Inorganic Chemistry

Scheme of examination: *MM: 23*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Covalent Bond : Valence bond theory and its limitations, directional and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, ICl_2, H_2O.

UNIT – II

Covalent Bond : MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicener bonding in electron deficient molecules bond strength and bond energy, percentage ionic character from dipole moment and electro negativity difference.

UNIT – III

Ionic Solids : Ionic structures, radius ratio effect and coordination number, limitation of radius ration rule, lattice defects, semiconductors, lattice energy and Born haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule.

UNIT – IV

Ionic Solids: Metallic bond free electron, valence bond and band theories.

Weak Interactions: Hydrogen bonding, Wander Walls forces.

UNIT – V

S-Block Element - Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in bisystems, an introduction to alkyls and aryls.

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

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

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

UNIT - II

Alkanes: IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes, Isomerism in alkanes, sources, methods of formation (with special reference of Wurtz reaction, Kolbe reaction, Corey house reaction and decarboxylation of carboxylic acids). Physical properties and chemical reaction of alkanes. Mechanism of free radical halogenations of Alkanes: orientation, reactivity and selectivity.

UNIT - III

Alkenes: Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann

elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration oxidation oxymercuration - reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation. with $KMnO_4$, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

UNIT – IV

Alkynes: Nomenclature, structure and bonding in alkynes. Methods of formation, Chemical reactions of alkynes, acidity of alkynes, mechanism of electrophilic and nucleophilic addition reaction, hydroboration-oxidation, metal-ammonia reduction, oxidation and polymerization.
Dienes: Nomenclature and classification of dienes : isolated, conjugated and cummulated dienes. Structure of allenes and butadiene, methods of formation, polymerization, Chemical reaction-1,2 and 1,4 additions, Diels- Alder reaction.

UNIT – V

Cycloalkanes: Nomenclature, methods of formation. Chemical reactions,Baeyer’s strain theory and its limitations. Ring strain in small rings(Cyclo-propane and Cyclo-butane), Theory of strainless rings. The case of Cyclopropane ring: banana bonds.
Cycloalkenes: Methods of formation, conformation and chemical reactions of Cycloalkenes.

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Mathematical Concepts : Lorgarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of function like kx, ex, xn, sin x and log x; maxima and Minima, partial differential and reciprocity relations, integration of some useful/relevant functions; permutations and combinations, Factorials, Probability.

UNIT - II

Computers : General introduction to computers, different computer of a computer, hardware and software, input-output devices; binary numbers and arithmatic, introduction to computer languages. Programming, operating systems.

UNIT - III

Gaseous States : Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander Waals equation of state.

Critical Phenomena *:* PV isotherms of real gases; continuity of states, the isotherms of Van der Waals equation, relationship between cirtical constants and Vander Waals constants, the law of corresponding states, reduced equation of state.

UNIT - IV

Molecular velocities : Root means square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of

molecular velocities, collision number, means free path and collision diameter. Liquification of gases (based on Joule-Thomson effect).

UNIT - V

Liquid State - Intermolecular forces, structure of liquids (a qualitative description).

Structural differences between solids, liquids an gases.

Liquid crystals : Difference between liquid crystal, solid and liquid. Classification, Structure of nematic and cholestric phases.

Inorganic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Periodicity of p-Block Elements: Periodicity in properties of p-Block Elements with special reference to atomic and ionic radii, ionization energy.

UNIT – II

Periodicity of p-Block Elements: Electron affinity, electronegativity, catenation (including diagonal relationship).

UNIT – III

Some important compounds of p-Block Elements: Hydrides of boron diborane and higher boranes, borazine, borohydrides, fullerenes, carbides

UNIT – IV

Some important compounds of p-Block Elements: Fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

UNIT – V

Chemistry of Noble Gases -Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Stereochemistry of Organic Compounds: Concept of isomerism. Type of isomerism.

Optical Isomerism - Elements of symmetry, molecular chrirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers , chiral and achera molecules with two steropgenic centres diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

UNIT – II

Geometric Isomerism : Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicylic compound.

Conformational isomerism: Conformational analysis of ethane and n-butane, conformation of mon subsituded cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configurational conformation.

UNIT – III

Arenes and Aromaticity : Nomenclature of benzene derivatives. The aryl group, aromatic nucleus and side chain. Structure of benzene: molecular formula ad kekule structure. Stability and carbon-carbon bond

lengths of benzene, resonce structure, MO picture.

Aromaticity: The Huckel huckel rule, aromatic ions.

UNIT – IV

Aromatic electrophilic substituion - general pattern of the mechanism, role of sigma and pi complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagrams. Activating and deactivating substitutents, orientation and orgho/para ratio. Side chain reactions of benzenes derivatives. Birch reduction.

UNIT – V

Alkyl and Aryl Halides: Nomenclature and classes of alkyl halides, methods of formation, chemical reaction. Mechanism of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams.

Polyhalogen compounds : Chloroform, Carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition - elimination and the elimination-addition mechanism of nucleophilic aromatic substitution reactions.

Relatives reactivities of alkyl halides vs allyls, vinyl and aryl halides. Synthesis and uses of DDT and BHC

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Solid State: Definition of space lattice, unit cell. Laws of crystallograph- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCl, and CsCl (Laue's method and powder method).

UNIT – II

Colloidal State - Definition of colloids, classification of colloids. Solids in liquids (sols) : Properties - kinetic, optical and electrical; stability of colloids, protective action. Hardy-Schulze law, Gold number.

Liquids in solids (gels) : Classification, preparation and properties, inhibition, general application of colloids.

UNIT – III

Chemical Kinetics and Catalysis :Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction Concentration dependence of rates, mathematical characteristics of simple chemical reactions - zero order, first order, second order pseudo order, half life and means life. Determination of the order of reaction - differential method, method of integration , method of half life period and isolation method.

UNIT - IV

Radioactive decay as a first order phenomenon. Experimental methods of chemical kinetics : conductomertric, potentiometric, optical methods,

polarimetry and spectrophotometry. Theories of chemical kinetics: effect of temperature on rate of reaction,

UNIT - V

Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model transition state theory (equilibrium hypothesis). Experession for the rate constant based on equilibrium constant and thermodynamic aspects.

Inorganic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

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 and Third Transition Series

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

Unit-III

Coordination Compounds

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

Unit-IV

Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stability in water-Frost, Latimer and Pourbaix diagrams.

Unit-V

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Electromagnetic Spectrum : An introduction

Absorption Spectra-I : Ultraviolet (UV) absorption spectroscopy - absorption laws (Beer Lamber law) molar absorptivity, presentation and analysis o UV spectra, types of electronic transitions, effect of solvent on transitions, effect of conjugation, concept of chromophore and auxochrome Bathochromic, hypsochromic and hyperchromic and hypochromic shifts, UV spectra and conjugated enes and enones.

UNIT – II

Absorption spectra – II:

Infrared IR absorption spectroscopy - molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

UNIT – III

Alcohols: Classification and nomenclature.

Monhydric Alcohols : Methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters, Hydrogen bonding Acidic nature, Reactions of alcohols.

Dihydric Alcohols : Methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol pinacolone

rearrangement.

Trihydric alcohols : Methods of formation, chemicals reactions of glycerol.

Unit-IV

Phenols: Nomenclature, structure and bonding, Preparation of Phenols, Physical properties and acidic character. Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion reactions of phenols electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement. Gatterman synthesis, Hauben-Hoesch reaction, Leader manasse reaction and Reimer Tiemann reaction.

UNIT - V

Ethers and Epoxides: Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions, cleavage and autoxidation, Ziesels' method.

Synthesis of epoxides. Acid and base-catalyed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithim reagents with epoxides.

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Thermodynamics-I: Definition of theromdynamic terms : System, surroundings etc. Types of systems intensive and extensive properties. State and path functions and their differentials. Thermodynamics process, concept of heat and work.

First Law of Thermodynamics : Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law- Joule - Thomson coefficient and inversion temperature, calculation of w, q, dU & dH for the expansion of ideal gases under isothermal nad adiabatic condition for reversible process.

UNIT - II

Thermochemistry: Standard state, standard enthalpy of formation Hess's law of heat summation and its application. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

Unit-III

Chemical Equilibrium: 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, applications.

Phase Equilibrium –I: Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilbria of one component system- water, CO_2 and S systems phase equilibria of two component system - solid - liquid equilibria, simple eutectic Bo - Cd, Pb-Ag systems, desilverisation of lead.

UNIT – IV

Electrochemistry-I: Electrical transport - conduction inmetals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohalrausch law,

Electrochemistry-II: Applications of conductivity measurements : Determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titerations.

UNIT V

Electrochemistry-III: 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.

Inorganic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

VBT of transition metal complexes, formation of octahedral complexes based on VBT, outer orbital and inner orbital complexes, formation of tetrahedral a square planar complexes based VBT, Limitations of VBT.

UNIT II

Acid and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

UNIT III

Lanthanide: Electronic structure, oxidation state and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

UNIT IV

General features and chemistry of actinides, similarities between the later actinides and the later lanthanides super heavy elements.

UNIT V

Principles involved in extraction of elements, chemistry of separation of Np, Pu and Am from U.

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Aldehydes and Ketones: Nomenclature and 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 from carboxylic acids. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Keoevengel condensations, Condensations with ammonia and its derivatives. Witting reaction, Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, clemmensen, Wolf-Kishner, $LiAl_4$ and $NaBH_4$ reductions, Halogenation of enolizable ketones.

UNIT II

Carboxylic Acid – I: Nomenclature, structure and bonding, Physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of Carboxylic acids Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides, reduction of carboxylic acids, Mechanism of decarboyxlation. Methods of formation and chemical reactions of halo acids. Hydroxy acid; malic, tartaric and citric acids.

Methods of formation and chemical reactions of α, β – unsaturated monocarboxylic acid.

Carboxylic acid-II: Dicarboxylic acid: Methods of formation and effect of heat and dehydration agents (Succinic, Glutaric and Adipic acids.).

UNIT III

Carboxylic Acid Derivatives: Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides, Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation f carboxylic acid derivatives, chemical reactions, Mechanisms of esterification and hydrolysis (acidic and basic).

UNIT IV

Organic Compounds of Nitrogen: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkenes, Mechanisms of nucleophilic substitution in nitro arenes and their reductions in acidic, neutral and alkaline media, Picric acid.

UNIT V

Halonitroarenes: Reactivity, structure and nomenclature of amines, physical properties, stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitrides), reductive amination of aldehydeic and ketonic compounds. Gabriel - phthalimide reaction, Hofmann bromide reaction.

Reaction of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Diazotisation mechanism. Synthetic transformation of aryl diazonium salts, azo coupling.

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Thermodynamics-II: Second Law of Thermodynamics: Need for the law, different statement of the law, Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium, Entropy change in ideal gases and mixing of gases.

UNIT II

Thermodynamics-III: Third law of thermodynamics: Nernest heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) Thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P, v and T.

UNIT III

Phase Equilibrium – II: 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 consolute temperature, Effect of impurity on consolute temperature.
Immiscible liquids, steam distillation.
Nernst distribution law-thermodynamic derivation, applications.

UNIT IV

Electrochemistry-IV: Types of reversible electrodes - gas - metal ion, metal -metal ion, metal-insoluble salt-anion and redox electrodes, Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance.
Electrolytic and Galvanic cells - reversible and irreversible cells, conventional representation of electrochemical cells.
EMF of a cell and its measurements, computation of cell EMF.
Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, cover potential and hydrogen overvoltage.

UNIT V

Concentration cell with and witout transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.
Definition of pH and pK_a, determination of pH using hydrogen quinhydrone and glass electrodes, by potentiometric methods.

Inorganic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Hard and Soft Acids and Bases (HSAB) : 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.

Unit-II

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.

UNIT – III

Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermo- dynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

UNIT - IV

Organometallic Chemistry-I: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyl and aryls of Li, Al, Hg, Sn and Ti.

UNIT – V

Bioinorganic Chemistry I: Essential and trace elements to Biological processes, Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}.

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Organometallic and Organosulphur Compounds: Organometallic Compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc Compounds: Formation and chemical reactions. Organolithium compounds: Formation and chemical reactions.

Organosulphur compounds: Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

Unit-II

Heterocylic Compounds-I: 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.

Unit-III

Carbohydrates: Classification and nomenclature monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of

D(+) - structures of glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving strcture determination.

Unit-IV

Amino Acids: Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.

Unit-V

Synthetic Polymers: 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.

