UNDERGRADUATE SYLLABUS OF CHEMISTRY

Under FYUGP (NEP-2020)

[MINOR COURSE]

DEPARTMENT OF CHEMISTRY

Jagannath Barooah College

(An Autonomous College Affiliated to Dibrugarh University)

Barpatra Ali, Jorhat-785001 (Assam)

SEMESTER-I

Paper Title : **GENERAL CHEMISTRY-I (THEORY)**
Paper Code : **CHMMI-011**
Course No : **C- 01**
Credits : **04**
No. of Classes : **60**
Total Theory Marks : **100 (End Semester: 70; In Semester: 30)**

Course Objectives:

- To understand the important features of the quantum mechanical model of atom.
- To know the position and properties of elements, predict chemical reactions, understand trends in periodic properties among different elements.
- To introduce with a variety of structural aspects of organic molecules that are designed to lay the foundations for the study of the organic molecule.
- To impart basic knowledge of the gaseous state of matter; to understand the basic properties of liquids and their application.

Course Outcome: Students will gain an understanding of

- Quantum mechanical model of atom; concept of wave function, contour diagram, probability diagram etc.
- Properties of elements, atomic radii, ionic radii, size effect of ionic bond, solvation energy, covalent character of ionic bond, redox equations etc.
- Organic compounds, their classification, nomenclature; reaction of aliphatic hydrocarbons.
- Kinetic molecular model of a gas, behaviour of real gases etc.; various physical properties of liquids with special reference to surface tension and viscosity.

SECTION A: INORGANIC CHEMISTRY - I

UNIT-I: Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

(10 Lectures; Marks: 13)

UNIT-II: Periodicity of Elements: Modern periodic table. s, p, d, f block elements, Detailed discussion of the following properties of the elements, with reference to s and p-block. Effective nuclear charge, shielding or screening effect and their variation, Slater rules, Atomic radii (van der Waals), Ionic and crystal radii, Covalent radii (octahedral and tetrahedral), Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy, Electron gain enthalpy, trends of electron gain enthalpy. Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio. Covalent character in ionic compounds, Polarising power and polarizability, Fajan's rules and consequences of polarization, Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

(10 Lectures; Marks: 10)

SECTION B: ORGANIC CHEMISTRY- I

UNIT-III: **Basics of Organic Chemistry:** Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric effect, resonance and mesomeric effects, hyperconjugation and their applications. Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions. Comparative study with emphasis on factors affecting pKa values. Aromaticity: Benzenoids and Hückel's rule.

(10 Lectures; Marks: 12)

UNIT-IV: Chemistry of Aliphatic Hydrocarbons: Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation - relative reactivity and selectivity. Carbon-Carbon pi Bonds: Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1- butene, toluene, ethyl benzene. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

(10 Lectures; Marks: 12)

SECTION C: PHYSICAL CHEMISTRY – I

UNIT-V: Gaseous State: Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Behaviour of Real Gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

(15 Lectures; Marks: 17)

UNIT- VI: Liquid State: Molecular forces and general properties of liquids. **Surface Tension:** surface tension, surface energy, effect of temperature on surface tension, shapes of liquid drops and soap bubbles, capillary action, determination of surface tension by capillary rise method, drop weight and drop number methods using stalagmometer. Effect of temperature on surface tension. Parachor, Additive and constitutive properties: atomic and structural parachor. Elucidation of structure of benzene and benzoquinone. **Viscosity:** Definition, viscosity coefficient, fluidity, molecular viscosity, relative viscosity and absolute viscosity, determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces.

(5 Lectures; Marks: 6)

Text Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 10th Ed., Oxford University Press (2014).

Reference Books:

- Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970.
- Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
- Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
- Kapoor, K. L. *A Textbook of Physical Chemistry*, Vol. 1

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SEMESTER-II

Paper Title : GENERAL CHEMISTRY-II (THEORY)
Paper Code : CHMMI-021
Course No : C- 02
Credits : 04
No. of Classes : 60
Total Theory Marks : 100 (End Semester: 70; In Semester: 30)

Course Objectives:

- To understand the different types of bonds formed by atoms and their chemical approaches of bonding and shape of molecules.
- To impart basic knowledge on transition metals and their applications.
- To impart knowledge on stereochemistry and importance of alkyl and aryl halides.
- To introduce with a variety of laws of thermodynamics, thermo-chemistry and their applications.

