon atoms in alkanes, Isomerism in alkanes sources, methods of formation of alkanes(with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboylation of carboxylic acids), Physical properties and chemical reactions of alkanes.

Mechanism of free radical halogenation of alkanes orientation reactivity and selectivity, Cycioalkanes—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.

Books Recommended:

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2. Physical Chemistry ----- P.C. Rokshit.
3. Physical Chemistry ----- Sharma, Puri and Pathania.
4. Physical Chemistry ----- Vol. I --- Pradeep Publication.
5. Advanced Physical Chemistry ----- D.N. Bajpai.
6. Advanced organic chemistry ----- S.Chand & Co.
7. Organic Chemistry Vol.-I ----- I.L Finar, ELBS.
8. Organic Chemistry Vol.-II ----- I.L Finar, ELBS.
9. Advanced Concepts in Organic Chemistry ----- Morrison and Boyd—TMH.
10. Organic Reaction Mechanism ----- Peter Syker.
11. Organic reactions ----- O.P. Agrawal & Reageuts.

B.Sc. Part - I
SEMESTER – I
Paper: 3, Practical

Full Marks: 50 **Time: 4 Hrs.** **Pass Marks: 23**

(INORGANIC)

1) **Semimicro qualitative Inorganic Analysis of Salt Mixtures containing THREE Basic Radicals and THREE Acid Radicals, including Interfering Radicals-**

BASIC RADICALS:-

Ag^{+}, Pb^{2+}, Cu^{2+}, Sb^{3+}, Sn^{2+} , Fe^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Co^{3+}, Ni^{2+} , Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+} , Na^{+}, K^{+}, $Mg^{2+}NH^{4+}$.

ACID RADICALS:-

CO_3^{2-}, SO_3^{2-}, SO_4^{2-}, S^{2-}, NO_2^{-}, NO_3^{-}, Cr^{-}, Br^{-}, I^{-}.

INTERFERING RADICALS: - Phosphate, Borate.

(PHYSICAL)

2) **Kinetics:-**

   a) **To determine the specific reaction rate of the hydrolysis of ethylacetate catalysed by H^{+} ion at room temp.**
   b) **Kinetics of Sponification of ester-Titrimetry.**

B.Sc. Part - I
SEMESTER – II
Paper: 4, Physical & Inorganic (54 lectures)

Full Marks: 25 (MSE) + **50 (ESE) = 75** **Time: 2½ Hrs.** **Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

Group A : Out of three, any two to be answered, i.e., 2 x 8½ = 17.

Group B : Out of five, any three to be answered, i.e., 3 x 11 = 33.

GROUP - A (PHYSICAL)

1) **THERMODYNMICS – I** (12)

Definition of thermodynamic terms system, surroundings etc, types of systems, intensive and extensive properties, State and path functions and their differentials, Thermodynamic processes, Concept of heat and work First Law of Thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and constant pressure and their inter relationships Joule's law, Joule-Thomson coefficient and inversion temperature, Calculation of w,q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Thermo chemistry:- standard state, standard enthalpy of formation- Hess's law of constant heat summation and its applications, Heat of reaction at constant apressure and at constant volume Enthalpy of neutralization, Bond dissociation energy and its calculation from thermochemical data, Temperature dependence of enthalpy, Kirchhoff's heat equation.

2) **THERMODYNAMICS – II** (12)

Second law of thermodynamics, need for the law, different statements of the second law. Carnot cycle and its efficiency, Carnot theorem, Thermodynamics scale of temperature, Concept of entropy, entropy as a state function, entropy as a function of volume and temperature, entropy as a function of pressure temperature. Entropy change in Physical processes, Clausius mequality, entropy as a criteria of spontaneity and equilibrium, Entropy change in ideal gases and mixing of gases. Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy, from heat capacity data Gibbs and Helmholtz functions Gibb's function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with pressure, volume and temperature.

GROUP - B (INORGANIC)

1. **ACIDS AND BASES** (6)

Arrhenius theory, Bronsted-Lowry theory, Lux flood and Solvent system concept, Relative strengths of acids and bases.

2. **s-BLOCK ELEMENTS** (6)

Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems an introduction to alkyls and aryls.