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Elementray quantum Mechanics-I: Black-body, radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect.
De Broglie hypothesis Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator.

UNIT - II

Elementary quantum Mechanics-II: 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.

Unit-III

(a)Spectroscopy: Introduction: Electromagnetic radiation, of the spectrum, basic features of different spectrometers, statement of the Born-Openheimer approximation, degrees of freedom.
(b)Electronic Spectrum: Concept of Potential Energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank Condon principle.
Qualitative description of σ, π and n M.O. their energy levels and the respective transitions.

UNIT – IV

Solutions, Dilute Solutions and Colligative Properties-I: Ideal and non-ideal solutions, 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. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Experimental methods for determining osmotic pressure.

UNIT - V

Solutions, Dilute Solutions and Colligative Properties-II: Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weight and elevation of boiling point and depression in freezing point. Experimental methods for determining elevation of boiling point and depression in freezing point. Abnormal molar mass, degree of dissociation and association of solutes.

Inorganic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

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

UNIT II

Electron Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6)]^{3+}$ complex ion.

UNIT III

Organometallic Chemistry-II: A brief account of metal ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

UNIT IV

Bioinorganic Chemistry-II: Metalloporphyrins with special reference to haemoglobin and myoglobin. Nitrogen fixation.

UNIT V

Silicones and Phosphazenes: Silicones and phosphazenes as example of inorganic polymers, nature of bonding in triphosphazenes.

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

NMR Spectroscopy: Nuclear magnetic resonance (NMR) spectroscopy. Proton Magnetic Resonance (H-NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant,
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.

UNIT II

Heterocylic Compounds-II: Introduction to condensed five and six-membered heterocyles. Preparation and reactions of indole, quainoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquionoline.

UNIT III

Organic Synthesis via Enolates: Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate : the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of examines.

UNIT IV

Peptides, Proteins and Nucleic Acids: Structures 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.

Nucleic acids: Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT V

Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates.

Synthetic Dyes: Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange. Congo red. Malachite green. Crystal violet, Phenolphthalein. Fluorescein. Alizarin and Indigo.

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Molecular orbital theory, basic ideas-criteria for forming M.O. from A.O. construction of M.O's by LCAO - H_2^+ ion, calculation of energy levels from wave functions, 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.

UNIT II

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

UNIT III

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 pure vibrational Raman Spectra of diatomic molecules, selection rules.

UNIT IV

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark -Einstein law, Jablosnski diagram depicting various processes occurring in the exited sate, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simplex examples).

UNIT V

Physical Properties and Molecular Structure: Optical activity, polarization - (Calusius-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.

Inorganic Chemistry

Scheme of examination: MM: 52

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Ionic bond: General Characteristic, types of ions, size effects radius ratio and coordination number, Madelung-constant, Born-Haber Cycle Application of lattice energy. Polarizing power polariability, Fajan's Rules, Hydration energy, solubility of ionic compounds, Defects in crystal structures Frankel and Schattky defects, Non-stoichoimetric compounds.

UNIT – II

Solids: Metallic bond: qualitative idea of free electron, valence bond and band theories, semiconductors and insulators, conduction in ionic solids, electrical and magnetic properties of solids, introduction to super conductors and super conductivity.

UNIT – III

Covalent Bond :- General characteristic, valence bond theory and its limitations, Directional characteristics of Covalent bond resonance and resonance energy, Hybridization involving s, p & d orbitals, Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_2O, H_3^+O, SF_6, CLF_3, ICL_2, shapes of simple inorganic molcules and ions. Dipole moment, percentage ionic character from dipole moment and electronegativity difference.

UNIT – IV

Molecular orbital theory: Detailed description of linear combination of atomic orbitals (LCAO), homonuclear (H2, He_2, B_2, C_2, N_2 O_2 F_2) and heteronuclear diatomic molecules (CO, NO) and their ions, comparison of valence bond and molecular orbital theories.

Multicenter bonding in electron deficient molecules, bond strength and bond energy.

Weak interactions: Hydrogen Bond, Theories of hydrogen bonding, valence bond treatment, weak intermolecular forces of attraction. Vander Waal,s forces.

UNIT – V

Chemistry of noble gases: Position in the periodic table, discovery, Isolation, important compounds of noble gases with special reference to xenon compounds; Synthesis, bonding and their stereochemistry.

Organic Chemistry (Paper Code 1017)

Scheme of examination: MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Mechanism of Organic Reactions:- Free Radical and ionic reactions, hemolytic and heterolytic bond breaking. Electrophiles and nucleophiles. Types of organic reactions. Energy considerations, transition states, Reactive intermediates-Carbocations, Carbanions, Free Radicals, Carbenes, arynes and nitrenes, Assigning formal charge on intermediates and other ionic species. Methods of determination of Reaction Mechanism.

UNIT – II

Alkanes and Cycloalkanes :- Nomenclature of branched and unbranched alkanes. Classification of carbon atoms in alkanes. Isomerism in alkanes. Methods of formation (with special reference of Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids) physical properties and chemical reactions of alkanes. Mechanism of free-radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes: Nomenclature, Methods of formation, chemical reactions. Baeyer's strain theory and its limitations. Ring strain in small rings (cyclo-propane and cyclo-butane). Theory of strainless rings. The case of cyclopropane rings : banana bonds.

UNIT – III

Alkeanes and Cycloalkenes :- Nomenclature of alkenes, Methods of formation, Mechanism of dehydration of alcohols and dehydrobalogenation of alkyl halides, Regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, Physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoffs rule, hydroboration-oxidation. Oxymercuration reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMno_4$, polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethane and propene.

Cycloalkens:- Methods of formation, conformations and chemical reactions.

UNIT – IV

Dienes and Alkynes:- Dienes:- Nomenclature and classification, Isolated, conjugated and cumulated dienes, structure of allenes and butadienes, methods of formation, polymerization, chemical reactions-1,2 and 1,4 additions. Diels – Alder reaction

Alkynes:- Nomenclature, structure and bonding, Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reduction, oxidation and polymerization.

UNIT – V

Electromagnetic spectra :-Absorpation spectra: Ultraviolet (UV) absorption Spectroscopy: Absorption laws (Bear-Lambert law), Molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and

hypochromic shifts. Absorption bands of simple molecules like alkenes, conjugated dienes, carbonyl compounds, enones, acids & aromatic compounds.

Physical Chemistry

Scheme of examination: MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Ideal gases:- Concept of molar mass and molar volume. Determination of molar mass of gas and volatile substances. The barometric distribution law Maxwell distribution law of molecular velocities. The Maxwell energy distribution law and its experimental verification.

UNIT – II

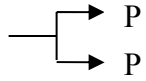
Real gases:- Causes of deviation from ideal gas behavior. Vander walls equation and its implications. Isotherms of Vander wall gas. Critical phenomena and critical constants. Reduced equations of state and the law of corresponding states.

UNIT – III

Chemical Dynamics:- Rate, initial rate, specific rate, rate constant and units. Methods of Determination of initial rate, Order, molecularity and tachometry of the reactions. Methods of Determination of order of a reaction. Derivation of integrated rate equations Zero order, First order, Second order, Third order. Graphical applications of these equations for the determination of rate constant. Effect of temperature on the rate constant, Arrhenius equations, Energy of activation and its Determination.

UNIT – IV

Complex reactions and their nature: How do these reactions differ from simple reactions. Derivations of rate equation for opposing

reactions. (A↔B→C), Parallel reactions A  (P's are products) and consecutive reactions (A→B→C) Characteristics of consecutive reactions.

UNIT – V

Solutions:- Solutions of gases in liquids. Henry's law and its applications to respiration. Solutions of solids in liquids and distribution law. Distribution law and extraction processes.

Osmosis, Osmotic pressure. Determination of osmotic pressure. Lowering of vapuor pressure relative. Lowering of vapour pressure and Raoult's Depression in freezing point and elevation in boiling point. Vont's Hoff factor and its implications.

Analytical Chemistry

Scheme of examination: MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Principle of Gravimetric analysis, precipitation methods, saturation and ppt. formation, the purity of the ppt, coprecipitation, post precipitation.

UNIT – II

Conditions of precipitation, precipitation from homogeneous solution, washing of the ppt. Ignition of the ppt, masking and demasking agents.

UNIT – III

Solvent extraction; principles and process of solvent extraction, the distribution law and the partition coefficient. Liquid- liquid extraction, factors favouring solvent extraction, choice of solvent for solvent extraction, stripping, solid - liquid extraction, organic reagents used in solvent extraction.

UNIT – IV

Organic reagents in quantitative inorganic analysis; application of the following organic reagents-DMG, cupferron, 8-hydroxquinoline, cupron, salicylaldehyde, oxim, 1-nitronapthol, 4-bromoandelic acid, nitron, tannic acid, arsenic acid, pyridine, anthralic acid, pyrogallal, ethylenediamine.

UNIT – V

Compilation of gravimetric results, compilation of results, reliability of results-accuracy and precision, cleaning and calibration of glassware, standard deviation,t,Q and F tests, correction, significant figures, errors in analysis.

Inorganic Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

s – Block elements: Comparative study, diagonal relationship, salient features of hydrides, salvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

UNIT – II

p – Block Elements: Comparative studies of the p - block elements, Group trends, electronic configuration, Physical and Chemical properties, Atomic and ionic radii, Ionization potentials, Electron affinity, Electronegativity and oxidation states, Oxidation state diagrams on the basis of redox potentials, inert pair effect catenation.

UNIT – III

Compounds of p – Block Elements: Hydrides of Boron, diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), silicones, oxygenfluorides, per-acids of sulphur, tetrasulphur, tetranitride, basic properties of halogens. interhalogen-compounds and polyhalides.

UNIT – IV

d – Block Elements: Chemistry of the elements of first transition series: Electronic configuration and comparative study with respect to atomic and ions radii, oxidation states and ionization potential. Redox potential, oxidation state diagrams on the basis of redox potentials binary

compounds and complexes illustrating relative stability of their oxidation states co-ordination numberand geometry, metallic nature magnetic properties, catalytic, colour and spectrul properties of transition metal ions.

UNIT – V

Chemistry of the elements of second and third transition series: Electronic configuration general characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviours, special properties and stereochemistry.

Organic Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Stereochemistry of Organic compounds (Part I):

Concept of isomerism, Types of isomerism. Conformational isomerism: conformational analysis of ethane and n-butane.

Newman projection and saw horse formulae. Fisher and flying wedge formulae. Differences between configuration and conformation.

UNIT – II

Stereochemistry of Organic compounds (Part II):

Optical isomerism: Elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization, Asymmetric synthesis. Relative and absolute configuration, sequence rules. D and L and R and S systems of vnomenclature.

Geometrical isomerism: Determination of configuration of geometrical isomers, E & Z system of nomenclature, Geometrical isomerism in oximes and alicyclic compounds.

UNIT – III

Arenes and aromaticity: Nomenclature of benzene derivatives. The aryl group, aromatic nucleus and side chain. Structure of benzene: Molecular formulae & Kekule structure. Stability and carbon-carbon bond lengths of

benzene, resonance structure, MO picture. Aromaticity: The Huckle rule and its applications. Energy level of p- molecular orbitals (ethane,1,3-butadine benzene).

Aromatic electrophilic substitution: General pattern of mechanism, role of sigma and pi complexes, mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction.

Effect of substitution groups (inductive, mesomeric and hyperconjugative effect), activating and deactivating groups, determination of orientation up to disubstituted derivatives, ortho/para ratio, Birch reduction. Method of formation and chemical reactions of benzene, alkyl benzenes and biphenyl.

UNIT – IV

Alkyl and Aryl halides: Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanism of nucleophilic substitution, rection of alkyl halides SN^2 and SN^1 rections with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanism of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides v/s allyl, vinyl and aryl halides. Praparation and properties of vinyl, allyl and benzyl halides: synthesis and uses of DDT and BHC.

UNIT – V

Electromagnetic Spectrum: Absorption Spectra

Infrared (IR) Absorption Spectroscopy: Molecular vibrations, Hook's Law, selection rules, Intensity and position of IR bands, measurement of IR spectrum, finger print region, characteristic absorption of simple organic compounds, alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, carboxylic acids and their derivatives.

Physical Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Liquid State: Thermal expansion and compressibility. Heat of vaporization vapour pressure and heat of vaporization. Disorder in liquid state and structure of liquid water. Intermolecular forces Cohesion of liquid. Eyring Theory of liquids.

