

NEHRU GRAM BHARATI UNIVERSITY

KOTWA-JAMUNIPUR, DUBAWAL, ALLAHABAD (U.P.)

(Approved by Board of Studies :22-10-16)

SYLLABUS : CHEMISTRY



B.Sc. Part - I, II, III
DEPARTMENT OF CHEMISTRY

There shall be three written papers and a practical examination as follows:-

B.Sc.- Part I

Paper-I	Inorganic Chemistry	M.M. 34	3 Hours
Paper-II	Organic Chemistry	M.M. 33	3 Hours
Paper-III	Physical Chemistry	M.M. 33	3 Hours
Practicals		M.M. 50	6 Hours

B.Sc.- Part II

Paper-I	Inorganic Chemistry	M.M. 34	3 Hours
Paper-II	Organic Chemistry	M.M. 33	3 Hours
Paper-III	Physical Chemistry	M.M. 33	3 Hours
Practicals		M.M. 50	6 Hours

B.Sc.- Part III

Paper-I	Inorganic Chemistry	M.M. 50	3 Hours
Paper-II	Organic Chemistry	M.M. 50	3 Hours
Paper-III	Physical Chemistry	M.M. 50	3 Hours
Practicals		M.M. 75	6 Hours

Candidates will be required to pass in Theory and Practical separately.

B.Sc.- Part I
Paper -I
Inorganic Chemistry
Unit -I

Atomic Structure:

Bohr's and Sommerfield's atomic models, de-Broglie equation, Heisenberg uncertainty principle, Schrodinger wave equation, Significance of wave function, Radial and angular wave functions, quantum numbers, shapes of s p d and f orbital, Aufbau's principle and electronic configuration of atoms, Paul's exclusion principle and Hund's rule of maximum multiplicity. Periodic classification of elements, long form of the periodic table including transuranic elements.

Periodic Properties of the elements :

Atomic, covalent and Ionic radii, Ionization potential, electron affinity, Electronegativity including trends in periodic table and applications in predicting and explaining the chemical behaviour, Lattice energy and hydration energy and their relation to solubility of ionic compounds.

Unit II

Chemical Bonding:

Ionic, Covalent (polar and non polar) Coordinate bond, Sigma and pi-bonds, odd electron bonds, hydrogen bond, Vander Walls Forces and metallic bond. Covalent character in ionic bonds, partial ionic character of covalent bond.

Coordination Chemistry:

Double salts and coordination compounds, Werner's theory, Chelates Sedgwick's concept of effective atomic number, IUPAC system of nomenclature of coordination compounds.

Unit III

Electrode Potential:

Electrode potential and electro-chemical series, Electrode potential diagram and its application.

Extraction of Elements:

General principle of extraction and purification of metals. Occurrence and isolation of the elements. Extraction and isolation of Li, Be and Ra from their minerals.

Unit IV

Chemistry of Zero Group and S-block elements:

(a) Isolation and separation of inert gases from air and compounds of inert gases.

(b) Cooperative study, diagonal relationships. Organometallic compounds of Li, Na, K, Be and Mg. Polymer complexes (Crown ether complexes) of alkali metals.

Preparation, Properties and Uses of:

(a) Heavy water, Lithium tetra hydro aluminate, Lithium separate, Basic beryllium acetate.

(b) Structure and Bonding of : H_2O_2 , Basic beryllium acetate, $\text{Be}(\text{BH}_4)$, $\text{Be}(\text{Me})_2$, Anhydrous beryllium chloride, Polymeric Calcium compounds.

Unit V

Principle involved in Qualitative and Volumetric analysis:

(a) Chemical reactions in qualitative analysis of inorganic mixture.

(b) Application of Coordination compounds in qualitative analysis.

(c) General principles of Volumetric analysis, Redox reactions, Equivalent weight, normality, molarity, and molality,

(d) Solubility product, Common ion effect, Co-precipitation post-precipitation

B.Sc.- Part I
Paper -II
Organic Chemistry
Unit-I

Structure of Bonding:

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Resonance, hyper conjugation, aromaticity, inductive effect, electromeric effect, mesomeric effect, hydrogen bonding.