3. **p-BLOCK ELEMENTS** (12)
   Hard & Soft Acid Base pair theory, Inert pair effect Compounds like hydrides, oxides, oxyacids and halides of groups 13-16. Hydrides of boron—diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, Silicates(structural principle), Tetrasulphur, tetranitride, basic properties of halogens, interhalogens and polyhalides.

4. **CHEMISTRY OF NOBLE GASES** (6)
   Compounds of noble gases, Chemistry of xenon, structure and bonding in xenon compounds.

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2. Physical Chemistry ----- P.C. Rokshit.
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5. Advanced Physical Chemistry ----- D.N. Bajpai.
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7. Concepts in Inorganic Chemistry ----- Madan, Malik and Tuli.
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9. Inorganic Chemistry ----- Sharma, Puri & Kalia.
10. Inorganic Chemistry ----- Vol. I , II & III – Ravi Prasad & Sons.

B.Sc. Part - I
SEMESTER – II
Paper: 5, Physical & Organic (54 lectures)

Full Marks: 25 (MSE) + **50 (ESE) = 75** **Time: 2½ Hrs.** **Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

Group A : Out of three, any two to be answered, i.e., 2 x 8½ = 17.

Group B : Out of five, any three to be answered, i.e., 3 x 11 = 33.

GROUP - A (PHYSICAL)

1) COLLOIDAL STATE (10)

Definition of colloids, classification of colloids, Solids in liquids (sols): properties-kinetics, optical and electrical, stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general application of colloids.

2) CHEMICAL EQUILIBRIUM (10)

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle.

Reaction isotherm and reaction isochore-Clapeyron equation and Clausius-clapeyron equation, application.

GROUP - B (ORGANIC)

3) ALKENES, CYCLOALKENES, DIENES AND ALKYNES (12)

Nomenclature of alkenes, method of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytezeff rule, Hoffmann elimination, physical properties and relative stabilities of alkenes, Chemical reactions of alkenes- mechanism involved in hydrogenation. Electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reductin. Epoxidation, ozonolysis, hydration, hydroxytation and oxidation with $KMno_4$, Polymerization of alkenes, Substitution at the allylic and vinylic postions of alkenes. Industrial applications of ethylene and propene. Methods of formation, conformation and chemical reactions of cycloalkenes, Nomenclature and classification of dienes: isolated conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formatjion polymerization, Chemical reactions 1:2 and 1:4 additions, Diels-Alder reaction.

Nomenclature, structure and bonding in alkynes, Methods of formation, Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration –oxidation, metal-ammonia reductions, oxidation and polymerization reactions.

4) ARENES AND AROMATICITY (10)

Nomenclature of benzene derivatives, The aryl group, Aromatic nucleus and side chain, Structure of benzene: molecular formula and Kekule structure, Stability and carbon-carbon bond lengths of benzene, resonance structure and molecular picture. Aromaticity : the Huckel rule, aromatics ions. π complexes, Mechanisms of nitration, halogenation,

sulphonation, mercuration and Friedel Crafts reaction, Energy profile diagrams, Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

5) ALKYL AND ARYL HALIDES (12)

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions: Mechanisms of nucleophilic substitution reactions of alkyl halides. S_N^1 and S_N^2 reaction with energy profile diagrams. Poly halogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl. Vinyl and aryl halides. Synthesis and uses of DDT and BHC.

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5. Advanced Physical Chemistry ----- D.N. Bajpai.
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B.Sc. Part - I
SEMESTER – II
Paper: 6, Practical

Full Marks: 50 **Time: 4 Hrs.** **Pass Marks: 23**

(ORGANIC)

1. Determination of melting point of organic compounds.
2. Determination of boiling point of organic compounds.
3. Crystallization of organic compounds using boiling water, ethanol as solvents.
4. Detection of elements- N,S, & halogens.
   Detection of functional groups, phenolic-(OH), carboxylic (-COOH), keto (>C=0). Amino($-NH_2$) amide ($-CONH_2$), nitro ($-NO_2$) groups and carbohydrates.