UNIT – II

Solid State: Crystalline and amorphous states. Isotropy and anisotropy. Elements of symmetry Law of rational indices. Weiss and Miller indices and equation of plane in intercept form. Law of constancy of interfacial Angeles. Unit cell and lattices, powder method of X-ray examination of crystals.

UNIT – III

Thermodynamics-I: Definition of thermodynamic terms. Concept of work and heat. Work of Expansion and compression. Zeroth Law of thermodynamics. First law of thermodynamics under isothermal and adiabatic conditions respectively. Enthalpy and changes are constant temperature and pressure. Concept of Cp and Cv and their thermodnamic relationship.

UNIT – IV

Thermodynamics-II: Application of First Law of Thermodynamics. The heat of reactions and heat of formation. Hess's Law. Heat of reactions at

constant pressure and volume. Variation of heat of reaction with temperature. Bond enthalpies and Bond energies.

UNIT – V

Phase Equilibria: Explanation of terms phase, component and degrees of freedom. Phase rule and its thermodynamic derivation. Restricted phase rule. Analysis of (a) One component system such as Sulfur and water. (b) Two component system - Lead Silver system.

Analytical Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Volumetric Analysis: Principal and applications of reagents used in titration, Iodometry and Iodimetry theory of complexation titration, methods of end point detection. EDTA as titrant, types of titration, titration of mixtures, selectivity masking and demasking agents metal indicators.

UNIT – II

Distillation methods of organic solvents, steams, fractional, vacuum distillations and monostates. Analysis of oil and fats, saponification value, iodine value, RM value, acid value. Quantitative estimation of following functional groups- alcoholic, phenolic, carboxylic acid and unsaturated groups (olefinic and ethylenic).

UNIT III

Polarimetry: Basic principal, instrumentation, experimental techniques, determination of (a) specific rotation of a substance (b) concentration of the substance and applications and elementary idea, refractrometry, interferometry circulat dichroism and optical rotatory dispersion.

UNIT IV

Water pollutants and their analysis: Water analysis pollutant, Analysis of water for DO, BOD, and COD Biological treatment methods, prevention of water pollution by treatment of industrial waste with special reference to cement industry, fertilizer industries and dying industries.

UNIT V

Air pollution: General consideration, types of air pollutants, measurement, sampling, monitoring and analysis of CO and CO_2 in atmosphere, effect of air pollutants on plants and human health, methods for pollution control, specially for pollution by automobiles.

Inorganic Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Coordination Chemistry

Werner's coordination theory, effective atomic number, chelates, nomenclature of coordination compounds, isomerism in coordination compounds.

UNIT – II

Magnetic Properties of Transition Metal Complexes

Type of magnetic behavior, methods of determination magnetic susceptibility, spin-only formula, L-S coupling, correlation of Us and Ueff values, orbital contribution of magnetic moments, application of magnetic moment data for 3d metal complexes.

UNIT – III

Theories of coordination compounds

Valence bond theory of transition metal complexes, limitation of valences bond theory, crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters, jahn-Teller effect.

UNIT – IV

Application of crystal field stabilization energy in explaining ionic radii of divalent ions of first transition series, heat of hydration of divalent ions of first transition series.

UNIT – V

Electronic spectra of transition metal complexes

Type of electronic transition, selection rules for d-d transition spectroscopic ground states, spectrochemical series, orgel-energy level diagrams for d^1 and d^9 states. Discussion of the electronic spectrum of $[Ti(H_2O)^-_6)^{3+}]$ complex ion.

Organic Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Alchols: Classification and nomenclature. Monohydric alcohols: primary, secondary & tertiary alcohols, method of preparation, hydrogen bonding, acidic nature, reactions of alcohols. Dihydric: alcohols-nomenclature, method of formation chemical reaction of vicinal glycerol oxidative cleavage[pb$(OAc)_4$] and HIO_4 and pinacol-pinacolone rearrangement. Trihydic alcohols-nomenclature and method of formation, chemical reaction of glycerol.

UNIT – II

Phenols: Nomenclature, Structure and bonding, preprations of phenols, physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion reaction of phenols, mechanism of fries rearrangement claisen rearrangement, gatterman synthesis, Hauben-Hoesch reaction. Laderer-Manases reaction and reimertieman reaction. Laderer-Manases reaction and reimertieman reaction.

UNIT – III

Ethers and Epoxides: Nomenclature of ethers and method of their formation, physical properties, chemical reaction cleavage and autoxidation, Ziesel's method, crown ethers. Synthesis of epoxides, acid and base catalyzed ring opening epoxides, orienation of epoxides ring opening reaction of grignard and organolithium reagent with epoxides.

UNIT – IV

Aldehydes and Ketones – 1: Nomenclature and structure of the carbonyl group. Synthesis of Aldehydes and Ketones with particular reference to formaldehyde, acetaladehyde, acetone, benzaldehyde, acetophenone and benzophenone, physical properties, reactivity. Mechanism of nuclcophilic addition to carbonyl group. Condensation with ammonia and its derivatives, benzoin aldol, perkin, knoevena gel condensation, witting reaction, mannich reaction and cannizzaro's reaction. Use of acetyls as protecting group, oxidation of aldehydes, baeyer-villiger oxidation of ketones, MPV, demmensen, wolff-kishner, $LiAlH_4$ and $NaBH_4$ reductions, halgenation of enolizable ketones.

UNIT – V

Aldehydes and Ketons – II: An introduction to α, β- unsaturated aldehydes and ketones, prepration and properties of acrolene, crotonaldehyde and vinyl methyl ketone, Michael reaction.

Acidity of α – hydrogen, alkylation of diethyl malonate & ethyl acetoacetate (EAA) synthes of EAA: the Claisen condensation, keto – enol tautomerism of EAA, synthetic importance of diethyl malonate and ethyl acetoacetate, alkylation & acylation of enamines.

Physical Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Electrochemistry

(a) Electrolytic conductance, specific, equivalent and molar conductance and their determination,

variation of conductance with dilution. Effect of temperature, pressure, solvent and viscosity on conductance.

Kohlrouseh's law and its application in determination of

(1) Degree of dissocation and dissocation constant of weak acids.

(2) Solubility of sparingly, soluble salt

(3) Hydrolysis constant

(4) Ionic product of water

UNIT – II

Interionic attraction theory, quantitative treatment of theory of strong electrolytes, verification of the Debye Huckel Onsagar equation, conductometric titration.

(b) Transference number and their determination by (I) Hitoff's method (2) Moving boundary method, Abnormal transference numbers, factors affecting the transport number.

UNIT – III

Thermodynamics-I: Limitation of first law of thermodynamics, spontaneous processes, second law of thermodynamics carnot cycle,

Kelvin scale of temperature, Concept of entropy. Entropy change for an ideal gas, entropy change for physical transformation, Entropy of mixing, physical significance of entropy.

UNIT – IV

Thermodynamics – II: Free energy and work function. Criteria of chemical equilibrium Gibb's Helmholtz equation. Third law of thermodynamics and determination of absolute entropies, effect of temperature on free energy and enthalpy, maxwell's thermodynamic relations.

UNIT – V

Spectroscopy: Electromagnetic radiations and wave parameters, interaction of electromagnetic radiations with matter. Ultraviolet and visible spectroscopy having absorption interaction, chromophores and auxochromes, bathochromic and hypsochromic shift determination of wavelength (max) and molar extinction coefficient of compound, electronic transition, colours in complexes, applications of uv-visible spectroscopy.

Analytical Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Chromatography: principle of adsorption and partition chromatography, techniques and applications of column, paper and thin layer chromatography, electeophoresis and its applications in separation of amino acids and cations.

UNIT – II

Ion exchange methods, general discussions, action of ion exchange resins, column operation, experimental techniques, types of ion exchange resins, determination of the following pairs by ion exchange techniques (a) chloride and bromide (b) nickel and cobalt.

UNIT – III

Coductometric titration: The basis of coductometric titrations, apparatus and measurement. Application of coductometric titrations. High frequency titrations, advantages of the techniques, some examples of high frequency titrations.

UNIT – IV

Potentiometric titrations: Introduction, electrodes, instrumentation, potentiometric titrations. Differential potentiometric titrations, automatic potentiometric titrations, location of end points, determination of some metals through potentiometric titrations.

UNIT – V

Spectrophotometric titrations: Basic principle, instrumentation, experimental techniques, spectrophotometrics of Fe(III), Co(II), Ni(II), Fe(III) in presence of AI (III) with EDTA.

Inorganic Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Thermodynamic and kinetic aspects of Metal complex: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability substitution reactions of square planar complexes.

UNIT II

Chemistry of Lanthanide elements: General study, Chemistry of separation of Np, Pu and Am from U, electronic configuration. Oxidation states magnetic properties, Complexation behaviour, comparison of lanthanides and actinides, super heavy elements.

UNIT III

Oxidation and reduction: Redox potential data and their analysis, redox stability in water, frost, latimer and pourbaix diagrams, principals involved in the extraction of the elements.

UNIT IV

Acids and bases: Arrhenius, Bronsted-Lowery, the lux-flood, solvent system and Lewis concept of acids and bases, 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.

UNIT V

Nonaqueous solvents: Physical properties of solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Organic Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Carboxylic Acids – I: Nomenclature structure and bonding, physical properties, acidity of carboxylic acids, effects of substitution on acid strength, comparison of acidity with phenols preparation of carboxylic acids, reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction, synthesis of acid chlorides, esters and amides, reduction of carboxylic acids, mechanism of decarboxylation.

Aromatic carboxylic acids: synthesis and reaction of Benzoic acid Salicylic acid, Pthalic acid and Cinnamic acid.

UNIT – II

Carboxylic Acids – II: Method of formation and chemical reactions of α, β and γ hydroxyl acids. Malic, tartaric and citric acids. Method of formation and chemical reactions of unsaturated monocarboxylic acids, dicarboxylic acids. Method of formation and effect of heat and dehydrating agents.

UNIT – III

Carboxylic Acid derivatives: Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides relative stability of acyl derivatives physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic acid derivatives, chemical reaction mechanism of esterification and hydrolysis (acidic and basic).

Fats, oil and detergents: natural fats, edible and industrial oil, vegetable origin common fatty acids, glycerides, hydrogenation of unsaturated oil, saponification value, iodine value, acid value soaps, synthetic detergents, alkyl and aryl sulphonates.

UNIT – IV

Organic compounds of Nitrogen: Preparation of nitroalkanes chemical reaction of nitroalkanes mechanism of nucleophilic. Substitution in nitroalkanes and their reduction in acid neutral and alkaline media. Picric acid structure and nomenclature of amines, physical properties, stereochemistry of amines, separation of a mixture of primary, secondary and tertiary amines, structural features affecting basicity of amines, amine salt aws phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds & nitriles). Reductive amination of of aldehydic and ketonoc compounds Gabrielphthalimide reaction. Hofmann bromamide reaction. Reaction of amines. Aryl diazonium salts, preparation and synthetic transformations, azo coupling diazomethane.

UNIT – V

NMR Spectroscopy: Proton magnetic resonance spectroscopy. Introduction, nuclear spin & energy levels transitions, equivalents & non equivalent protons, nuclear shielding and deshielding, chemical shift spin-spin coupling and coupling constant areas of signals, interpretation of PMR spectra of simple organic molecules like C_2H_5Br, C_2H_5OH, CH_3CHO, 1,1,2-tribromomethane, ethyl acetate, toluene and acetophenone.

Note: Mechanism of reactions should be studied where possible.

Physical Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Spectroscopy: IR Spectroscopy, conditions of IR Spectroscopy, modes of vibrations in diatomic, linear and non-linear polyomic molecules, force constant and its significance. Applications of infrared spectroscopy in elucidation of structure of molecules.

UNIT II

Quantum Chemistry – I: Quantum theory of radiations, photoelectric effect and Compton effect. Limitations of Bohr models, Heisenberg uncertainity principal, wave nature of election, Debroglie wave equation and its experimental verification, operator and their applications.

UNIT III

Quantum Chemistry – II: Sinusolidal wave motion, derivation of Schrodinger's wave equation, physical significance of ψ (psi) and ψ^2 (psi) ^{2} eigenvalue and eigen functions Characterstics of wave function. Normalization and orthogonality of wave functions solution of Schrodinger wave equation particle in one dimensional box.

UNIT IV

Photochemistry – I: Absorption of light Grothus Draper law, Einstein's law of photo chemical equivalence quantum yield of photochemical reactions. Reasons for high and low quantum yield of photochemical equations. Primary and secondary process, chain reaction between H_2 + Br_2.