Mechanism of Organic Reactions: Curves arrow rotation, drawing electron movements with arrows, half headed and double headed arrows, Homolytic and heterolytic bond fission. types of reagents electrophiles and nucleophiles, Types of organic reactions.

Reactive intermediates : carbocations, carbanions, free radicals, arynes, Carbenes and nitrenes (with examples)

Unit -II

Stereochemistry of Organic Compound:

Concept of isomerism and types of isomerism.

Optical isomerism- elements of symmetry, Molecular Chirality, enantiomers, stereogenic centre, optical activity, Properties of enantiomers, chiral and achiral molecules with stereogenic centers, diastereomers, threo and erythro Diastereomers, Meso compounds, resolution of Enantiomers Retention racemization and Inversion.

Relative and absolute configuration, **sequence** rules. D & L and R & S system of Nomenclature.

Geometrical isomerism : Elementary idea of geometrical isomerism, determination of configuration of geometric isomers. E & Z system of Nomenclature geometric isomerism in oximes and alicyclic compounds. Difference between configuration and confirmation.

Unit-III

Alkanes and cycloalkanes:

IUPAC nomenclature, Methods of preparation (with special reference to Wurtz reaction, Kolbe Reaction, Corey-house Reaction and decarboxylation of carboxylic acid) physical and chemical properties of alkanes.

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

Cycloalkanes- Nomenclature, Methods of preparation, chemical properties, Baeyer's strain theory and its limitation, Ring, Strain in small rings, (cyclopropane), theory of strained rings The case of cyclopropane ring: banana bonds.

Alkenes, Dienes and Alkynes:

Nomenclature of alkene, method of preparation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, The Saytzeff rule, Hofmann, elimination, chemical properties and relative stabilities of alkenes. Mechanism involved in by hydrogenation, Markownikoff's rule Industrial application of ethylene and propene.

Nomenclature and classification of dienes : Isolated, conjugated and cumulated dienes. Method of preparation, polymerization. Chemical reaction-1,2 and 1,4 addition, Diels-alder reaction.

Alkynes : Nomenclature, structure and bonding in alkynes. Method of formation, chemical properties and Acidity of Alkynes.

UNIT-IV**Arenes and Aromaticity:**

Structure of Benzene : Resonance structure, MO picture Nomenclature of benzene derivatives, the aryl group, Aromatic Nucleus and side chain, structure of benzene, Resonance structure and Mopicture.

Aromaticity: The Huckel rule, aromatic ions, Aromatic electrophilic substitution- general pattern of the mechanism, role of π -complexes, mechanism of nitration, halogenation, sulphonation mercuration and Friedel-Crafts reaction.

Unit-V**Alkyl and Arylhalides:**

Nomenclature and class of alkyl halides, Methods of formation, chemical reactions, mechanisms of nucleophilic substitution reaction of Alkyl halides SN^1 and SN^2 reaction with energy profile diagrams.

Polyhalogen compound: Chloroform and Carbon tetrachlorides. Method of formation of arylhalides, nuclear and side chain reaction. The addition-elimination and the elimination-addition mechanism of nucleophilic aromatic substitution reaction.

Relative reactivities of alkyl halides Vs alkyl, Vinyl and aryl halides Synthesis and uses of DDT and BHC.

B.Sc.- Part I
Paper -III
Physical Chemistry
Unit I

Gases:

Postulates of Kinetic theory of gases and gas laws, specific heat ratio C_p/C_v , deviation from ideal gas behaviour, vander Waals equation of state, critical constants and their determination. Reference to some other equations of state e.g. Bertheot and Dieterici. Law of corresponding states. Maxwell Law of Distribution of velocity (Qualitative treatment.)

Unit-II

The First Law of Thermodynamics:

Thermodynamics terms and statement of the first law, thermodynamic reversibility and maximum work, enthalpy of a system, heat capacity at constant volume and at constant pressure. Extensive and intensive properties, state functions and exact differentials, cyclic rule, integration factor. Variation of internal energy with temperature and volume, enthalpy as a function of temperature and pressure. Relation between C_p and C_v .

