B.Sc. CHEMISTRY SEMESTER -V

[THEORY]

Paper C - 501: Inorganic & Industrial Chemistry

Unit - I : Inorganic Chemistry

1. Wave Mechanics

Outline of the basic theory of wave mechanics (Sem. - III)

Operators: Algebra of Operators (Addition and subtraction, multiplication) commutative property, Linear operator, commutation operator, the operator ∇ and ∇^2 momentum operator, Hamiltonian operator

Particle in one dimensional box: Normalized wave equation and Energy related to a particle moving in one dimensional box, Energy levels linear polyenes as one dimensional box, examples.

Particle in three dimensional box: Derivation of Normalized wave function (In Cartesian coordinates) and energy related with, energy levels and degeneracy of energy levels, examples.

Wave equation for hydrogen atom:- To derive the relation between Cartesian and polar coordinates, derivation of volume element in polar coordinates, Schrödinger equation in polar coordinates for H -atom, separation of variables.

Energy of 1s orbital, Normalization condition & problems on it (in polar coordinates)

2 Crystal Field Theory:

Introduction, Concept of crystal field theory, Splitting of d-orbitals in octahedral and tetrahedral crystal field with C.F.S.E. concept, factors affecting splitting energy, weak field and strong field ligands, high spin and low spin complexes with paring energy, and Magnetic behavior of transition metal complexes, orbital angular momentum contribution to magnetic moment of complexes; Examples based on CFSE, Pairing energy and magnetic momentum

3 Transition metal complex of π-acid ligands

Metal carbonyls: definition, preparation, physical and chemical properties, nature of M-CO linear bonds based on M.O. theory with spectral support, classification of metal carbonyls, types of CO groups and detection of CO groups using IR spectra.

Structure of $Ni(CO)_4$, $Fe(CO)_5$, $Fe_2(CO)_9$, $Co_2(CO)_8$, $Fe_3(CO)_{12}$ and $Mn_2(CO)_{10}$

Metal nitrosyls.

Unit - II: Industrial Chemistry

1. Cement

Introduction.

Type of Cement.

Raw materials.

Cement rock beneficiation.

Manufacturing processes: Dry processes and wet processes

Setting of cement - hydrolysis and hydration.

Properties of cement

Testing of cement

Indian standard institute (lSI) specification of cement.
Mortars, concrete & RCC
Curing and decay of concrete
Uses of cement.

2. Fertilizers

Introduction
Plant nutrients and its role, Classification of fertilizers, Properties of fertilizers,
Nitrogeneous fertilizers:
Ammonium nitrate – manufacture by Prilling method and manufacture by Stengel method
ammonium sulphate- manufacture from gypsum (Sindri process) and action as fertilizer,
Urea manufacture from ammonium carbamate and action as fertilizer
Calcium cyanamide – manufacture bycalcium carbide and action as fertilizer,
Phosphate fertilizer
Normal Super phosphate – manufacture
Ammonium phosphate – manufacture of monoammonium phosphate & Diammonium phosphate
Potassium fertilizer
NPK fertilizer
Nomenclature

3. Petrochemical

Introduction.
Petrochemicals from Methane -C_1, Ethylene - C_2 and Propylene C_3
Methane

1. Manufacture of chloromethanes (chlorinated hydrocarbons)
2. Manufacture of synthetic gas from methane.

Ethylene

1. Manufacture of Ethylene glycol from ethylene chlorhydrins and ethylene oxide
2. Manufacture of ethylalcohol by sulphuric acid process and catalytic hydration process from ethylene.

Propylene

1. Manufacture of Glycerol via allyl chloride and via acrylein
2. Manufacture of acrylonitrile

Paper C- 502: Organic Chemistry and Spectroscopy

Unit- I:Organic Chemistry

1. **Name Reactions, Rearrangement and Reagents**:

   Reactions

   a. Arndt Eistert Reaction
   b. Bischler Napierski Reaction
   c. Leuckart Wallach Reaction

   Rearrangements

   a. Hoffmann Rearrangement
   b. Curtius Rearrangement
   c. Fries Rearrangement

   Reagents

   a. Lithium Aluminium Hydride $LiAlH_4$
   b. Triphenyl phosphine
   c. Sodamide

2. **Alkaloids**

   Introduction, Occurrence, Classification, Isolation, General method of proving structure of Alkaloids, Constitution, Properties and Synthesis of:

   a. Coniine
   b. Nicotine
   c. Papaverine

3. **Carbohydrates**

   Introduction, Classification and nomenclature, General reactions of Monosaccharides (with reference to Glucose and Fructose)