(PHYSICAL)

1. To determine the heat capacity of calorimeter.
2. To determine the enthalpy of neutralization of a weak acid / weak base versus strong base/ strong acid.
3. Determine the enthalpy of ionization of the weak acid and/weak base.
4. To determine the integral enthalpy of solution of ammonium chloride.
5. Kinetics of reaction between sodium Thiosulphate and hydrochloric acid by initial reate method.
   a) The order of solution in $S_2O_3^{2-}$ ion
   b) The order of reaction in H+ ions at low concentration range.

CHEMISTRY

B.Sc. Part - II

SEMESTER – III

Paper: 7, Physical & Inorganic (54 lectures)

Full Marks: 25 (MSE) **+ 50 (ESE) = 75Time: 2½ Hrs. Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

Group A : Out of three, any two to be answered, i.e., 2 x 8½ = 17.

Group B : Out of five, any three to be answered, i.e., 3 x 11 = 33.

GROUP - A (PHYSICAL)

1. **PHASE EQUILIBRIUM** (20)

Statement and meaning of the terms, phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system –water, Co_2 and Sulphur systems.

Phase equilibria of two component system-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions, compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H_2O) ($FeCl_3$-H_2O and $CuSO_4$-H_2O system. Freezing mixtures, acetone- dry ice Liquid-liquid mixtures- ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes- HCl- H_2O and ethanol-water systems.

Partially miscible liquids-Phenol-water, trimethylamine-water, nicotine-water systems.

Lower and upper sonsolute temperature. Effect of impurity on consolute temperature.

Immiscible liquids, steam distillation.

Nernst distribution law-thermodynamic derivation, applications.

GROUP - B (INORGANIC)

1. **CHEMISTRY OF ELEMENTS OF FIRST TRANSITION SERIES** (12)

Characteristic properties of d-block elements. Physics chemical properties atomic/ionic radii, metallic character, atomic volume, mp, bp, ionization energy, Reduction potential oxidation states, colour, magnetic properties, interstitial compounds, alloy formation, catalytic activity.

Properties of the elements of the first transition series, their binary compounds and complexes illustrating relaive stability of their oxidation states, coordination number and geometry.

2. **CHEMISTRY OF ELEMENTS OF SECOND AND THIRD TRANSITION SERIES**

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

(10)

3. **COORDINATION COMPOUNDS** (12)

Nomenclature of coordination compounds. Including polynuclear complexes

Valence bond theory of transition metal complexes.

THEORIES OF BONDING IN COMPLESES:

- **i.** Werner's theory and its experimental verification.
- **ii.** Effective atomic number concept (Sidgwicks theory) – predication of unpaired electrons.
- **iii.** Valence bond theory of transition metal complexes-inner and outer orbital octahedral complexes and square planar complexes.

ISOMERISM IN COMPLESXES:

- **i.** Structural Isomerism including Ionization, Ligand, Hydrate, coordination, Coordination position, Polymerization & Valence isomerism.
- **ii.** Stereo Isomerism: Geometrical isomerism of four and six coordinate complexes. Optical isomerism in complexes having co-ordination no. four & six.

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10. Inorganic Chemistry ----- Vol. I , II & III – Ravi Prasad & Sons.

B.Sc. Part - II
SEMESTER – III
Paper: 8, Physical & Organic (54 lectures)

Full Marks: 25 (MSE) + **50 (ESE) = 75** **Time: 2½ Hrs.** **Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

Group A : Out of three, any two to be answered, i.e., 2 x 8½ = 17.

Group B : Out of five, any three to be answered, i.e., 3 x 11 = 33.

GROUP - A (PHYSICAL)

1. **PHYSICAL PROPERTIES & MOLECULAR STRUCTURE** (6)
   Parachor, Refractive index & Molecular refractivity, Dipole moment, Magnetic properties and Magnetic susceptibility. Additive & constitutive properties and their uses in elucidation of molecular structure.

2. **PHOTOCHEMISTRY** (6)
   Basic principles, Lambert's law and Beer's law. Molar extinction coefficient and optical density, Photochemical laws-Grothus-Draper law, Startk-Einstein law, Quantum yield, low and high quantum yield.