Joule-Thomson effect: Joule and Joule-Thomson effect, Joule-Thomson coefficient. Inversion temperature. Van der Waals equation and J-T effect.

Important thermodynamic quantities (W, Q, E and H) in an isothermal expansion of an ideal gas and adiabatic expansion of an ideal gas. Calculations of various thermodynamic quantities for Vander Waals gases undergoing various operations under different conditions.

Unit III

Thermo chemistry :

Heat of reaction, formation, combustion and neutralisation, solvation, dilution and hydration, Hess's law and its application, Bond energy and resonance energy.

Unit IV

Chemical Kinetics:

Reaction rate, order and molecularity of reaction, zero, first, second and third order reactions. Methods for determining the order of reaction. Complex reactions, opposing reactions, consecutive reactions and side reactions with reference to first order reactions. Effect of temperature on reaction velocity. Energy of activation and to experimental determination. collision theory of bi-molecular gaseous reactions.

Unit V

Electrochemistry:

Electrolytic conductance: equivalent conductance, molar conductance, variation of conductance with concentration, Kohlrausch's law of independent migration of ions, conductance ratio, effect of other factors on conductance. Qualitative treatment of the Debye-Huckel theory of strong electrolytes, Ionic mobilities, transport number, determination of transport number (Hittorf and moving boundary method). Some applications of conductance measurements. Hydrolysis of salts. Bronsted and Lewis acids and bases. pH and pKa, acid-base concept in non-aqueous media, Buffer solutions. Theory of acid-base indicators.

Applications of Conductivity, measurements, determination of degree of dissociation, determination of K_a of acids. Determination of solubility Product of a sparingly soluble salt, conductometric titrations.

B.Sc.- Part I
Chemistry Practical

Time : 6 Hours (one day)

M.M.-50

1. Analysis of inorganic mixture (semi-micro) for five radicals including insoluble and interfering radicals. **-15 Marks**
2. Volumetric Analysis:
 - (i) Determination of Iron using $K_2Cr_2O_7$ **-15 Marks**
 - (ii) Iodometry and Iodimetry (determination of Copper, dichromate and arsenious oxide)
3. Detection of elements and functional groups in organic compounds. **-10 Marks**
5. Record and Viva-Voce **(5 + 5)= 10 Marks**

Syllabus of B.Sc. Part-II

There shall be three written papers and a practical examination as follows:-

Paper-I	Inorganic Chemistry	M.M. 34	3 Hours
Paper-II	Organic Chemistry	M.M. 33	3 Hours
Paper-III	Physical Chemistry	M.M. 33	3 Hours
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B.Sc.- Part II

Paper -I

Inorganic Chemistry

Unit - I

Chemical Bonding and Shapes of Molecules :

Covalent bond, Hybridization of orbitals and directional nature of covalent bond, Sidgwick- Powell theory, VSEPR theory, Shapes of Molecules (inorganic) and anions (BeCl_2 , BF_3 , NH_3 , H_2O , OF_2 , Cl_2O , ClO_2 , PCl_3 , PCl_5 , SF_4 , ClF_3 , ICl_3 , BrF_5 , IF_7 , XeF_2 , XeF_4 , ClO_4^- , I_3^-), MO theory homonuclear and heteronuclear (CO and NO) diatomic molecules.

Unit - II

P-Block Elements:

Chemical reactivity and group trend of elements, hydrides and halides (synthesis, properties and structure), Application of redox potential diagrams with reference to N, P, S, Cl, Br and I. Oxy acids of N, P, S and halogens, Interhalogens, Pseudohalogens and polyhalides.

d- Block Elements :

Transition elements, General Characteristics, Variable oxidation states, Complex formation, colour, magnetic properties and catalytic properties. Comparative account of 3d, 4d and 5d transition metals with respect to their atomic and ionic sizes, stability of oxidation states and magnetic properties.

Coordination Chemistry:

Isomerism in coordination compounds, stereo chemistry of complexes involving coordination number 4 and 6.

Unit - III

Extraction of elements :

Extraction of isolation of the following elements B, F, Ge, Cr, Ni.