   Inter-conversions:

   a. Conversion of Aldose to the corresponding Ketose
   b. Conversion of Aldose to the next higher Ketose (Wolform method)
   c. Conversion of Aldose to the Ketose having two more carbon atoms (Sowden method)
   d. Conversion of Ketose to the corresponding Aldose

   Step-up reactions (Ascending in Aldose series)

   a. Kiliani Reaction
   b. Swoden Nitromethane reaction

   Step-down reactions (Descending in Aldose series - Aldohexose to Aldopentose) by Ruff's Method

   Configuration of monosaccharides

   Ring structure of Aldoses

   Determination of ring size of Glucose by

   a. Methylation method
   b. Periodic oxidation method

   Mutarotation of D (+) glucose

4. **Synthetic Drugs, Dyes and Sweetening Agents**

   Only Synthesis and Uses of

   Drugs: Ibuprofen, Atenlol and Adrenaline

Dyes: Orange II, Crysodine G, Auramine O

Sweetening Agents: Saccharin, p-anisylurea and Dulcin

5. **Synthesis of Heterocyclic Compounds containing two hetero atoms**

Preparation of:

1) Pyrazole
2) Imidazole
3) Isoxazole
4) Thiazole
5) Pyrimidine
6) Pyridazine
7) Oxazine
8) Thiazine
9) Dioxane

Unit –II Spectroscopy

1. **Molecular Symmetry**

Introduction; Symmetry elements and symmetry operations with illustrations; definition of properties of group; subgroup and classes; products of symmetry operations; symmetry point groups; C_1, C_s, C_i, C_n, C_{nv}, C_{nh}, D_n, D_{nh}, D_{nd}, C_v, $D_{\infty h}$, T_d, O_h; multiplication tables for C_{2v}, C_{3v} and C_{2h} point groups.

2. **Ultraviolet and visible spectra**

Instrumentation; types of transition in organic molecules; auxochrome; chromophore; explanation of bathochromic shift and hypsochromic shift; hyperchromic and hypochromic effects; types of bands; effect of solvent; Frank Condon principles; application of UV spectra; calculation of λ_{max} of (i) dienes and conjugated dienes; (ii) enones and dienones ie unsaturated carbonyl compounds; (iii) aromatic carbonyl system.

3. **Infrared spectroscopy**

Introduction; range of IR; theory of IR; modes of fundamental vibrations; I.R active, force constant; vibration coupling; Fermi resonance; finger print region; instrumentation; application of IR, structure of organic molecules from IR; interpretation of IR for given molecules and problems.

Paper C 503 (Physical and Analytical Chemistry)

Unit I: Physical Chemistry

1. **Second Law of Thermodynamics**

   Limitation of first law of thermodynamics
   Spontaneous process
   Carnot Cycle and Theorem
   Statements of Second Law of Thermodynamics
   Perpetual motion of second kind (briefly)
   Concept of entropy
   Definition of entropy
   ΔS in reversible and irreversible (spontaneous) process
   ΔS in ideal gases
   ΔS of mixture of ideal gas
   ΔS in physical transformations
   Entropy and second law of thermodynamics
   Physical significance of entropy

2. **Free energy and Chemical Equilibrium**

   Work function its physical significance and variation with V and T
   Free energy: its significance with P and T
   ΔG for ideal gases, Gibbs and Helmholtz equation and its application
   Criteria for chemical equilibrium
   Vant Hoff reaction isotherm
   Vant Hoff isochor
   Law of active mass
   Clausius Clapeyron equation

3. **Crystalline State**

   Difference between crystalline and amorphous solid, Crystal and crystallography
   Three laws of crystallography, Structure of crystals, Space lattice and unit cell, Bravice lattices
   Type of cubic lattice and inter planar spacing
   X-ray diffraction: Braggs equation, Experimental methods (rotating crystal and powder method), Structure of Rock salt (NaCl) and Sylvine (KCl)
   Liquid crystals: Introduction, Definition and classification of liquid crystals (Smectic, nematic, Chollesteric and disc shaped)

1. **Phase Rule**

   Three component system
   Method of graphical presentation
   Types of partially miscible three liquid systems:
   - i) One partially miscible pair effect of adding third component, nature of tie line, plait point, binodal curve, characteristic of diagram A is added to binary system, A is constant and B and C varied
   - ii) Formation of two pairs of partially miscible liquids
   - iii) Formation of three pairs of partially miscible liquids