UNIT V

Photochemistry – II: Photochemical reaction such as (1) $H_2 + Cl_2$ reaction (2) photolysis of ammonia (3) hydrolysis of mono chloroacetic acid. Consequences of light absorption – phosphorescence fluorescence, chemiluminescence & photosensization.

Analytical Chemistry

Scheme of examination: *MM: 52*

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Nephelometry & Turbidimetry: General discussion instrumentation some nephelometry determination (a) Sulphate (b) phosphate.

UNIT II

Atomic emission and atomic absorption spectrometry: Elementary theory instrumentation. Nebulization, flames and flame temperatures interferences flame spectrometric techniques.

UNIT III

Flame emission and atomic flame emission and spectrography: Spectroscopic instrument for emission spectroscopic analysis qualitative and quantitative spectrographic analysis quantitative spectrographic analysis of (a) a non ferrous alloy (b) a complex organic mixture.

UNIT IV

Thermal analysis: Thermogravimetry (TG), instrumentation, thermometric titration, applications.

UNIT V

Differential thermal analysis and differential scanning colorimetry instrumentation.

Inorganic Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Metal-Ligand Bonding: Limitations of crystal field theory, molecular orbital theory of octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

UNIT – II

Organometallic Compounds: Definition and classification of organometallic compounds, synthesis, properties and structures of organometallic compounds of magnesium, aluminium, tin and lead.

UNIT – III

Inorganic Polymers - I: Type of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones, phosphonitrillic halides and condensed phosphates.

UNIT – IV

Nuclear Chemistry - I: Fundamental particles of nucleus (nucleons), concept of nuclides. Representation of nuclides, isotopes, isobars and isotones with specific examples. Applications of radioisotopes, size concept in nucleus and atom. Qualitative idea of the stability of nucleus (n/p ratio).

UNIT – V

Bioinorganic Chemistry – I : Role of bulk and trace metal ions in biological systems with special reference to Na,K,Mg,Ca,Fe,Cu and Zn. Chlorophylls and their role in photosynthesis.

Organic Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Heterocyclic Compounds: Nomenclature, Five and six membered heterocyclic compounds, Aromatic Character, preparation, reactions, chemical reactivity, orientation (Electrophilic and nucleophilic substitution reaction), basicity of pyrrole, furan, thiophene and pyridine. Condensed five and six membered heterocycles, structure, preparation and reactions of indole, quinoline and isoquinoline.

UNIT – II

Polymers and Polymerization: Addition and condensation polymerization, their mechanism, copolymerization, coordination polymerization, Ziegler-Natta catalyst, plastics, thermoplastic and thermosetting resins, plasticizers, polystyrene, PVC, polyacrylates, polyacrylonitrile, Dacron, terylene, nylon-66, bakelite, melamine and polyurethanes. Elementary idea of the stereochemistry of polymers. Synthetic and natural rubber.

UNIT – III

Amino Acids: Classification, structure and stereochemistry of amino acids. Physical properties, zwitter ion structure, isoelectric point and electrophoresis. Preparation and reaction of a-amino acids.

UNIT – IV

Carbohydrates: Introduction, classification, constitution and reaction of glucose and fructose, mutarotation and its mechanism, cyclic structure,

pyranose and furanose forms, Haworth projection formulae, configuration of monosaccharides, determination of ring size, conformational analysis of monosaccharides, Epimerization, chain lengthening and chain shortening in aldoses. Interconversion of aldoses and ketoses.
Disaccharides: Structure determinations of maltose, lactose and sucrose.
Polysaccharides: Structure of starch and cellulose.

UNIT – V

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

Physical Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Quantum Mechanics: Schrodinger's wave equation for particle in three dimensional box, H-atom, quantum no. and their importance, hydrogen like wave functions, radial wave function's angular wave functions.

M.O. Theory, basic ideas-criteria for forming M.O. from A.O. construction of M.O's by LCAO – H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ^* and II, II* orbitals and their characteristics.

Hybird 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. model.

UNIT – II

Photochemistry: Introduction of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry: Grothus – Dropper law, stark – Einstein law, jablonski diagram depicting various processes occurring in the excited state, qualitative description of the fluorescence, phosphorescence, non radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple example).

UNIT – III

Physical properties and molecular structure: Optical activity, polarization (Clausius Mossotti equation), orientation of dipole in the 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.

UNIT – IV

Chemical Kinetics : **Catalysis:-** The simple catalysis mechanism S+C $\rightarrow$ SC $\rightarrow$ P + C. Its mathematical treatment and its consequences. Specific and general acid base catalysis, Enzyme catalysis, Surface catalysis and Langmuir Adsorption Isotherm, Mechanism of surface catalysis.

UNIT – V

Macromolecules :- Linear, Branched, network and homopolymer. Polymer Classification – Condensation polymers and addition polymers, number average and weight average, molecular weight, Determination methods of polymers by (I) Osmotic pressure (II) Viscosity (III) Light scattering. Properties of macromolecules.

Analytical Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Electrogravimetry – I: Theory, electrode reactions, over potential, completeness of deposition,electrolytic separation of metals, character of the deposit, electrolytic separation of metals with controlled cathode potential.

UNIT – II

(A) Electrogravimetry – II: Electrolytic determinations at constant current-Copper and Lead. Electrolytic determinations with controlled cathode potential antimony, copper, lead and tin in an alloy.

(B) Coulometry: Coulmetry at controlled potential, separation of Ni & Co by coulometric analysis at controlled potential, coulometry at constant current, coulometry titrations.

UNIT – III

Polarography: Principle and experimental set-up. Diffusion current and Half wave potential – Qualitative and quantitative applications of polarography in analytical chemistry.

(i) wave height concentration graph.

(ii) Internal standard (piloton method)

(iii) Standard addition method

Use of polarography in :

(i) Zn and Cu in brass

(ii) Dissolved oxygen in sample.

UNIT – IV

(A) Amperometry : Amperometric titrations, technique of amperometric titrations with the dropping mercury electrode, titration with the rotating platinum micro electrode, biamperometric titrations.

(B) Modified Voltammetric methods: Current sampled (TAST) Polarography, pulse polarography, Differential pulse polarography, Cyclic Voltammetry, Sinusoidal Alternating current polarography, Stripping Voltammmetry.

UNIT – V

Mass spectrometry : Instrumentation & technique, Elementary idea about electron impact, chemical ionization and matrix assisted laser desorption ionization (MALDI), mass spectrometer techniques. Principle of Fragmentation, Molecular ion peak, base peak isotopic peaks and metastable ion peak. Determination of molecular formula, mass spectra of alkanes, alkenes, alkynes, cycloalkanes and arenes, alcohols and ethers, aldehydes and ketones.

Inorganic Chemistry

Scheme of examination: ***MM: 52***

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Metal carbonyls: Preparation, properties and bonding of transition metal carbonyls. Detailed study of mononuclear and polynuclear carbonyls.

UNIT II

Inorganic Polymers-II: Metal Clusters: Higher boranes, carboranes, mettaloboranes and mettalocarboranes, metal carbonyl and halide clusters, compounds with metal - metal multiple bonds.

UNIT III

Nuclear Chemistry-II: Shell and liquid drop model, Natural and artificial radioactivity, disintegration series, disintegration rates, half life, average life, nuclear binding energy, Mass defects, Einstein's mass energy relations, Artificial transmutation, Nuclear reactions, spallations, Nuclear fission & Fusion. Nuclear reactors. Hazards of radioactive emanations.

UNIT IV

Bioniorganic Chemistry-II: Metalloporphyrins: Hemoglobin and Myoglobin and their role as oxygen carriers. Cytochrome-c.

UNIT V

Nitrogen fixation: Mechanism, Nitrogenase enzymes, dinitrogen complexes as models for nitrogen fixation.

Metalloenzymes: General discussion of enzymes, functions of metal ions, inhibition (explanation based on coordination elemistry), Carboxypetidase-A.

Organic Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Polynuclear Compounds: Structure of naphthalene, mechanism and orientation of electrophilic substitution in naphthalene, preparation and properties of naphthalene and anthracene, some important derivatives of naphthalene like naphthols and naphthylamines. Preparation and reaction of diphenyl, diphenylmethane and triphenylmethane.

UNIT- II

Synthetic Dyes: Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, phenolphathalein, Fluorescein, Alozarin and Indigo.

Drugs: Chemotheraphy, Synthetic uses and side effect of:

Analgesics- Aspirin, Phenacetin, Paracetamol.

Antimalarials – Chloroquine, Plasmoquine.

Antibiotics- Chloramphenicol (Chloromycetin)

Sulpha drugs and their mechanism of action. Synthesis of sulphadiazine, sulphapyridine, sulphathiazole, sulphaguanidine and sulphamethazole.

UNIT- III

Peptides and Proteins: 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. Structure of peptides and proteins. Levels of protein structure. Protein denaturation / renaturation.
Nucleic Acids: Introduction, constituents of nucleic acids (RNA and DNA) Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT- IV

Mass Spectroscopy: Introduction, instrumentation, factors affecting fragmentation, ion analysis, ion abundance, fragmentation modes, mass spectral fragmentation of simple organic compounds – alkanes, primary alcohols, aliphatic ketones, aldehydes and carboxylic acids, Types of peak: molecular ion peak, isotopic peak, base peak, metastable peak, doubly charged ion, Mc Lafferty rearrangement, retro Diels-Alder fragmentation, Nitrogen rule.

UNIT- V

Organometallic Compounds: Organomagnesium compounds: The Grignard reagents-formation, structure and chemical reactions.
Organozine Compounds: Formation and chemical reactions.
Organolithium Compounds: Formation and chemical reactions.

Physical Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Electrochemistry-I: Types of reversible electrodes- Gas-metal ion, metal-metal ion, metal insoluble salt anion, and redox electrodes, Electrode reactions, Nernst's equation, derivation of cell E.M.F and single electrode potential. Standard hydrogen electrode, reference electrode, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells- Reversible and irreversible cells, conventional representation of electrochemical cells. E.M.F. of cell and its measurements. Computation of cell e.m.f. Calculation of thermodynamic quantities of cell reaction(ΔG, ΔH and k).

UNIT- II

Electrochemistry-II: Polarization, Overpotential and Over Voltage, Structure of double layer, theories by Helmholtz, Guoy-Chapman and Stern. Concentration cells with and without transport, Liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods. Introduction of Polarographic technique.

Classification of electrochemical cells, Requirement of power source, Lead storage cell and fuel cell.

Corrosion- Types, Theories and methods of combating it.

UNIT- III

Phase Equilibrium-I: Solid Solutions:- Compound formation with congruent M.Pt.(Mg-Zn) and Benzophenone – dimethylamine incongruent M.Pt NaCI-H_2O, Picric acid & Benzene, $FeCl_3$-H_2O and $CuSO_4$-H_2O system.

Liquid – Liquid Mixtures – Ideal liquid mixtures, Rault's law and Henry's law, non ideal system, Azeotropes – HCI-H_2O and Ethanol-Water system.

Partially miscible liquids-pheno-Water, Trimethylamine-Water, Nicotine-Water system, Lower and upper consulate temperature, Effect of impurities on consulate temperature.

Immiscible liquids- steam distillation.

UNIT- IV

Phase Equilibrium-II: Surface Phenomena, Micelles: Surface active agents, classification of surface active agents, micellization, hydrophilic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization. Phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

UNIT- V

Adsorption: Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electro kinetic phenomenon), catalytic activity at surfaces, Electrode/electrolyte interface.

Analytical Chemistry

Scheme of examination: *MM: 52*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Gas Chromatography & HPLC: Introduction, gas chromatographs, detectors, programmed temperature gas chromatography, quantitative analysis by GLC, gas – solid chromatography.

High performances liquid chromatographic methods - Adsorption Chromatiography. Liquid – liquid partition chromatography, Ion exhange, HPLC, exclusion chromatography.

UNIT- II

Diffraction Pattern-I: Fundamental principles, instrumentation, use of X-ray, electron and neutron in diffractommetry and applications of X-ray. Application of X-ray in C.T. Scan.

UNIT- III

Diffraction Pattern-II: Electron and neutron diffractometry in biological and as analytical techniques.

UNIT- IV

Automated Methods of analysis: Automatic instruments and automation. Automation of sampling and preliminary treatment for air, water and soil, continuous flow method, Discrete methods, Automatic Analysis based on Multilayer Films.