Course Outcome: Students will gain an understanding of

- Molecular geometries, physical and chemical properties of the molecules; Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters.
- Catalytic, magnetic and redox properties of transition elements.
- Stereochemistry; 2D, 3D structures of molecules and their interconversion; E/Z, R/S nomenclature, Conformational analysis of alkanes.
- Chemistry of alkyl halides aryl halides; their preparation and reactions.
- Different thermodynamic functions; First, second & third law of thermodynamics.

SECTION A: INORGANIC CHEMISTRY - II

UNIT-I: Chemical Bonding: Ionic Bonding: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé and Kapustinskii

expression and its application (no derivation). Madelung constant, Born-Haber cycle and its application, Solvation energy. Covalent Bonding: Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Metallic Bonding: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids. Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution processes.

(12 Lectures; Marks: 16)

UNIT-II: Transition Elements: General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Bsworth diagrams). Difference between the first, second and third transition series. Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excluding their metallurgy)

(08 Lectures; Marks: 8)

SECTION B: ORGANIC CHEMISTRY- II

UNIT-III: **Stereochemistry:** Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: *cis–trans* and, *syn-anti* isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations. Cycloalkanes and Conformational Analysis; Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

(12 Lectures; Marks: 14)

UNIT-IV: Alkyl and Aryl Halides: Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (S_N1, S_N2 and S_Ni) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution. Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic

nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

(08 Lectures; Marks: 9)

SECTION C: PHYSICAL CHEMISTRY– II

UNIT-V: Chemical Thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. **First law:** Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions. Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature. **Second Law:** Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes. **Third Law:** Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules

(20 Lectures; Marks: 23)

Text Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Kapoor K. L. *A Textbook of Physical Chemistry* Sixth Ed., Vol. 2, Macmillan, India

Reference Books:

- Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970
- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.
- Eliel, E. L. & Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.
- Kalsi, P. S. *Stereochemistry Conformation and Mechanism*, New Age International, 2005.
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- McQuarrie, D. A. & Simon, J. D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.:New Delhi (2004).
- Levine, I .N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010).

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SEMESTER-III

Paper Title : **GENERAL CHEMISTRY-III(THEORY)**
Paper Code : **CHMMI-031**
Course No : **C- 03**
Credits : **03**
No. of Classes : **45**
Total Theory Marks : **70 (End Semester: 50; In Semester: 20)**

Course Objectives: To understand acid –base concept, indicators, principles of quantitative analysis, preparations and reactions of Alcohols, Phenols, Ethers and Epoxides and interactions of ions in solutions.

Course Outcome: Students will gain an understanding of

- Different theories of acid – base concept, relative strength of acids, HSAB principle and its application and indicators'
- Principles of qualitative analysis namely Volumetric Analysis and Gravimetric Analysis.
- Preparation and reactions of Alcohols, Phenols, Ethers and Epoxides
- Ionization of electrolytes, dissociation constants, pH scale, common ion effect; buffer solutions, solubility, solubility product and its application hydrolysis and hydrolysis constants.

SECTION A: INORGANIC CHEMISTRY - III

UNIT-I: Acid-Base Concepts: Arrhenius Definition, Lewis Definition, Bronsted-Lowry Definition, Lux Flood Definition, Solvent System Definition, Solvated Proton, Relative Strength of Acids, Leveling Solvents, Types of Acid-Base Reactions, Pearson's Hard and Soft Acids and Bases (HSAB) Concept, Application of HSAB Principle, Theory of Acid–Base Indicators, Selection of Indicators and their Limitations.

(10 Lectures; 11 Marks)

UNIT-II: Principles of Volumetric Analysis and Gravimetric Analysis: Principle involved in volumetric (Redox & Complexometry) and Gravimetric analysis. Application in analytical chemistry: Estimation of Ni(II) by DMG, Al (III) as oxinate in a given solution, Estimation of Mg (II) and Zn (II) by complexometric titrations using EDTA.

(05 Lectures; 6 Marks)

SECTION B: ORGANIC CHEMISTRY- III

Unit-III: Alcohols, Phenols, Ethers and Epoxides:

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement. Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt

Reactions, Fries and Claisen rearrangements with mechanism; Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$.

(15 Lectures; Marks: 17)

SECTION C: PHYSICAL CHEMISTRY – III

Unit-IV: Ionic Equilibria: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of monoprotic acid (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Theory of acid–base indicators; selection of indicators and their limitations. hydrolysis and hydrolysis constants.