GROUP - B (ORGANIC)

1. **ALDEHYDES AND KETONES** (12)
   Nomenclature of aldehydes and ketones, structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-dithianes, synthesis of ketones from nitriles and carboxylic acids. Physical properties of aldehydes and ketones.
   Mechanism of nucleophilic additons to carbonyl group with particular emphasis to Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Witting reaction, Mannich reaction.
   Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Vigiller oxidation of ketones, Cannizzaro reaction, Meerwein Pondorf Valerey, Clemmensen, Wolff-Kishner reduction, reductions with $LiAlH_4$ and $NaBh_4$ halogenation of enolizable ketones.
   An introduction to unsaturated aldehydes and ketones.

2. **ALCOHOLS** (10)
   Classification and nomenclature. Monohydric alcohols-methods of formation by reduction of Aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding in alcohols, acidic nature. Reaction of alcohols.
   Dihydirc alcohols- nomenclature, methods of formation chemical reactions of vicinal glycols, oxidative cleavage [with $Pb(OAc)_4$ and HiO_4] and pinacol pinacolone rearrangement. Trihydric alcohols-methods of formation, chemical reactions of glycerol.

3. **PHENOLS** (10)
   Nomenclature, structure and bonding Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement Gatterman synthesis, Hauben-Hoesch reaction, Lederer-manasses reaction and Reimer-Tiemann reaction.

4. **ETHERS AND EPOXIDES** (10)
   Nomenclature of ethers and methods of their formation. Physical properties. Chemical reactions-cleavage and autoxidation. Ziesel's method. Synthesis of epoxides. Acid and base- catalyzed reactions ring opening reactions of epoxides, orientation of epoxidering opening, reactions with Grignard regents and organolithium compounds. Reactions with epoxides.

Books Recommended:

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7. Organic Chemistry Vol.-I ----- I.L Finar, ELBS.
8. Organic Chemistry Vol.-II ----- I.L Finar, ELBS.
9. Advanced Concepts in Organic Chemistry ----- Morrison and Boyd—TMH.
10. Organic Reaction Mechanism ----- Peter Syker.

B.Sc. Part - II
SEMESTER – III
Paper: 9, Practical

Full Marks: 50 **Time: 4 Hrs.** **Pass Marks: 23**

(PHYSICAL)

1. **VISCOSITY & SURFACE TENSION**
   a) To determine the coefficient of viscosity of a given liquid or (non-interacting system) liquid solution.
   b) To determine the surface tension of a given liquid or liquid solution.
2. **PHASE EQUILIBRIUM**
   a) Distribution coefficient of iodine in carbon tetrachloride-water system.
   b) Distribution coefficient of benzoic acid in Toluene-water system.

(INORGANIC)

a) Determination of acetic acid in commercial vinegar using NaOH.
b) Determination of alkali content-antacid tablet using HCL
c) Estimation of hardness of water by EDTA.
d) Estimation of calcium content in chalk as calcium oxalate by Permanganometey.

B.Sc. Part - II
SEMESTER – IV
Paper: 10, Physical & Inorganic (54 lectures)

Full Marks: 25 (MSE) + **50 (ESE) = 75** **Time: 2½ Hrs.** **Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

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GROUP - A (PHYSICAL)

1) **ELECTROCHEMISTRY-I** (18)

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

Application of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

2) **PHOTOCHEMISTRY** (5)

Some photochemical reaction-photolysis of HI, photochemical reactions between H_2 and Br_2 and H_2 and Cl_2, Photosensitization, fate of excite molecules, fluorescence and phosphorescence.

GROUP - B(INORGANIC)

1. **ANALYTICAL CHEMISTRY** (7)

Principles involved in the separation of cations. Application of and Solubility product. Common ion effect. Detection and removal of interfering radicals, Principle involved in the redox titration. Uses of $KMnO_4$, $K2Cr_2O_7$ iodometry and iodimetry.

2. **CHEMISTRY OF LANTHANIDE ELEMENTS** (6)

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

3. **CHEMISTRY OF ACTINIDES** (6)

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

4. **NUCLEAR CHEMISTRY & ISOTOPES** (6)

Nuclear stability, mass defect, packing fraction nuclear binding energy, Nuclear shell model(magic numbers). Half life, Radioactive series and radioactive equilibrium. Detection separation and applications of isotopes.