UNIT- V

NMR Spectroscopy: Theory of nuclear magnetic resonance, experimental methods of NMR spectroscopy, applications of proton NMR including application in MRI technique

M.Sc CHEMISTRY Sem. I Paper – I **(P C 1071)**

Inorganic Chemistry

Scheme of examination: **MM: 70**

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

2 Each question shall be of 14 marks.

UNIT – I

Stereochemistry and Bonding in Main Group Compounds :

VSEPR, Walsh diagram (triatomic (AH2 type) and penta-atomic (CH3I) molecules), dπ-pπ bond, Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.

UNIT – II

Metal-Ligand bonding Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, p-bonding and molecular orbital theory.

UNIT - III

Electronic Spectra and Magnetic Properties of Transition Metal Complexes :

Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), calculations of dα, B and β parameters

UNIT - IV

Reaction Mechanism of Transition Me tal Complexes :

Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories,

kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis,

Isopoly and Heteropoly Acids and Salts

UNIT - V

(a) Reaction Mechanism of Transition Me tal Complexes :

conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect and mechanism of the substitution reaction.

(b) Metal π-Complexes

Metal carbonyls: structure and bonding,

←◙→

M.Sc CHEMISTRY Sem. I Paper – II **(P C 1072)**

Organic Chemistry

Scheme of examination: **MM: 70**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 14 marks.

UNIT – I

Nature of Bonding in Organic Molecules: Delocalized chemical bonding-conjugation, cross conjugation, resonance hyperconjugation, bonding in fullerences, tautomerism. Aromaticity in benzenoid and non-benzoid compounds, alternant and non-alternanthydrocarbons. Huckel's rule, energy. Level of p-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds, crown ether complexs and cryptands, inclusion compounds, catenanes and rotaxanes.

UNIT - II

Stereochemistry: Conformational analysis of cycloalkanes, decalines, effect of conformation on reactivity, conformation of sugars, strain due to unavoidable crowding Elements of symmetry, chirality, molecules with more than one chiral center, threo and ertyhro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spirane), chirallity due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

Unit-III

Reaction Mechanism: Structure and Reactivity: Type of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtir-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects, Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. Effect of structure on reactivity, resonance and field effects, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants, Taft equation.

UNIT – IV

Addition to Carbon-Carbon Multiple Bonds: Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bounds, hydrogenation of aromatic rings. Hydroboration, Michael reaction, sharpless asymmetric epoxidation.

Addition to Carbon-Hetero Multiple bonds

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acid esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and usaturated carbonyl compounds. Witting reaction.

UNIT - V

Mechanism of condensation reactions involving enolates-Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

Hydrolysis of esters and amides, ammonolysis of esters.

Elimination Reactions The E2, E1 and E1 cB mechanisms and their spectrum. Orientation of the double bond. Reactitivty-effects of substrate structures, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination.

M.Sc CHEMISTRY Sem. I Paper – III **(P C 1073)**

Physical Chemistry

Scheme of examination: **MM: 70**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 14 marks.

UNIT – I

Classical Thermodynamics: Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity. Non-ideal systems : Excess functions for non-ideal solutions. Activity, activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transitions.

UNIT - II

Statistical Thermodynamics: Concept of distribution, thermocdynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and microcanonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in tems of partition. Application

of partition functions. Heat capacity behaviour of solids-chemical equilibria and equilibrium constant in terms of partition functions, Fermi-Dirac Statistics, distribution law and applications to metal. Bose-Einstein statistics distribution Law and application to helium.

UNIT - III

Non Equilibrium Theromodynamics: Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

UNIT - IV

Surface Chemistry

A. Adsorption: Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of dropletes (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).

B. Micelles: Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

Unit-V

Macromolecules: Polymer-definitin, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentatin, chain configuration of macromlecules, calculation of average dimension of various chain structures.

Chemical Dynamics: Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activiated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dyamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane).

M.Sc CHEMISTRY Sem. I Paper – IV **(P C 1074)**

Group Theory & Spectroscopy - I

Scheme of examination: **MM: 52**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 10 marks and remaining four questions of 10½ marks each.

UNIT – I

Symmetry and Group theory in Chemistry: Symmetry elements and symmetry operation, definition of group, subgroup. Conjugacy relation and classes. Point symmetry group. Schonflies symbols, representations of groups by matrices (representation for the CN, CNV, Dnh etc, group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy. Derivation of character table for C_{2v} and C_{3v} point group Symmetry aspects of molecular vibrations of H_2O molecule.

Unit-II

Unifying Principles: Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorption, emission, transmission, reflection, refraction, dispersion, polarisation and scattering. Uncertainty relation and natural line width and natural line broadening, transition probability, results of the time dependent perturbation theory, transition moment, selection rules, intensity of spectral lines.

UNIT - III

Microwave Spectroscopy: Classification of molecules, rigid rotor model, effect of isotopic substituion on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.

Unit-IV

Vibrational Spectroscopy: A. Infrared-Spectroscopy

Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy. P.Q.R. branches, Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group- frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis.

B. Raman Spectroscopy: Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).

Unit-V

Electronic Spectroscopy: A. Atomic Spectroscopy

Energies of atomic orbitals, vector representation of momenta and vector coupling, spectra of hydrogen atom and alkali metal atoms.

B. Molecular Spectroscopy: Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radiative and non-radiative decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra.

M.Sc CHY Sem. I Paper – V(a) **(P C 1075)**

Mathematics for Chemists

(For students without mathematics in B.Sc)

Scheme of examination: **MM: 17**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 3 marks and remaining four questions of 3½ marks each.

UNIT – I

Vectors: Vectors, dot, cross and triple products etc. gradient, divergence and curl, Vector Calculus.

UNIT - II

Matrix Algebra: Addition and multiplication; inverse, adjoint and transpose of matrices, special matrices (Symmetric, skew-symmetric, Hermitian, Skey-Harmitian, unit, diagonal, unitary etc.) and their properties.

UNIT - III

Matrix equations: Homogeneous, non-homogeneous linear equations and conditions for the solution, linear dependence and independence. Introduction to vector spaces, matrix eigenvalues and eigenvectors, diagonalization, determinatnts (examples from Huckel theory).

UNIT - IV

Differential Calculus:

Functions, continuity and differentiability, rules for differentiation.

UNIT - V

Applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc.).

M.Sc CHY Sem. I Paper – V(b) **(P C 1076)**

Biology for Chemists

(For students without biology in B.Sc)

Scheme of examination: **MM: 17**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 3 marks and remaining four questions of 3½ marks each.

UNIT – I

Cell Structure: Structure prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparision of plant and animal cells.

UNIT - II

Cell Functions: Overview and their functions, comparision of plant and animal cells. Overview of metabolic processes-catabolism and analbolism. ATP - the biological energy currency. Origin of life-unique properties of carbon chemical evolution and rise of living systems. Introduction to biomolecules, building blocks of biol-macromolecules.

UNIT – III

Carbohydreates: Conformation of monosaccharides, structure and functions of important derivatieves of monosaccharides like glycosides, deoxy sugars, myoinositol, amino sugars. N-acetylmuramic acid, sialic acid disaccharides and polysaccharides. Structural polysaccharides cellulose and chitin.

UNIT - IV

Storage polysaccharides-starch and glycogen. Structure and biological fucntion of glucosaminoglycans of mucopolysaccharides. Carbohydrates of glycoporteins and glycolipids. Role of sugars in biological recognition. Blood group substances. Ascorbic acid. Carbohydrate metabolism-Kreb's cycle, glycolysis, glycogenesis and glycogenolysis, gluconeogenesis, pentose phosphate pathway.

Unit-V

Lipids: Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Liproproteins-compositiion and function, role in atherosclerosis.

M.Sc CHY Sem. I Paper –VI **(P C 1077)**

Computers for Chemists

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

This is a theory cum laboratory course with more emphasis on laboratory work.

UNIT – I

Introductiion to computers and Computing: Basic structure and functioning of computer with a PC as illustrative example. Memory I/O devices. Secondary storage Computer languages. Operating systems with DOS as an example.

UNIT - II

Introduction to UNIX and WINDOWS. Principles of programming Alogrithms and flow-charts.

Unit-III

Computer Programming in FORTRAN/C/BASIC - I:

(the language features are listed here with reference to FORTRAN. The instructor may choose another language such as BASIC or C the features may be replaced appropriately). Elements of the compute language. Constants and variables.

UNIT - IV

Computer Programming in FORTRAN/C/BASIC - II:

Operations and symbols Experssions. Arithmatic assignment statement.

Input and output Format statement. Terminatino statements. Branching statements as IF or GO TO statement.

UNIT - V

Computer Programming in FORTRAN/C/BASIC - III:

LOGICAL variables. Double precission variables. Subscripted variables and DIMENSION. DO statement FUNCTION AND SUBROUTINE. COMMON and DATA statement (Student learn the programming logic and these language feature by hands on experience on a personal computer from the beginning of this topic.)

←◙→

M.Sc CHY Sem. II Paper –I **(P C 2071)**

Inorganic Chemistry

Scheme of examination: **MM: 70**

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

2 Each question shall be of 14 marks.

UNIT – I

Metal Clusters:

Higher boranes, carboranes, metallocarboranes and metallocarborane compounds with metal metal multiple bonds.

UNIT II

Metal-Ligand Equilibria in Solution:

Stepwise and overall formation constants and their interaction, trends in stepwise constant, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand. Chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry and spectrophotometry.

UNIT III

Reaction Mechanism of Transition Me tal Complexes :

Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

UNIT IV

Electronic Spectra and Magnetic Properties of Transition Metal Complexes :

Charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical conformation, anomalous magnetic moments, magnetic exchange coupling and spin crossover.

UNIT V

Metal pi-Complexes

Vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls: preparation, bonding structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.

Organic Chemistry

Scheme of examination: **MM: 70**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 14 marks.

UNIT – I

Aliphatic Nucleophilic Subsitution: The SN2, SN1 mixed SN1 and SN2 and SET mechanism. The neighbouring group mechanism, neighbouring group participation by p and s bonds, anchimeric assistance. Classical and nonclassical carbocations, phenomium ions, norborynl systems, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations.

The SNi mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

UNIT II

Aliphatic Electrophilic Substitution: Bimolecular mechanisms SE2 and SE1, The SE1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving groups and the solvent polarity on the reactivity.

Aromatic Electrophilic Substitution:

The arenium ion mechanism, orientation and reactivity, energy profile

diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reactiion, Gatterman-Koch reaction

Aromatic Nucleophilic Substitution: The SNAr SN1, benzyne and SN1 mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richte. Sommelet-Hauser, and Smiles rearrangments.

UNIT III

Pericyclic Reactions: Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, 4n 4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1, 3 dipolar cycloadditions and cheleotrpic reactions.

UNIT IV

Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties, 3,3- and 5,5 sigmatropic rearrangements. Claise n, Cope and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

UNIT V

Free Radical Reactions :

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance.

Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

M.Sc CHY Sem. II Paper –III **(P C 2073)**

Physical Chemistry

Scheme of examination: **MM: 70**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 14 marks.

UNIT – I

Quantum Chemistry:

A.**Introduction to Exact Quantum Mechanical Results**

The Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model system viz., particle in a box, the harmonic oscillator, the rigid rotator, the hydrogen atom.

B. Approximate Methods

The variation theorem, linear variation principle. Perturabation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.

UNIT II

Quantum Chemistry:

A. Angular Momentum

Ordinary angular momentum, generalized angular momentum, eigenfucntions for angular momentum, eigenvalues of angular momentum operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

B**. Molecular Orbital Theory**

Huckel theory of conjugated systems bond and charge density

calculations. Applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene etc. Introduction to extended Huckel theory.

UNIT III

Electrochemistry:

Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of detrminations. Structure of electrified interfaces. Guoy-Chapman, Stern, Grahmam Devanathan-Mottwatts, Tobin, Bockris, Devanathan models, Overpotentials, exchange current density, derivation of Butler Volmer equation, Tatel plot.

UNIT IV

Electrochemistry:

Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface. Polarography theory, Ilkovic equation; half wave potential and its significance.

UNIT V

Chemical Dynamics

Photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and homogenous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method,

flash photolysis and the nuclear magnetic resonance method, dynamics of unimolecular reaction (Lindemann Hinshelwood and Rice-Ramserger-Kassel-Marcus (RRKM) theories of unimolecular reactions).

M.Sc CHY Sem. II Paper –IV **(P C 2074)**

Spectroscopy and Diffraction Methods

Scheme of examination: **MM: 52**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 10 marks and remaining four questions of 10½ marks each.