(15 Lectures; Marks: 16)

Text Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Pathania, P. S.; *Physical Chemistry. 48th Edition* (2021).

Reference Books:

- Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970
- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Kapoor K. L. *A Textbook of Physical Chemistry* Sixth Ed., Vol. 2, Macmillan, India

Paper Title	**: CHEMISTRY LAB-I (Practical)**
Paper Code	**: CHMMI-031 PR**
Course No	**: C- 04**
Credits	**: 01**
No. of Classes	**: 30**
Total Marks	**: 30 (End Semester: 20; In Semester: 10)**

Section A (Inorganic Chemistry)

Unit-I: Acid-Base Titrations

1. Estimation of carbonate and hydroxide present together in mixture.

2. Estimation of carbonate and bicarbonate present together in a mixture.

Section B (Organic Chemistry)
Unit II:
Purification of organic compound and determination of melting point: Purification of organic compounds by crystallization using the following solvents: Water, Alcohol, Alcohol-Water.

Section C (Physical Chemistry)
Unit III:pH Metry
1. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetateand their mixtures.
2. Preparation of buffer solutions of different pH: (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide

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SEMESTER-IV

Paper Title	**: GENERAL CHEMISTRY-IV (THEORY)**
Paper Code	**: CHMMI-041**
Course No	**: C- 05**
Credits	**: 03**
No. of Classes	**: 45**
Total Theory Marks	**: 70 (End Semester: 50; In Semester: 20)**

Course Objectives: To understand oxidation and reduction processes and the principles underlying qualitative analysis, preparation and reactions of carbonyl compounds and structure and arrangement of constituent particles in solid state of matter.

Course Outcome: Students will gain an understanding of

- Oxidation and reduction reactions and balancing of redox reactions by oxidation Number Method and Ion-electron Method
- Basic Principles Involved in Analysis of acid and basic radicals, different types of equilibrium, solubility products, common ion effect
- Structure, reactivity, preparation and reactions of carbonyl compounds
- Arrangement of constituent particles in solids, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements

SECTION A: INORGANIC CHEMISTRY - IV

UNIT-I: Oxidation-Reduction: Oxidation and Reduction Reactions, Oxidation Number Concept, Balancing Redox Equations by Oxidation Number Method and Ion-electron Method, Equivalent Weight of Oxidizing and Reducing agents, Standard Electrode Potential and its Application to Inorganic Reactions.

(06 Lectures; 7 Marks)

UNIT-II: Theoretical Principles in Qualitative Analysis (H_2S Scheme): Basic Principles Involved in Analysis of Cations and Anions, Different types of equilibrium, solubility products, common ion effect (with example). Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II and removal methods.

(09 Lectures; 10 Marks)

SECTION B: ORGANIC CHEMISTRY- IV

Unit-III: Carbonyl Compounds - Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH4, NaBH4, MPV, PDC and PGC); Addition reactions of unsaturated carbonyl compounds: Michael addition.

Active Methylene Compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

(15 Lectures; Marks: 16)

SECTION C: PHYSICAL CHEMISTRY – IV

Unit-IV: Solid State: Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Glasses and liquid crystals.

(16 Lectures; Marks: 17)

Text Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
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- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Kapoor K. L. *A Textbook of Physical Chemistry* Sixth Ed., Vol. 2, Macmillan, India

Paper Title	**: CHEMISTRY LAB-II (Practical)**
Paper Code	**: CHMMI-041 PR**
Course No	**: C- 04**
Credits	**: 01**
No. of Classes	**: 30**
Total Marks	**: 30 (End Semester: 20; In Semester: 10)**

Section A (Inorganic Chemistry)

Unit-I: Qualitative semimicro analysis of mixtures containing 6 radicals. The following radicals are suggested:

CO_3^{2-}, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+},Sr^{2+}, Ca^{2+}, Mg^{2+}

Mixtures should preferably contain one interfering anion, or Insoluble component.

Section B (Organic Chemistry)

Unit II: Chromatography:

1. Separation of a mixture of two amino acids by ascending and horizontalpaper chromatographySeparation of a mixture of two sugars by ascending paper chromatograph.
2. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)

Section C (Physical Chemistry)

Unit-I: Surface Tension and Viscosity

1. Surface tension measurements: Determine the surface tension by (i) drop number (ii) drop weight method, Study the variation of surface tension of detergent solutions withconcentration.
2. Viscosity measurement using Ostwald's viscometer: Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature. Study the variation of viscosity of sucrose solution with the concentration of solute.

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