5. **NON-AQUEOUS SOLVENTS** (6)
   Physical properties of a solvent, types of solvets and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Books Recommended:

1. Physical Chemistry ----- E. Glass-Stone.
2. Physical Chemistry ----- P.C. Rokshit.
3. Physical Chemistry ----- Sharma, Puri and Pathania.
4. Physical Chemistry ----- Vol. II --- Pradeep Publication.
5. Advanced Physical Chemistry ----- D.N. Bajpai.
6. Advanced Inorganic Chemistry ----- Cotton & Will Kingson.
7. Concepts in Inorganic Chemistry ----- Madan, Malik and Tuli.
8. Inorganic Chemistry ----- Vol. II – Pradeep Publications.
9. Inorganic Chemistry ----- Sharma, Puri & Kalia.
10. Inorganic Chemistry ----- Vol. I , II & III – Ravi Prasad & Sons.

B.Sc. Part - II
SEMESTER – IV
Paper: 11, Physical & Organic (54 lectures)

Full Marks: 25 (MSE) + **50 (ESE) = 75** **Time: 2½ Hrs.** **Pass Marks: 34**

Instructions to Paper Setter

Questions will be set in two groups – A & B.

Group A : Out of three, any two to be answered, i.e., 2 x 8½ = 17.

Group B : Out of five, any three to be answered, i.e., 3 x 11 = 33.

GROUP - A (PHYSICAL)

1) ELECTROCHEMISTRY-II (20)

Types of reversible electrodes-gas –metalion, metal-metalion, metalinsoluble salt-salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell e.m.f and single electrode potential, standard hydrogen electrode-reference electrodes-standare electrode potential, sign convention, electrochemical series and its significances. Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of cell and its measurements, Computation of cell EMF calculation of thermodynamic quantitites of cell reaction (DG,Dh and), polarization, over potential and hydrogen over voltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Definition of pH and pKa determination of pH using hydrolysis of salts. Corrosin-types, therories and methods of combating it.

GROUP - B(ORGANIC)

1. CARBOXYLIC ACIDS (8)

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid chlorides, ester and amides. Reduction of carboxylic, acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxy, acids malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids : methods of formation and effect of heat and dehydrating agents.

2. CARBOXYLIC ACID DERIVATIVES (8)

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions, Mechanisms of esterification and hydrolysis (acidic and basic).

3. ORGANIC COMPOUNDS OF NITROGEN (8)

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substiutution in nitroarenes and their reductions in acidic neutral and alkaline media. Picric acid. Halonitroarenes: reactivity Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Swparation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amnes Amine salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aidehydic and ketonic

compounds. Gabriel-phthalimid reaction, Hofmann bromamiae reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

4. **GENERAL INTRODUCTION TO SPECTROSCOPY** (10)
Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Ultraviolet(UV) absorption sepectroscopy-absorption laws (Beer-lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transition, effect of conjugation concept of chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts; UV spectra of conjugatedenes and enones. Infrared (IR) absoroption spectroscopy-molecular vibrations, Hooke's law, selection rules, intensity and postion of IR bands, measurement of IR spectrum, fingerprint region characteristic absorptions of various functional groups and interpretation of IR spectra of Simple organic compounds.

Books Recommended:

1. Physical Chemistry ----- E. Glass-Stone.
2. Physical Chemistry ----- P.C. Rokshit.
3. Physical Chemistry ----- Sharma, Puri and Pathania.
4. Physical Chemistry ----- Vol. II --- Pradeep Publication.
5. Advanced Physical Chemistry ----- D.N. Bajpai.
6. Advanced organic chemistry ----- S.Chand & Co.
7. Organic Chemistry Vol.-I ----- I.L Finar, ELBS.
8. Organic Chemistry Vol.-II ----- I.L Finar, ELBS.
9. Advanced Concepts in Organic Chemistry ----- Morrison and Boyd—TMH.
10. Organic Reaction Mechanism ----- Peter Syker.