Unit - IV

Inorganic Compounds-Preparation, Properties and uses of :

Boric acid, Borides, Diborane, Febrons Alumina, Zirconia, Silanes, Ultrapine Si and Ge. Hydrozine, hydroxylamine, hydrozoic acid, hyponitrons acid, potassium hexacyano ferrate (i) and ferrite (iii) sodium hexanitrita cobaltate(iii)

Inorganic Compounds- Structure and bending of :

Diborane, Borazine, Phophazine, Dimeic aluminium chloride (Al_2Cl_6) Ae $(BH_4)_3$, hyponitrons acid, Hydrazoic acid, Nickel carbeuyl.

Unit - V

Gravimetry :

Principles of gravimetric analysis, Co precipitation, post precipitation and super saturation.

B.Sc.- Part II

Paper -II

Organic Chemistry

Unit-I

Electromagnetic Spectrum : Absorption Spectra -

Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-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. UV spectra of conjugated enes and enones.

Infrared (IR) absorption spectroscopy- molecular vibrations.

Hooke'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-II

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 [$\text{Pb}(\text{OAc})_4$ and (HIO_4)] and pinacol- pinacolone rearrangement.

Trihydric alcohols-Methods of formation, chemical reactions of glycerol.

Phenols:

Preparation of phenols, acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carbxylation. Mechanisms of Fries rearrangement" Claisen rearrangement, Gatterman Synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

UNIT-III

Ethers and Epoxides :

Ethers- Williamson's synthesis, Reaction with HX Synthesis of epoxides, Acid and base- catalyzed ring opening of epoxides, orientation of epoxide ring opening, reaction of Grignard and organolithium reagents with epoxides.

Aldehydes and Ketones:

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 acid.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevengel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Bayer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAlH_4 ; and NaBH_4 , reductions. Halogenation of enolizable ketones.

UNIT-IV

Carboxylic Acids :

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

decarboxylation.

Methods of formation and chemical reactions of halo acids and hydroxy acids.

Carboxylic Acid Derivatives:

Relative stability of acyl derivatives. Interconversion of acid derivatives by nucleophilic acyl substitution.

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

UNIT-V

Organic Compounds of Nitrogen :

Preparation of nitro alkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.

Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines.

(reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds Gabriel-phthalimide reaction, Hofmann bromamide reaction.

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

B.Sc.- Part II
Paper -III
Physical Chemistry

Unit - I

Thermodynamics

Second Law of thermodynamics: need for the law, different statements 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

Chemical Equilibrium:

Law of mass action and its application to homogeneous and heterogeneous equilibria, Le-Chatelier principle and its application to chemical equilibrium. Degree of dissociation and abnormal molecular weights.

Equilibrium constant and free energy - Thermodynamic derivation of law of mass action.

Reaction isotherm and reaction isochore- Clausius-Clapeyron equation and Clapeyron equation and its applications.

Unit III

Phase Equilibrium:

Statement and meaning of the terms- Phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibrium of one component system-water, S system. Phase equilibrium of two component system- solid-liquid equilibrium, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead.

Nernst distribution law-thermodynamic derivation of the distribution law, limitations and applications of the distribution law.

Unit IV

Electrochemistry

Types of reversible electrodes- Gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. 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. e.m.f. of cell and its measurements. Computation of cell. e.m.f. of calculation of thermodynamic quantities of cell reactions (ΔG , ΔH and ΔK) polarization, over potential and hydrogen over-voltage.

Definition of pH and pKa determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers-mechanism of buffer action, Henderson-Hassel equation; Hydrolysis of salts.

Corrosion-types, theories and methods of combating it.

Unit V

Surface Phenomenon : Physical and chemical adsorption Freundlich adsorption isotherm, Gibb's adsorption isotherm, Langmuir's theory of monomolecular adsorption. B.E.T. theory.

Colloids : Preparation of colloids, theories of stability of colloids, Determination of size of colloidal particles, Electrokinetic potential (Zeta potential). Donnan membrane theory and its applications.