UNIT – I

Photoelectron Spectroscopy:

Basic principles; photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea.

UNIT II

Magnetic Resonance Spectroscopy:

A.Nuclear Magnetic Resonance Spectroscopy

Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors, influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.). spin decoupling; basic ideas about instrument, NMR studies of nuclei other than protin-13C, 19F and 31P. FT NMR, advantages of FT NMR.

B. Electron Spin Resonance Spectroscopy

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyper fin coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications.

UNIT III

X-ray Diffraction

Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules.

UNIT IV

Electron Diffraction

Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron difffraction and structure of surfaces. **Neutron Diffraction** Scattering of neutrons by solids me asurement techniques, Elucidation of structure of magnetically ordered unit cell.

UNIT V

Photoacoustic Spectroscopy

Basic principles of photoacoustic spectroscopy (PAS), PAS – gases and condensed systems, chemical and surface application.

M.Sc CHY Sem. II Paper –V(a) **(P C 2075)**

Mathematics of Chemists

Scheme of examination: **MM: 17**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 3 marks and remaining four questions of 3½ marks each.

UNIT – I

Integral calculus, basic rules for integration, integration by parts, partial fractions and substitution. Reduction formulae, applications of integral calculus.

UNIT II

Functions of several variables, partial differentiation, co-ordinate transformations (e.g. cartesian to spherical polar).

UNIT III

Elementary Differential equations First-order and first degree differential equations, homogenous, exact and linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry etc. second order differential equation and their solutions.

UNIT IV

Permutation and combinations

Permutations and combinations,

UNIT V

Probability and probability theorems average, variance root means square deviation examples from the kinetic theory of gases etc., fitting (including least squares fit etc with a general polynomial fit.

M.Sc CHY Sem. II Paper –V(b) **(P C 2076)**

Biology for Chemists

Scheme of examination: **MM: 17**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 3 marks and remaining four questions of 3½ marks each.

UNIT – I

Lipid: Properties of lipid aggregates-mic elles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism-β-oxidation of fatty acids.

UNIT II

Amino-acids: Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins. force responsible for holding of secondary structures. α-helix, β-sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and domina structure. Quaternary structure.

UNIT III

Peptides and Proteins: Amino acid metabolism-degradation and biosynthesis of amino acids, sequence determination: chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH).

UNIT IV

Nucleic Acids: Purine and pyrimidine bases of nucleic acids, base pairing via H bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA).

UNIT V

Double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical sysnthesis of mono and trinucleoside.

Computers for Chemists

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

This is a theory cum laboratory course with more emphasis on laboratory work.

UNIT – I

Programming in Chemistry-I: Developing of small computer codes (FORTRAN/C/BASIC) involving simple formulae in Chemistry, such as Van der Waals equation. Chemical kinetics (determination of rate constant) Radioactive decay (Half Life and Average Life).

UNIT II

Programming in Chemistry-II:

Determination Normality, Molarity and Molality of solutions. Evaluation Electronegativity of atom and Lattice Energy from experimental data.

UNIT III

Programming in Chemistry-III:

Determination of molecular weight and percentage of element organic compounds using data from experimental metal representation of molecules in terms of elementary structural features such as bond lengths, bond angles, dihedral angles, etc.

UNIT IV

Computer programmes-I: Operation of PC. Data Processing. Running of standard Programs and Packages such as MS WORD, MS EXCEL special emphasis on calculations and chart formations. X-Y plot. Simpson's Numerical Integration method.

UNIT V

Computer programmes-II:

Programmes with data preferably from physical chemistry laboratry. Introduction of working of any one of the packages such as LOTUS/EXCEL/FOXPRO/MOPAC and Word Processing software such as WORDSTAR/MS WORD.

M.Sc CHY Sem. III Paper –I **(P C 3061)**

(a) Applications of Spectroscopy, (b) Photochemistry, (c) Solid State Chemistry

Scheme of examination: **MM: 70**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 14 marks.

(a) Applications of Spectroscopy

UNIT – I

Vibrational Spectroscopy: Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6, mode of bonding of ambidentate ligands, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins.

Electron Spin Resonance Spectroscopy: Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as PH_4, F_2^- and (BH_3^-).

Organic Chemistry

UNIT – II

(a) **Ultraviolet and Visible spectroscopy:** Various electronic transitions (185-800 nm) Beer-Lambert law, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in biphenyls.

(b) Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD): Definition, deduction of absolute configuration, octant rule for ketones.

UNIT - III

Infrared Spectroscopy: Instrumentation and Sample handling: Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ether's, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonance.

(b) Photochemistry

Unit-IV

Photochemical Reactions: Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

Determination of Reaction Mechanism

Classification, rate constants and life times of reactive energy state determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photo dissociation, gas-phase photolysis.

Photochemistry of Alkene: Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes.

(c) **SOLID STATE CHEMISTRY**

Unit-V

Solid State Reactions: General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.

Crystal Defects and Non-Stoichiometry: Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects.

Organic Solids: Electrically conducting solids. organic charge transfer complex, organic metals, new superconductors.

M.Sc CHY Sem. III Paper –II **(P C 3062)**

Bio-inorganic, Bio-organic and Bio-physical Chemistry

Scheme of examination: **MM: 52**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 10 marks and remaining four questions of 10½ marks each.

UNIT – I

(a) BIOINORGANIC CHEMISTRY

Metal Ions in Biological Systems: Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K^+/Na^+ pump.

Bioenergetics and ATP Cycle: DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll's, photosystem I and photosystem II in cleavage of water.

Unit-II

(b) : BIOORGANIC CHEMISTRY

Introduction: Basic considerations, Proximity effects and molecular adaption.

Enzymes: Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michaelis-Menten and Lineweaver-Burk

plots, reversible and irreversible inhibition.

UNIT - III

Mechanism of Enzyme Action: Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, ribonuclease, lysozyme and carboxypeptidase.

Kinds of Reactions Catalysed by Enzymes: Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisations reactions, β-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

Unit-IV

(c) : BIOPHYSICAL CHEMISTRY

Biological Cell and its Constituents: Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coils transition.

Statistical Mechanics in Biopolymers: Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. Polypeptide and protein structures, introduction to protein folding problem.

UNIT - V

Thermodynamics of Biopolymers Solutions: thermodynamics of Biopolymer Solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system.

Cell Membrane and Transport of Ions: Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

M.Sc CHY Sem. III Paper –III **(P C 3063)**

Environmental Chemistry

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Atmosphere: Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphure, phosphorus oxygen. Residence times.

Unit-II

Atmospheric Chemistry: Sources of trace atmospheric constituents : nitrogen oxides, sulphure dioxide and other sulphure compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons.

Unit-III

Air Pollution: Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health.

Acid Rain: Definition, Acid rain precursors and their aqueous and gas phase atmospheric Oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO2 and NOx. Acid rain control strategies.

Stratospheric Ozone Depletion: Mechanism of Ozone formation,

Mechanism of catalytic Ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies.

Unit-IV

Aquatic Chemistry and Water Pollution: Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Eutrophication, Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.

Unit-V

Soil: Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic and metals. Methods of re-mediation of soil.

←◙→

M.Sc CHY Sem. III Gr. I Paper – IV **(P C 3064)**

Organotransition Metal Chemistry-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Alkyls and Aryls of Transition Metals Types, routes of synthesis, stability and decomposition pathways organocopper in organic synthesis.

Unit-II

Compounds of Transition Metal-Carbon Multiple Bond-I

alkylidenes, alkylidynes, low valent carbenes and carbynes-synthesis, nature of bond, structural characteristics.

Unit-III

Compounds of Transition Metal-Carbon Multiple Bond-II

Nucleophilic and electrophilic reactions on the ligands, role in organic synthesis.

Unit-IV

Transition Metal π-Complexes-I Unsaturated organic molecules, alkenes, alkynes, allyl preparation, Transition Metal π -Complexes with properties, nature of bonding and structural features.

Unit-V

Transition Metal π-Complexes-II

Diene, dienyl, arene and trienyl complexes, preparation, properties, nature of bonding and structural features.

M.Sc CHY Sem. III Gr. I Paper – V **(P C 3065)**

Bio-inorganic and supramolecular Chemistry-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Metal Storage and Transport

Ferritin transferrin, and siderophores.

Unit-II

Calcium in Biology

Calcium in living cells, transport and regulation, molecular, aspects of intramolecular processes, extracellular binding proteins.

Unit-III

Metalloenzymes

Zinc enzymes-carboxypeptidase and carbonic anhydrase. Iron enzymes-catalase, peroxidase and cytochrome P-450.

Unit-IV

Supramolecular Chemistry-I

Molecular recognition : Molecular receptors for different types of molecules including arisonic substrates, design and synthesis of co receptor molecules and multiple recognition.

UNIT – V

Supramolecular Chemistry-II

Supramolecular reactivity and catalysis.

M.Sc CHY Sem. III Gr. I Paper – VI **(P C 3066)**

Photo-inorganic Chemistry-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Basics of Photochemistry-I

Absorption, excitation, photochemical laws, quantum yield, electrically excited states-life times-measurements of the times. Flash photolysis.

UNIT-II

Properties of Excited States

Structure, dipole moment, acid-base strengths, reactivity. Photochemical kinetics-calculation of rates of radiative processes. Bimolecular deactivation-quenching.

Unit-III

Ligand Field Photochemistry-I

Photosubstitution, photooxidation and photoreduction, lability and selectivity, zero vibrational levels of ground state and excited state.

Unit-IV

Redox Reactions by Excited Metal Complexes-I

Energy transfer under conditions of weak interaction and strong

interaction-exciplex formation; condition of the excited states to be useful as redox reactants.

Unit-V

Redox Reactions by Excited Metal Complexes-II

Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants into high energy products, chemical energy into light.

M.Sc CHY Sem. III Gr. I Paper – VII **(P C 3067)**

Polymers - I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Basics: Importance of polymers. Basic concepts : Monomers, repeat units, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization : condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.

Unit-II

Polymer Characterization

Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity an molecular weight distribution. The practical significance of molecular weight. Measurement of molecular-weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.

Unit-III

(A) Structure, Properties and Applications of

Polymers based on boron-borazines, boranes and carboranes.

UNIT- IV

(B) Structure, Properties and Applications of Polymers based on Phosphorous-Phosphazenes, Polyphosphates

Unit-V

(C) Structure, Properties and Applications of: Metal clusters.

←◙→

M.Sc CHY Sem. III Gr. II Paper – IV **(P C 3068)**

Organic Synthesis-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Organometallic Reagents-I

Principle, preparations, properties and applications of the following in organic synthesis with mechanistic details. Group I and II metal organic compounds Li, Mg, Hg, Cd, Zn and Ce Compounds.

Unit-II

Oxidation – I: Introduction, Different oxidative processes. Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids.

Unit-III

Oxidation – II: Amines, hydrazines and sulphides. Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium (III) Nitrate.

Unit-IV

Rearrangements-I: General mechanistic considerations-nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements. Pinacol-pinacolone, Wagner-Meerwein,

Demjanov, Benzil-Benzillic acid. Favorskii, Arndt-Eister synthesis, Neber.

Unit-V

Rearrangements-II: Beckmann, Hofmann Curtius, Schmidt, Baeyer-Villiger, Shapiro reaction.

←◙→

M.Sc CHY Sem. III Gr. II Paper – V **(P C 3069)**

Organic Synthesis-III

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Disconnection Approach-I: An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis.

UNIT-II

Disconnection Approach-II: one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction, amine synthesis.

Unit-III

Protecting Groups: Principle of protection of alcohol, amine, carbonyl and carboxyl groups.

Unit-IV

One Group C-C Disconnections-I: Alcohols and carbonyl compounds, regioselectivity.

Unit-V

One Group C-C Disconnections-II: Alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis.

M.Sc CHY Sem. III Gr. II Paper – VI **(P C 3070)**

Heterocyclic Chemistry-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Nomenclature of Heterocycles: Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic fused and bridged heterocycles.

UNIT-II

Aromatic Heterocycles: General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in ^{1}H-NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.

Unit-III

Small Ring Heterocycles: Three-membered and four-membered heterocycles-synthesis and reactions of azirodines, oxiranes, thiranes, azetidines, oxetanes and thietanes.

Unit-IV

Six-Membered Heterocycles with one Heteroatom: Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts, phridones. Synthesis and reactions of quionlizinium and benzopyrylium salts, coumarins and chromones.