B.Sc. Part - II
SEMESTER – IV
Paper: 12, Practical

Full Marks: 50 **Time: 4 Hrs.** **Pass Marks: 23**

(ORGANIC)

1) **A] <u>T.L.C</u>**
   - **a)** Separation of Green leaf pigments (spinach leaves)
   - **b)** Preparation. and separation of 2, 4-dinitrophenyl hydrazone of acetone, 2-butanone using toluene & liquid petroleum (40:60)

   B] <u>PAPER CHROMATOGRAPHY</u>
   - **a)** Separation of a mixture of phenylalanine & glycine. Alanine & aspartic acid. Spray reagent – ninhydrin.
   - **b)** Separation of monosaccharides-a mixture of D-galactose & D-fructose using n-butanol acetone water (4:5:1). Spray reagent-quiline hydrogen phthalate.

2) **QUALITATIVE ANALYSIS**
   Identification of organic compounds.

B.Sc. Part - III
SEMESTER – V
Paper: 13, Inorganic (48 lectures)

Full Marks: 30 (MSE) + **70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions to Paper Setter

Altogether eight questions will be set. Out of eight, any five to be answered, i.e., 5 x 14 = 70.

GROUP - A (INORGANIC)

1) **HARD AND SOFT ACIDS AND BASES (HSAB)** (10)
Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

2) **METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES** (10)
Limitations of valence bond theory, and elementary idea of cystalfield theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

3) **MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES** (10)
Types of magnetic behaviour: Paramagnetism, diamagnetism, ferromagnetism, antiferromagnetism method of determining magnetic, susceptibility Gway & Faraday's method, Curie & Wein's law 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.

4) **SILICONES AND PHOSPHAZENES** (8)
Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

5) **ANALYTICAL CHEMISTRY** (10)
Organic reagents used in Inorganic analysis: DMG, Oxine, cupferron, aluminon, x-nitroso β napthiol o-phenanthroline, EDTA, Theories of Indicators; precipitation, Redox and Absorption indicators.

Books Recommended:

1. Advanced Inorganic Chemistry ----- Cotton & Will Kingson.
2. Concepts in Inorganic Chemistry ----- Madan, Malik and Tuli.
3. Inorganic Chemistry ----- Vol. I , II & III – Pradeep Publications.
4. Inorganic Chemistry ----- Sharma, Puri & Kalia.
5. Inorganic Chemistry ----- Vol. I , II & III – Ravi Prasad & Sons

B.Sc. Part - III
SEMESTER – V
Paper: 14, Organic (54 lectures)

Full Marks: 30 (MSE) + **70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions to Paper Setter
Altogether eight questions will be set. Out of eight,
any five to be answered, i.e., 5 x 14 = 70.

GROUP - A (ORGANIC)

1) ORGANIC SYNTHESIS VIA ENOLATES (10)
Acidity of a-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation Keto-enol tautomerism of ethyl acetoacetate, Alkylation of I, 3-dithianes, alkylation and acylation of enamines.

2) CARBOHYDRATES (10)
Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of alsoses. Configuration of monosaccharides. Drythro and threo diastereomers. Conversion glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)- glucose Mechanism of mutarotaion. Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides(starch and cellulose) without involving structure determination.

3) ORGANIC METALLIC COMPOUNDS (8)
Organomagnesium compounds: the Grignard reagents-formation, structure And chemical reactions.

4) ORGANIC SULPHUR COMPOUNDS (8)
Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

5) FATS, OILS AND DETERGENTS (8)
Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hygdrogenetion of unsaturated oils. Saponification value, iodine value acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

6) Nuclear magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (IHNMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure- spin-spin splitting and coupling constants, areas of signals, Interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1. 1-2 tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques. (10)

Books Recommended:

1. Advanced organic chemistry ----- S.Chand & Co.
2. Organic Chemistry Vol.-I ----- I.L Finar, ELBS.
3. Organic Chemistry Vol.-II ----- I.L Finar, ELBS.
4. Advanced Concepts in Organic Chemistry ----- Morrison and Boyd—TMH.
5. Organic Reaction Mechanism ----- Peter Syker.
6. Organic reactions ----- O.P. Agrawal & Reageuts.

B.Sc. Part - III
SEMESTER – V
Paper: 15, Physical (42 lectures)

Full Marks: 30 (MSE) + **70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions to Paper Setter

Altogether eight questions will be set. Out of eight, any five to be answered, i.e., 5 x 14 = 70.