B.Sc.- Part II
Chemistry Practical

Time : 6 Hours (one day)

M.M.-50

1. **Gravimetric Analysis:** **-10 Marks**
 - i. Barium as BaSO_4
 - ii. Iron as Fe_2O_3
 - iii. Zinc as ZnO
 - iv. Copper as CuO
2. **Organic preparation (one step) and crystallization:** **-15 Marks**
 - i. Acetylation
 - ii. Osazone formation
 - iii. Picrate formation
 - iv. Azo-dye formation
3. **Physical Chemistry experiments:** **-15 Marks**
 - i. Experiments of surface tension (using stalagmometer)
 - ii. Experiments on viscosity (using viscometer)
 - iii. Partition coefficient determination.
 - iv. Molecular weight determination of a volatile substance (by Victor Meyers method)
4. **Records and Viva-Voce** **(5+5)=10 Marks**

Syllabus of B.Sc. Part-III

There shall be three written papers and a practical examination as follows:-

Paper-I	Inorganic Chemistry	M.M. 50	3 Hours
Paper-II	Organic Chemistry	M.M. 50	3 Hours
Paper-III	Physical Chemistry	M.M. 50	3 Hours
Practical's		M.M. 75	6 Hours

Candidates will be required to pass in Theory and Practical separately.

B.Sc.- Part III

Paper -I

Inorganic Chemistry

- Theories of Covalent bond :**
Valence bond theory-Heitler-London and Pauling Slater theories and resonance, Molecular orbital theory-LCAO method, bonding, non-bonding and anti bonding molecular orbitals, Molecular orbital energy level diagrams for homonuclear and heteronuclear diatomic molecules, electronic structure, bond order, bond length, and bond energy.
- Theories of coordination bond-**
Valence bond theory and its limitations, crystal field theory-d orbital splitting in octahedral and tetrahedral crystal fields, Ligand field splitting ($10Dq$) and factors affecting its magnitude, spectrochemical series. Crystal field stabilization energies (CFSE) for d^1 to d^{10} systems in octahedral and tetrahedral fields.
- Metals and Metallurgy:**
Comparative study of the chemistry of d block elements and their important compounds. Application of reduction potential diagram. Metallurgical extraction of Ti, V, Ni, W and Re.
- 4 f block elements:**
Characteristics-Electronic structure, lanthanide contraction its consequences, oxidation states, complex formation, magnetic properties, their differences from transition metals. Separation of lanthanides
- Silicones and Phosphazenes:**
Silicones and phosphazenes as example of inorganic polymers, nature of bonding in triphosphazenes.
- Structures and Characteristics of Solids:**
Metallic, Ionic, and molecular crystals. structures of ionic solid-radius ratio rules. Structure of metals-close-packed structures, characteristics of unit cells.
- Environmental Pollution:**
Air pollutions, Acid rain and green house effects, Water pollutions.

8. **Bioinorganic chemistry :**

Essential and trace elements. Chemistry of chlorophyll, Haemoglobin, Myoglobin and Cyanocobalamin, biological role of alkali and alkaline earth metal ions. Nitrogen fixation.

B.Sc.- Part III
Paper -II
Organic Chemistry

Unit I

1. **Spectroscopy -**

Nuclear magnetic resonance (N. M. R.) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, area of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethyl acetate, toluene and acetophenone.

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

Unit- II

Organometallic Compounds :

Organomagnesium compounds: The Grignard reagents-formation, structure and chemical reactions.

Organozinc compounds : formation and chemical reactions.

Organolithium compounds : formation and chemical reactions.

Organosulphur Compounds:

Methods of formation and chemical reactions of thiols, thio-ethers, sulphonic acids, sulphonamides and sulphaguanidine.

Unit III

Heterocyclic compounds:

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 substitutions. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napleralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit IV

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 acetatoacetate. Alkylation of 1, 3-dithianes, Alkylation and acylation of enamines.

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 (+) - glucose, Mechanism of mutarotation. Disaccharides-maltose, sucrose and lactose, structure determination.

Unit V

Amino Acids, Peptides and Proteins:

Amino acids, acid-base behaviour, isoelectric point and electrophoresis, Preparation and reactions of α -aminoacids. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Solid-phase peptide synthesis.