Six Membered Heterocycles with Two or More Heteroatoms

Synthesis and reactions of diazines, triazines, tetrazines and thiazines.

Unit-V

Seven-and Large-Membered Heterocycles Synthesis and reactions of azepines, oxepines, thiepines, diazepines thiazepines, azocines, diazocines, dioxocines and dithiocines.

←◙→

M.Sc CHY Sem. III Gr. II Paper – VII **(P C 3071)**

Chemistry of Natural Products-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Terpenoids-I: Clasification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Citral, Gerniol α-Terpeneol.

UNIT-II

Terpenoids-I and and Carotenoids: Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Menthol, Farnesol, Zingiberence, Santonin, Phytol, Abietic acid and b-Carotene.

Unit-III

Alkaloids-I: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants.

UNIT-IV

Alkaloids-II: Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine , (+)- Conine, Nicotine, Atropine, Quinine and Morphine.

Unit-V

Prostaglandis: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE_2 and $PGF_{2\alpha}$.

←◙→

M.Sc CHY Sem. III Gr. III Paper – IV **(P C 3072)**

Analytical Chemistry-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Introduction: Role of analytical chemistry Classification of analytical methods classical and instrumental. Types of instrumental analysis. Selecting an analytical method. Neatness and cleanliness. laboratory operations and practices. Analytical balance. Techniques of weighing, errors. Volumetric glassware cleaning and calibration of glassware.

Unit-II

Errors and Evaluation-I: Definition of terms in mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of error in experimental data deterninate (systematic), indeterminate (or random) and gross.

Unit-III

Errors and Evaluation-II: Sources of error and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.

UNIT-IV

Food analysis: Moisture, ash, crude protein, fat crude fibre, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulteratnts in food, contamination of foods stuffs. Microscopic examination of foods for adulterants. Pesticide analysis in

food prodcuts. Extraction and purification of sample. HPLC. Gas chromatogrphay for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.

Unit-V

Analysis of Water Pollution-I: Origin of Waste water, types, water pollutants and their effects. Sources of water pollution-domestic, industrial, agriculatural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis-colour, turbidity, total solids, conductivity, acidity, alakalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen.

M.Sc CHY Sem. III Gr. III Paper – V **(P C 3073)**

Physical Organic Chemistry-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Concepts in Molecular Orbital (MO) and Valence Bond (VB) Theory : Introduction to Huckel molecular orbital (MO) method as a mean to explain mdoern theoretical methods. Advanced techniques in PMO and FMO theory. Molecular mechanics, semi empirical methods and abinito and density functional methods. Scope and limitations of several computational programmes.

Quanitative MO theory : Huckel molecular orbital (HMO - method as applied to ethene, allyl and butadiene. Qualitative MO theory ionisation potential. Electron affinities. MO energy levels. Orbital symmetry. Orbital interaction diagrams. MO of simple organic systems such as ethene, allyl, butadiene, methane and methyo group. Conjugation and hypeconjugation. Aromaticity.

Valence bond (VB) configuration mixing diagrams. Relationship between VB configuration mixing and resonance theory. Reaction profiles. Potential energy diagrams. Curve-crossing model-nature of activation barrier in chemical reactions.

Unit-II

Principles of Reactivity: Mechanistic significance of entropy, enthalphy and Gibb's free energy. Arrrhenius equation. Transition state theory. Uses of activation parameters, Hammond's postulate, Bell-Evans-Polanyi Principle. Potential energy surface model. Marcus theory of electron transfer. Reactivity and selectivity principles.

Unit-III

Kinetic Isotope Effect: Theory of isotope effects. Primary and secondary kinetic isotope effects. Heavy atom isotope effects. Tunneling effect. Solvent effects.

Unit-IV

Structural Effects on Reactivity: Linear free energy relationships (LFER). The Hammett equation, substitutent constants, theories sof substitutent effects. Interpretation of σ-values. Reaction constantp. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, σ 1 and σ R scales.

Unit-V

Solvation and Solvent Effects: Qualitative understanding of solvent-solute effects on reactivity. Thermodynamic measure of solvation. Effects of solvation on reaction rates and equilibria. Various empirical indexes of solvation based on physical properties, solvent-sensitive reaction rates, spectroscopic properties and scales for specific solvation. Use of solvation scales in mechanistic studies. Solvent effects from the curve-crossing model.

←◙→

M.Sc CHY Sem. III Gr. III Paper – VI **(P C 3074)**

Chemical Dynamics-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Atmospheric Reactions-I: Physical structure of the atmosphere, chemical composition of the atmosphere, Kinetic and mechanism of NOx, ClOx cycles and H_2+O_2 reaction. Mechanism of general methane oxidation.

Unit-II

Atmospheric Reactions-II:

(a)Kinetics and mechanism of low temperature oxidation of methane. Concept of global warming.

(b) **Oscillatory Reactions:** Autocatlysis and oscilatory reactions, Kinetics and mechanism of Belousov-Zhabotinski (B-z) reactions.

Unit-III

Enzymes and Inhibitions: Kinetics of one enzymes-Two substrate systems and their experimental characteristics. Enzyme inhibitiors and their experimetnal characteristics. Kinetics of enzyme inhibited reactions.

Unit-IV

Micelles catalysis and inhibition: Kinetics and mechanism of micelle catalyzed reactions (Ist order and second order) Various type of micelle cataeyzed reactions. Micelle inhibited reactions.

Unit-V

Dynamics of Gas-surface Reactions: Adsorption/desorption kinetics and transitin state theory. Dissociative adsorption and precursor state. Mechanism of Langimur's adsorption of the oxidation of carbon monoxide to carbon dioxide. True and apparent activation energies. Industrial imporance of heterogeneous catalysis.

←◙→

M.Sc CHY Sem. III Gr. III Paper – VII **(P C 3075)**

Electrochemistry-I

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Conversion and Storage of Electrochemical Energy Present status of energy consumption: Pollution problem, History of fuel cells, direct energy conversion by electrochemical means. Maximum intrinsic efficiency of an electrochemical converter. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs.

electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkaline fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells.

Unit-II

Electrochemical Energy Storage: Properties of Electrochemical energy stores: Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries: (i) Lead Acid (ii) Nickel-Cadmium. Modern Batteries: (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity storers: Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.

Unit-III

Irreversible Electrode processes : Criteria of irreversibility, informatino from irreversible wave.

Methods of determining kinetic parameters for quasi-rversible and irreversible waves : Koutecky's methods, Meits Israel Method, Gellings method.

Unit-IV

Electrocatalysis: Chemical catalysts and Electrochemical catalysts with special reference to purostates, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.

Unit-V

Kinetic of Electrode Process: Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (K^0) and Transfer coefficient (α), Exchange Current.

(a) Applications of Spectroscopy, (b) Photochemistry, (c) Solid State Chemistry

Scheme of examination: **MM: 70**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 14 marks.

(a) Applications of Spectroscopy

UNIT – I

Nuclear Magnetic Resonance of Paramagnetic Substances in Solution:

The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on ^{195}Pt and ^{119}Sn NMR.

Mossbauer Spectroscopy:

Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2}, Sn^{+4} compounds nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

UNIT II

Nuclear Magnetic Resonance Spectroscopy: General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and

other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto), chemical exchange, effect of duteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with dihedral angle. Simplification of complex spectra nuclear magnetic double resonance, NMR shift reagents, solvent effects, Fourier transform technique, Nuclear Overhauser Effect (NOE).

Carbon-13 NMR Spectroscopy: General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carboynl carbon), coupling constants. Two dimension NMR spectroscopy-COSY, NOESY, DEPT, INEPT, APT and INADEQUATE techniques.

UNIT III

Mass Spectroscopy: Introduction, ion production EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak. Mc Lafferty rearrangement. Nitrogen rule. High resolution mass spectroscopy. Example of mass spectral fragmentation of organic compounds with respect to their structure determination.

(b) Photochemistry

UNIT IV

Photochemistry of Carbonyl Compounds: Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, β, γ unsaturated and α, β unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.

Photochemistry of Aromatic Compounds: Isomerisations, additions

and substitutions.

Miscellaneous Photochemical Reactions: Photo-Fries reactions of anilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular Oxygen reaction. Photochemical formation of smog. Photo degradation of polymers. Photochemistry of vision.

(c) SOLID STATE CHEMISTRY:

UNIT V

Electronic Properties and Band Theory: Metals, insulators and semiconductors, electronic structure of solids, band theory, Band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors.

Optical properties: Application of optical and electron microscopy.

Magnetic Properties: Classification of materials: Effect of temperature, calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.

Bio-inorganic, Bio-organic and Bio-physical Chemistry

Scheme of examination: **MM: 52**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 10 marks and remaining four questions of 10½ marks each.

UNIT – I

(a) Bio-inorganic Chemistry:

Transport and Storage of Dioxygen:

Heam proteins and oxygen uptake, structure and function of haemoglobin, mygolobin, haemocyanin and hemerythrin, model synthetic complexes of iron, cobalt and copper.

Electron Transfer in Biology: Structure and function of metal of proteins in electron transport process, cytochromes and ion-sulphure proteins, synthetic models.

Nitrogen fixation: Biological nitrogen fixation and its mechanism, nitrogenase, Chemical nitrogen fixation.

UNIT II

(b) Bio-organic Chemistry

Co-Enzyme Chemistry: Cofactors as derived from vitamines, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate,

NAD^+, $NADP^+$, FMN, FAD, lipoic acid, vitamin B_{12}. Mechanism of reactions catalyzed by the above cofactors.

Enzyme Models: Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biomimetic chemistry, crown ethers, cryptates. Cyclodextrins, cyclodextrin-based enzyme models, calixarenes, ionophores, micelles, synthetic enzymes or synzymes.

UNIT III

Biotechnological Applications of Enzymes: Large-scale production and purification of

enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from corn starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.

UNIT IV

(c) Bio-physical chemistry

Bioenergetics: Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

Biopolymer Interactions: Forces involved in biopolymer interactions, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.

UNIT V

Biopolymers and their molecular Weights: Evaluation of size, shape, molecular weight and extent of hydration of biopolymers by various experimental techniques. Sedimentation equilibrium, hydrodynamic methods, diffusion, sedimentation velocity, viscosity, electrophoresis and rotational motions.

M.Sc CHY Sem. IV Paper –III **(P C 4063)**

Environmental Chemistry

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Tropospheric Photochemistry: Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_x. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.

UNIT II

Green House Effect: Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.

Urban Air Pollution: Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.

UNIT III

Environmental Toxicology-I:

(a) Toxic heavy metals: Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical

speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects.

(b) **Toxic Organic Compounds:** Pesticides, classification, properties and uses of organochlorine and organophosphorous pesticides, detection and damaging effects.

UNIT IV

Environmental Toxicology-II:

(a) **Polychlorinated biphenyls :** Properties, use and environmental contamination and effects.

(b) **Polynuclear Aromatic Hydrocarbons :** Source, structures and as pollutants.

UNIT V

Environmental Disaster-II

Bhopal gas tragedy, Chernobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog.

M.Sc CHY Sem. IV Gr. I Paper – IV **(P C 4064)**

Organotransition Metal Chemistry-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Transition Metal π - Complexes – II: Important reactions relating to nucleophilic and electrophilic attack on ligands and organic synthesis.

UNIT II

Transition metal compounds with bonds to hydrogen.

UNIT III

Homogeneous Catalysis-I

Homogeneous Catalysis, Stoichiometric reactions for catalysis, hydrogenation, Zeigler-Natta polymerization of olefins.

UNIT IV

Homogeneous Catalysis-II

Catalytic reactions involving carbon monoxide, oxoreaction, oxopalladation reaction, activation of C-H bond.

UNIT V

Fluxional Organometallic Compounds

Fluxionality and dynamic equilibria in compounds such as η^2 - olefine, η^3-allyl and dienyl complexes.

M.Sc CHY Sem. IV Gr. I Paper – V **(P C 4065)**

Bio-inorganic and supramolecular Chemistry-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Metals in Medicine: Metal deficiency and disease, toxic effects of metals, metals used for diagnosis and chemotherapy with particular reference to anticancer drugs.

UNIT II

Metalloenzymes-II: Copper enzymes-superoxide dismutase. Molybdenum oxatransferase enzymes-xanthine oxidase. Coenzyme vitamin B12.

UNIT III

Metal-Nucleic Acid Complexes: Metal ions and metal complex interactions. Metal complex nucleic acids.