   Application of ternary liquid diagram

Unit II Analytical Chemistry

1. **Errors and Statistics:**

   Introduction

   Explanation of error and mistake

   classification of error, Determinate and indeterminate errors, operational and personal errors, instrumental errors and reagent errors, additive and proportional errors

   accuracy and precision, minimization of error

   calibration of instruments, blank measurement, independent method, parallel method, standard addition method

   Explanation of significant figure and its laws with complete interpretation

   Mean and standard deviation, variance and coefficient of variance

   absolute error and relative error, mean value, deviation and relative mean deviation

   Gausian curve and its explanation

   Importance of Q -test and T -test (student T- test), examples on errors, significant figures, Q-test and T -test

2. **Basic principles of Qualitative Analysis (only separation):**

   Separation of the following in presence of each other (by any one method)

   Cl^{1-}, Br^{1-} and I^{1-}; NO_2^{1-}, NO_3^{1-} and Br^{1-}; S^{2-}, SO_3^{2-} and SO_4^{2-}; PO_4^{3-}, AsO_3^{3-} and AsO_4^{3-}; CO_3^{2-}, SO_3^{2-} and S^{2-}; Cu^{2+} and Cd^{2+}

3. **Colourimetry:**

   Introduction, growth Drapper Law, Lambert's Law, Bayer's law, Lambert - Bayer's law, and derivation, application and deviation of Lambert's Law

   Spectrophotometric titration with graph and proper explanation

   1) Deficit of absorbance by product and titrant
   2) Deficit of absorbance by product and reagent
   3) Deficit of absorbance by reagent and titrant
   4) Deficit of absorbance by product only

4. **Volumetric Analysis**

   (With example of calculation based on pH, Normality, Molarity, Ksp, etc)

   Ostwald's Law regarding indicators – necessary derivation and formulae of indicators used in neutralization, Redox, Precipitation titration

   Primary and secondary standards explanation

   i) Explanations of neutralization titration with graphs:

      Strong acid –strong base

      Strong acid -weak base

      Weak acid – strong base

      Poly protic acid- strong base titration

   ii) Redox titration:

   - Principle of external and internal indicator in redox titration e.g. diphenylamine, starch and $K_3[Fe(CN)_6]$,
   - redox titration with graph and calculation.
   - Iodometry and iodimetry titration
   - preparation of standard sodium thiosulphate solution

iii) Precipitation titration:

- Argenometric titration: Mohar method, Fazan method, Volhard method with use of proper indicator, graph and its practical application
- Example of calculation based on pH, Normality, Molarity, Ksp, etc.

BSc CHEMISTRY SEMESTER - V
[PRACTICALS]

1. Organic Separation (Mixture of two compounds) [30 marks]

[Minimum 12 mixtures should be done]

Separation & Analysis of an organic mixture containing:

(a) Two solid components using water, $NaHCO_3$, NaOH and HCl for separation

(b) Liquid + liquid component - separation by physical method.

(c) Liquid + solid component - separation by physical method.

2. Inorganic Volumetric Analysis [20 marks]

[Minimum 8 eight exercises should be done]

For volumetric exercise all the standard solutions are to be prepared by the students.

(i) Iodometry and Iodimetry

1. Estimation of Cu^{+2} and $CuSO_4.5H_2O$ in the given $CuSO_4.5H_2O$ using 0.05N $Na_2S_2O_3.5H_2O$ solution.
2. Estimation of As^{+3} and As_2O_3 in the given As_2O_3 using 0.05N $Na_2S_2O_3.5H_2O$ solution.

(ii) Complexometric titration:

1. Estimation of the amount of Ni^{+2} in the given $NiSO_4.7H_2O$ solution using 0.02 N / 0.01 M EDTA solution.
2. Estimation of the amount of Mg^{+2} and Pb^{+2} in the given solution containing a mixture of Mg^{+2} and Pb^{+2} using 0.02 N/ 0.01 M EDTA solution
3. Estimation of the amount of Ca^{+2} and Zn^{+2} in the given solution containing a mixture of Ca^{+2} and Zn^{+2} using 0.02 N / 0.01 M EDTA solution
4. Estimation of the amount of Fe^{+3} and Cr^{+3} in the given solution containing a mixture of Fe^{+3} and Cr^{+3} using 0.02 N/ 0.01 M $Pb(NO_3)_2$ and 0.02 N/ 0.01 M EDTA solution

(iii) Redox titration:

1. Determination of the amount of NO_2^{-1} in the given $NaNO_2$ or KNO_2 solution by reduction method using 0.1 N $KMnO_4$ solution.