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 and polyurethanes.

Natural and synthetic rubbers.

B.Sc.- Part III
Paper -III
Physical Chemistry
Unit -I

1. **Third Law of thermodynamics** : Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs functions (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T. Thermodynamics derivation of the law of mass action, reaction isotherm and Van't Hoff equation (influence of temperature on equilibrium constant). Thermodynamics derivation of phase rule. Partial molar quantities. Chemical potential, Gibbs-Duhem equation, Chemical potential and other thermodynamic functions. Effect of temperature on chemical potential. Effect of pressure on chemical potential. Chemical potential of real gases and fugacity of real gases. Colligative properties (thermodynamic treatment) : Lowering of vapour pressure, osmotic pressure, elevation of boiling point and depression of freezing point.

Unit -II

Chemical Kinetics and Catalysis: Steady state approximation Lindemann's theory of unimolecular reaction. Quantitative treatment of transition state theory of reaction rates. Primary salt effect in ionic reactions. Kinetics of homogeneous, acid-base and enzyme catalysis, heterogeneous catalysis, negative catalysis and inhibition. Effect of pH and temperature on enzyme catalysis. Effect of temperature on surface reaction. Promoters and poisons.

Unit -III

Photochemistry:

Absorption of light, Chain reaction, free radical chains (Rice-Heertzfeld mechanism for the decomposition of ethane). Lambert's and Beer's law, Grothaus-Draper law, Einstein's law of photochemical equivalence, quantum efficiency, reasons for low and high quantum yields. Kinetics of some typical photochemical reactions (Decomposition of acetaldehyde, dimerisation of anthracene). Photo electric cell. Photosensitization.

Unit -IV

Atomic structure: Bohr's theory, Sommerfield's model, dual nature of electron, de-Broglie's equation. Experimental verification of the wave nature of electron (Davisson and Germer's experiment). Heisenberg's uncertainty principle. Derivation of Schrodinger's wave equation, Applications of Schrodinger's wave equation, two particle in a one dimensional and three dimensional box and physical significance of the wave function.

E.M.F. : Concentration cells with and without transference, liquid junction potential, fuel cells, chemical cells without transference.

Unit -V

Nuclear Chemistry: Radioactive decay and equilibrium, nuclear reactions, Q value, cross sections, type of reactions, Chemical effects of nuclear transformations. Natural and artificial radioactivity, theory of nuclear disintegration; disintegration and displacement laws; radioactive series; nuclear bindings energy ; nuclear reaction; fission and fusion products and fission yields, radioactive isotopes and their uses. Radioactive techniques; tracer technique, neutron activation analysis, counting technique such as G.M. ionization and preoperational counter.

B.Sc.- Part III
Chemistry Practical

Time : 6 Hours (one day)

M.M.-75

1. **Inorganic:** **-20 Marks**
- i. Paper chromatographic separation of metal ions (binary mixture only)
 - ii. Colorimetric determination of metal ions.
 - iii. Solvent extraction separation and estimation of Mg (ii) and Fe(ii)
 - iv. Ion exchange Method- Separation and estimation of Mg (ii) and Zn(ii)
 - v. EDTA titrations of Ca^{2+} , Mg^{2+} , Zn^{2+} and Cu^{+2}
 - vi. Determination of hardness of water by EDTA.
2. **Organic:** **-20 Marks**
- i Paper chromatographic separation of amino acids and sugars (only binary mixtures)
 - ii. Determination of acid value of a vegetable oil.
 - iii. Determination of iodine value of a vegetable oil.
 - iv. Determination of saponification value of vegetable oil.
3. **Physical** **-20 Marks**
- i. Hydrolysis of methyl acetate catalyses by an acid.
 - ii. Hydrolysis of Ethyle acetate.
 - iii. Acetone iodine reaction Catalysed by H^+
 - iv. Heat of neutralization of NaOH an HCl
 - v. Molecular weight determination of a volatile substance by Duma's method
 - vi. To study the effects of acid strength on the hydrolysis of an ester. Acid strength on the hydrolysis of an ester.
4. **Records and Viva-Voce** **(8 + 7)=15 Marks**