GROUP - A (PHYSICAL)

1) SPECTROSCOPY (15)

ROTATIONAL SPECTRUM

Diatomic molecules. Energy levels of a rigid rotor(semi-classical principles), selection rules, spectral intensity, distribution using population distribution(Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

VIBRATIONAL SPECTRUM

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, Intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum. Idea of vibrational frequencies of different functional groups.

Raman Spectrum: concept of polarizability, pure rotational and pue vibrational Raman spectra of diatomic molecules, selectopm riles.

2) PHOTOCHEMISTRY (12)

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes(internal conversion, intersystem crossing), quantum yield, photosensitize reactions-energy transfer processes (simple examples).

3) PHYSICAL PROPERTIES AND MOLECULAR STRUCTURE (15)

Optical activity, polarization-(Clausisus-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetism.

Books recommended:

1. Physical Chemistry ----- E. Glass-Stone.
2. Physical Chemistry ----- P.C. Rokshit.
3. Physical Chemistry ----- Sharma, Puri and Pathania.
4. Physical Chemistry ----- Vol. III--- Pradeep Publication.
5. Advanced Physical Chemistry ----- D.N. Bajpai.

B.Sc. Part - III
SEMESTER – V
Paper: 16, Practical

Full Marks: 100 **Time: 5 Hrs.** **Pass Marks: 45**

(INORGANIC)

1) SYNTHESIS ANALYSIS
   a) Prepn. of Ni-DMG complex
   b) Prepn. of $\{Cu(NH_3)_4\}SO_4$
   c) Prepn. of $Na_3[Fe(C_2O_4)_3\}$ & determination of its composition by permaganometry.

2) COLOUMN CHROMATOGRAPHY
   Separation of leaf pigments from spinach leaves.

3) QUALITATIVE ANALYSIS
   Analysis of an organic mixture containing two or three solid components using water, organic solvents, $NaHCO_3$ & NaOH for separation & their identification.

4) a) CST of Phonol water system.
   b) Effect of impurity on CST of Phenol-water system.

PROJECT + SEMINAR

Every student should either complete one project approved by any teacher of the department or should deliver at least one seminar on any suitable topic approved by the department.

B.Sc. Part - III
SEMESTER – VI
Paper: 17, Inorganic (48 lectures)

Full Marks: 30 (MSE) + **70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions to Paper Setter

Altogether eight questions will be set. Out of eight, any five to be answered, i.e., 5 x 14 = 70.

1) **ELECTRONIC SPECTRA OF TRANSITION METAL COMPLEXES** (12)
Types of electronic transition, selection rules for d-d transitions, spectroscopic ground state, spectrochemical series. Orgel energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$. Complexion.

2) **THERMODYNAMIC AND KINETIC ASPECTS OF METAL COMPLEXES** (12)
Stability of complexes: Thermodynamic & kinetic stability. Factors affecting stability. Methods of determination of stability. Labile & Inert complexes. Ligand substitution reactions in octahedral complexes & square alanar complexes.

3) **ORGANOMETALLIC CHEMISTRY** (12)
Definition, nomenclature and classification of organometallic, Compounds. Preparation, properties, bonding and applications of alkyls of Li, Al, Hg, Sn and Ti, a brieg account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

4) **BIOINORGANIC CHEMISTRY** (12)
Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference top Ca^{2+}, Nitrogen fixation.

Books Recommended:

1. Advanced Inorganic Chemistry ----- Cotton & Will Kingson.
2. Concepts in Inorganic Chemistry ----- Madan, Malik and Tuli.
3. Inorganic Chemistry ----- Vol. I , II & III – Pradeep Publications.
4. Inorganic Chemistry ----- Sharma, Puri & Kalia.
5. Inorganic Chemistry ----- Vol. I , II & III – Ravi Prasad & Sons.
6. Molecular Spectroscopy ------ G.N. Banwell -- TMH.
7. Concept of Organic Chemistry ----- William Kemp.
8. Organic Spectroscopy ----- Silverstein

B.Sc. Part - III
SEMESTER – VI
Paper: 18, Organic (48 lectures)

Full Marks: 30 (MSE) + **70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions to Paper Setter

Altogether eight questions will be set. Out of eight, any five to be answered, i.e., 5 x 14 = 70.