UNIT IV

Supramolecular Chemistry-II(A): Transport processes and carrier design.

UNIT V

Supramolecular Chemistry-II(B):

Supramolecular devices. Supramolecular photochemistry, supramolecular electronic, ionic and switching devices.

M.Sc CHY Sem. IV Gr. I Paper – VI **(P C 4066)**

Photo-inorganic Chemistry-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Basics of Photochemistry-II: Energy dissipation by radiative and non-radiative processes, absorption spectra, Frank-Condon principle, photochemical stages-primary and secondary processes.

UNIT II

Excited States of Metal Complexes

Excited states of metal complexes : Comparison with organic compounds, electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations.

UNIT III

Ligand Field Photochemistry – II: Energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

UNIT IV

Redox Reactions by Excited Metal Complexes – III: Excited electron transfer, metal complexes as attractive candidates, (2,2-bipyridine and 1,10-phenanthroline complexes), illustration of reducing and oxidising

character of Ruthenium (Ru^{+2}) (bipyridal complex), comparison with Fe $(bipy)_3$; role of spin-orbit coupling-life time of these complexes.

UNIT V

Metal Complex Sensitizers: Metal complex sensitizer, electron relay, metal colloid systems, semiconductor supported metal oxide systems, water photolysis, nitrogen fixation and carbon dioxide reduction.

M.Sc CHY Sem. IV Gr. I Paper – VII **(P C 4067)**

Polymers - II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Polymer Characterization – II: Analysis and testing of polymers-chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength. fatigue, impact. tear resistance, hardness and abrasion resistance.

UNIT II

Inorganic Polymers: A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers.

UNIT III

Structure, Properties and Applications of Polymers based on Silicon, silicones, polymetalloxanes and polymetallosiloxanes, silazanes.

UNIT IV

Structure, Properties and Applications (D): Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds.

UNIT V

Structure, Properties and Applications (E): Co-ordination and metal chelate polymers.

M.Sc CHY Sem. IV Gr. II Paper – IV **(P C 4068)**

Organic Synthesis-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Organometallic Reagents – II:

Principle precipitation, properties and applications of the following in organic synthesis with mechanistic details. Transition metals. Cu, Pd, Ni, Fe, Co, Rh, Cr, and Ti compounds. Other elements S, Si, B and I compounds.

UNIT II

Reduction - I: Introduction, Different reductive processes. Alkanes, alkenes, alkynes, and aromatic rings. Carbonyl compounds-aldehydes, ketones, acids and their derivatives.

UNIT III

Reduction - II: Epoxides, Nitro, nitroso, azo and oxime groups. Hydrogenolysis.

UNIT IV

Metallocenes, Nonbenzenoid Aromatics Compounds and Polycyclic Compounds – I: General consideration. Synthesis and reactions of some representative compounds. (Tropone, tropolone, azulene.)

UNIT V

Metallocenes, Nonbenzenoid Aromatics Compounds and Polycyclic Compounds – II: General consideration. Synthesis and reactions of some representative compounds. (Ferrocene, phenanthrene, fluorine and indene).

M.Sc CHY Sem. IV Gr. II Paper – V **(P C 4069)**

Organic Synthesis-IV

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Two Group C-C Disconnections-I: Diels-Alder Reaction, 1,3-difunctionalised compounds, α, β- unsaturated carbonyl compounds, control in carbonyl condensations.

UNIT II

Two Group C-C Disconnections-II:

1,5-difunctionalised compounds. Micheal addition and Robinson annelation.

UNIT III

Ring Synthesis: Saturated heterocycles, synthesis of 3,4,5 and 6 membered rings. aromatic heterocycles in organic synthesis.

UNIT IV

Synthesis of Some Complex Molecules – I: Application of the above in the synthesis of following compounds: Camphor, Longifoline, Cortsone, Reserpine.

UNIT V

Synthesis of Some Complex Molecules – II: Vitamin D, Juvabione, Aphidicolin and Fredericamycin A.

M.Sc CHY Sem. IV Gr. II Paper – VI **(P C 4070)**

Heterocyclic Chemistry-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Non-aromatic Heterocycles: Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformatino of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Stereo-electronic effects anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions.

UNIT II

Heterocyclic Synthesis: Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions.

UNIT III

Meso-ionic Heterocycles

General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.

UNIT IV

Benzo-Fused Five-Membered Heterocycles

Synthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.

UNIT V

Heterocyclic Systems Containing P: Heterocyclic rings containing phosphorus, Introduction, nomenclature, synthesis and characteristics of 5- and 6-membered ring systems - phosphorinanes, phosphorines, phospholanes and phospholes.

Heterocyclic rings containing As and Sb: Introduction, synthesis, reactivity and special characteristics of 3-, 5- and 6-membered ring system.

Heterocyclic rings containing B: Introduction, synthesis, reactivity and spectral characteristics of 3- 5- and 6- membered ring systems.

M.Sc CHY Sem. IV Gr. II Paper – VII **(P C 4071)**

Chemistry of Natural Products-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Steroids – I: Occurrence, nomenclature, classification, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, structure, determination and synthesis of Cholesterol and Bile acids.

UNIT II

Steroids – II: Structure, determination and synthesis of Androsterone, Testosterone, Estrone, Progestrone, Aldosterone, Biosynthesis of Steroids.

UNIT III

Plant Pigments – I: Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin Quercetin, Myrcetin, Quereentin, β-glucoside and Vitexin.

Plant Pigments – II: Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Diadzein, Buttein, Ireusin Cyanidin-7, arabinoside, Cyanidin, Esutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway.

UNIT IV

Prophyrins: Structure and synthesis of Haemoglobin and Chlorphyll.

UNIT V

Pyrethroids and Rotenones: Synthesis and reactions of Pyrethroids and Rotenones. (For structure educidation, emphasis is to be placed on the use of spectral parameters wherever possible).

M.Sc CHY Sem. IV Gr. III Paper – IV **(P C 4072)**

Analytical Chemistry-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Introduction: Sample separation-dissolution and decompositions. Gravimetric techniques. Selecting and handling of reagents. Laboratory notebooks. Safety in the analytical laboratory.

UNIT II

Analysis of Water Pollution – II:

Heavy metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, managanese, mercurry and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurements of DO, BOD, and COD. Pesticides as water pollutants and analysis. Water pollution laws and standards.

UNIT III

Analysis of soil and Fuel: (a) Analysis of Soil, moisture pH, total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts.

(b) Fuel analysis : liquid and gas. Ultimate and proximate analysis-heating values-grading of coal. Liquid fuels-flash point, aniline point,

octane number and carbon residue. Gaseous fuels-producer gas and water gas-calcorific value.

UNIT IV

Clinical Chemistry: Composition of blood-collection and preservation of samples. Clinical analysis. Serum electrolytes, blood glucose, blood urea nirogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates. Immunoassay : principles of radio immunoassay (RIA) and applications. The blood gas analysis trace elements in the body.

UNIT V

Drug analysis : Narcotics and dangerous drugs. Classification of drugs. Screeing by gas and hing-layer chromatography and spectrophotometric measurements.

M.Sc CHY Sem. IV Gr. III Paper – V **(P C 4073)**

Physical Organic Chemistry-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Acids, Bases, Electrophiles, Nucleophiles and Catalysis: Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity functions and their applications. hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The a-effect. Ambivalent nucleophiles. Acid-base catalysis-specific and general catalysis. Bronsted catalysis, Nuceophilic and electrophilic catalysis. Catalysis by noncovalent binding-micellar catalysis.

UNIT II

Steric and Conformation Properties: Various type of steric strain and their influence on reactivity. Steric acceleration. Molecular measurements of steric effects upon rates. Steric LFET, Conformational barrier to bond rotation-spectroscopic detection of individual conformers. Acyclic and monocyclic systems. Rotation around partial double bonds. Winstein-Holness and Curtin-Hammett principle.

UNIT III

Nucleophilic and Electrophilic Reactivity: Structural and electronic effects on SN1 and SN2 reactivity. Solvent effect Kinetic isotope effects.

Intromolecular assistance. Electron transfer nature of SN2 reaction. Nucleophilicity and SN2 reactivity based on curvedcrossing mode. Relationshiop between polar and electron transfer reactions SRN1 mechanism. Electrophilic reactivity, general mechanism. Kinetic of SE2 Ar reaction. Structural effects on rates and selectivity. Curve-crossing approach to electrophilic reactivity.

UNIT IV

Radical and Pericyclic Reactivity: Radical stability, polar influences, solvent and steric effects. A curve crossing approach to radical addition, factors effecting barrier heights in addition, regioselectivity in radical reactions. Reactivity, specificity and periselectivity in pericyclic reactions.

UNIT V

Supramolecular Chemistry: Properties of covalent bonds-bond length, inter-bond angles, force constant, bond and molecular dipole moments. Molecular and bond polarizability, bond dissociation enthalpy, entropy. intermolecular forces, hydrophobic effects. Electrostatic, induction, dispersion and resonance energy, magnetic interactions, magnitude of interaction energy, forces between macroscopic bodies, medium effects. Hydrogen bond. Princples of molecular association and organization as exemplified in biological macromolecules like enzymes, nucleic acids, membranes and model system like micelles and vesicles. Molecular receptors and design principles. Cryptands, cyclophanes, calixeranes, cyclodextrines. Supramolecular reactivity and catalysis. Molecular channels and trnasport processes, Molecular devices and nanotechnology.

M.Sc CHY Sem. IV Gr. III Paper – VI **(P C 4074)**

Chemical Dynamics-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Radiation Chemistry: Radiation chemistry and photochemistry. Radiation chemistry of water and aqueous solutions. Hydrogen atom and hydroxyl radical-oxidizing and reducing conditions. Kinetics and mechanism of photochemical and photosensitized reactions (One example in each case). Stern-Volmer equation and its application. Hole-concept in the presence of semiconductor type photocatalysis. Kinetics and mechanism of electron transfer reaction in the presence of visible light. Kinetics of exchange reactions (Mathematical analysis).

UNIT II

Transition State: A brief aspect of statistical mechanics and transition state theory. Application in calculation of the second order rate constants for reactions with collision for (1) and + (2) atom + molecular (3) + molecule reactions. Static solvent effects and thermodynamics formulations. Adiabatic electron transfer reactions, energy surfaces.

UNIT III

Substitution Reactions – I: Substitution reactions. Classification of ligand substitution mechanism. Anation and base catalyzed kinetics of anation reactions. Aquation and acid catalyzed kinetics of aquation reactions (octahedral complexes). Inner-sphere electron transfer reactions

and mechanism. Various types of inner sphere bridges, adjustment and remote attack. Linkage isomerism.

UNIT IV

Substitution Reactions – I: Chemical and resonance mechanism. Marcus-Cross relation in outersphere reactions (no mathematical derivation). Its application in reactions : Ce(IV) + $Mo(CN)_6^{4-}$ —>Ce(III) + Mo $(CN)_6^{3-}$, $Fe(CN)_6^{3-}$ + $Fe(CN)_6^{4-}$ $Fe(CN)_6^{4-}$ + $Fe(CN)_6^{3-}$ Bridged outer-sphere electron transfer mechanism. Kinetics of reactions in the presence of cyclodextrines. Considering one full case study, Nucleophilic and electrophilic catalyst and their mode of action.

UNIT V

Metal ion catalysis and induced Phenomena: Metal ion catalyzed reactions, their kinetics and reaction mechanism in solutions. Induced reactions, their characteristics. Mechanism of (i) Fe (II) induced oxidation of iodine by Cr(VI). (ii) As (III) induced oxidation of Mn (II) by chromate in acid solutions. Kinetics and mechanism of induced reactions in metal complexes (octahedral complexes of Cobalt (III) only). Kinetics of hydroformylation reaction.

M.Sc CHY Sem. IV Gr. III Paper – VII **(P C 4075)**

Electrochemistry-II

Scheme of examination: **MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Corrosion and Stability of Metals: Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential -pH (or Pourbaix) Diaphragmal; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate: (i) Weight Loss method, (ii) Electrochemical Method.

UNIT II

Inhibiting Corrosion : Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors.

UNIT III

Bioelectrochemistry : Bioelectrodics, Membrane Potentials, Simplistic theory, Modern theory, Electrical conductance in biological organism: Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes.

UNIT IV

Potential Sweep Method: Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cyclic voltammetry. Controlled current microelectrode techniques: comparison with controlled potentials methods, chronopotentiometry, theory and applications.

UNIT V

Bulk Electrolysis Methods : Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis: anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.