GROUP - A (BIO-ORGANIC CHEMISTRY)

1) AMINO ACIDS, PEPTIDES, PROTEINS AND NUCLEIC ACIDS (12)

Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of a –amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation. Nuclec acid: introduction Constituents of nucleic acids. Ribonucleosides and riboonucleotides. The double helical structure of DNA.

2) SYNTHETIC POLYMERS (12)

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization, Polyesters, Polyamides, Phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.

Natural-and synthetic rubbers.

3) HETEROCYCLIC COMPOUNDS (12)

Introduction: molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution.

Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher Indole, quinoline synthesis, skraup synthesis and Baischler-Napieralski synthesis. Mechanism of electrophilic substitution reaction of indole and ssoquinoline.

4) SYNTHETIC DYES (12)

Colour and constitution(electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orang, Congo red, malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.

Books recommended:

1. Advanced organic chemistry ----- S.Chand & Co.
2. Organic Chemistry Vol.-I ----- I.L Finar, ELBS.
3. Organic Chemistry Vol.-II ----- I.L Finar, ELBS.
4. Advanced Concepts in Organic Chemistry ----- Morrison and Boyd—TMH.
5. Organic Reaction Mechanism ----- Peter Syker.

6. Organic reactions ----- O.P. Agrawal & Reageuts.

B.Sc. Part - III
SEMESTER – VI
Paper: 19, Physical (45 lectures)

Full Marks: 30 (MSE) + **70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions to Paper Setter

Altogether eight questions will be set. Out of eight, any five to be answered, i.e., 5 x 14 = 70.

GROUP - A (PHYSICAL CHEMISTRY)

1) ELECTRONIC SPECTRUM (15)

Morsh's potential energy curves for bonding and anti-bonding molecular orbitals, qualitative description of selection rules and Franck condom principle, Qualitative description of bonding, non-bonding and anti-bonding M, O, their levels and the respective transitions. Relationship of potentials energy curves to electronic spectra.

2) SOLUTIONS, DILUTE SOLUTIONS AND COLLIGATIVE PROPETIC (15)

Ideal and non-ideal solution, methods of expressing concentrations of solutions, activity and activity coefficient.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osomosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point.

3) ELEMENTARY QUANTUM MECHANICS (15)

Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions, Molecular orbital theory, basic ideal-criteria for forming M.O from A.O, construction of M.O.'s by $LCAOH^{2+}$ ion, calculation of energy levels from wave functions, physicsl picture of bonding and antibonding wave fucnctions, concept of bonding, non-bonding and ant-bonding molecular orbitals and their characteristics, Hybrid orbitals-sp, sp^2 sp^3, calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2 comparison of M.O. and V.B. models.

Books recommended:

1. Physical Chemistry ----- E. Glass-Stone.
2. Physical Chemistry ----- P.C. Rokshit.
3. Physical Chemistry ----- Sharma, Puri and Pathania.
4. Physical Chemistry ----- Vol. III--- Pradeep Publication.
5. Advanced Physical Chemistry ----- D.N. Bajpai.

B.Sc. Part - III
SEMESTER – VI
Paper: 20, Practical

Full Marks: 100 **Time: 5 Hrs.** **Pass Marks: 45**

(ORGANIC)

1) **SYNTHESIS OF ORGANIC COMPOUNDS:**
   - **a)** Acetyln. of salicyclic Acid & aniline.
   - **b)** Benzoyln. Of aniline phenol
   - **c)** Prepn. of p-nitroacetaniline.
   - **d)** Prepn. of 2,4,6-tribramophenol.
   - **e)** Prepn. of methylorange.
   - **f)** Prepn. of aniline from nitrobenzene.

(PHYSICAL)

2) **ELECTROCHEMISTRY**
   - **a)** To determine the strength of the given acid conducto metrically using standard alkali solutions.
   - **b)** To determine the ionization constant of weak acid conductometrically.
3) **ORGANIC ESTIMATION:**
   - **a)** Determination of –NH2 group by bromination method.
   - **b)** Estimation of Phenol by bromination method.
   - **c)** Estimation of glucose by Benedict's/Fehling solution