(iv) Water Analysis:

To determine the amount of chloride in the given sample of water using 0.02 N $AgNO_3$

(v) To determine the purity of $NaHCO_3$ in the given sample

3. Physicochemical Exercise [25 marks]

[Minimum 12 exercises should be done]

Conductometry:

1. To determine normality and gms/lit of xN HCl and also determine specific conductance by conductometry.
2. To determine normality and gms/lit of the mixture of $HCl+CH_3COOH$ by conductometry.
3. To determine the normality of weak acid by conductometry.

4. To determine the concentration of Ni^{+2} using 0.1M EDTA solution.
5. To determine the normality of xNAgNO3 using 0.5N NaCl by conductometry.

pH metry

1. To determine normality of xN HCl by pH metry.
2. To determine normality and dissociation constant of weak acid (xN CH_3COOH) by pH metry.
3. To determine normality and dissociation constant of of dibasic acid (xN oxalic acid/malonic acid/maleic acid) using 0.1N NaOH solution.

Colourimetry

1. Find out the amount of Ni^{+2} in the given solution by colourimetry method.
2. Find out the amount of Fe^{+3} in the given solution by colourimetry method.

Viscosity

1. To determine relative and absolute viscosity of pure liquid A, B, C, D by Ostwald's viscometer.
2. Prepare three different 10%, 5%, 2.5% aqueous solution of Glycerine. Find viscosity of these three solutions as well as unknown concentration solution with the help Ostwalds viscometer.

Refractometer

1. To determine specific refractivity and molecular refractivity of given pure liquid A, B, C, D.
2. To determine specific refractivity and molecular refractivity of glycerine (10%, 5%, 2.5%) and unknown glycerine solution

BSc CHEMISTRY SEMESTER –VI
[THEORY]

Paper C – 601: Inorganic & Industrial Chemistry

Unit-I : Inorganic Chemistry

1. Multi electron system:

Concept of spectral terms and terms symbols.

L-S coupling scheme: s-s coupling, l-l coupling, l-s coupling, j- j coupling and L-S coupling with vector diagram.

Derivation of spectral term symbols for p^1, p^2, p^3 and d^1 to d^9

Microstates: Definition, calculation and derivation of microstates for p^1, p^2, d^1 & d^2

Calculation of spectral terms and term symbols for – Microstates for p^1, p^2, d^1 & d^2 (Pigeon hole diagram).

Hund's rules for the determination of ground state spectral term.

2. Crystal Field Theory - II

Jahn Teller effect

Tetragonal distortion with example.

Splitting of d- orbitals in square planar complexes with example.

Hole formalism.

Splitting of F and D ground state terms (using hole formalism)

Orgel diagram for D and F states.

Selection rules for d - d transition.

Types of electron transition in metal complexes

Absorption spectrum of Ti^{+3}, Cu^{+2}, and Ni^{+2}.

3. **Magneto Chemistry**

Introduction (Magnetic field, magnetic pole, intensity of magnetization)

Magnetic induction

Permeability, intensity of magnetism, magnetic susceptibility, molar magnetic susceptibility

Magnetic behavior: Diamagnetism, Paramagnetism, Ferromagnetism and antiferromagnetism

Effect of temperature on magnetic behavior of substances

Derivation of equation for total angular magnetic momentum and diamagnetic momentum

Determination of magnetic susceptibility by Gouy's method

Unit - II - Industrial Chemistry

1. Glass

Introduction.

Physical and chemical properties of glass.

Raw materials for manufacture

Chemical reactions involved

Method of manufacturing: Formation of batch material, melting, shaping, annealing and finishing

Special types of glasses: Fused silica glass, high silica glass, optical glass, borosilicate glass, lead glass, coloured glass, opal glass, safety glass, fibre glass, glasswool, pyrex glass, photochromic glass, insulating glass, rare earth glass, vitresil glass and photosensitive glass

2. Oils and Fats

Introduction
Distinction between oils and fats
Properties between oils and fats
Classification
Manufacturing of cotton seed oil by expression method
Manufacturing of cotton seed oil by solvent extraction method
Refining of crude vegetable oil
Hydrogenation of oils
Optimum conditions for the process
Dry process
Wet process
Analysis - saponification value, acid value, Iodine value and Reichert- Meissel (RM) value

3. Soap and Detergents

Introduction to soap
Raw material for manufacture
Methods for manufacture of soap: Batch process & Continuous process
Type of soap; toilet soap, transparent soap, shaving soap, neem soap, liquid soap
Recovery of glycerine from spent lye
Introduction to detergents
Principal group of detergents
Biodegradability of surfactants
Classification of surface active agents
Anionic detergents
Manufacture of anionic detergents: oxo process, alfol process &Welsh process
Cationic detergents- manufacture
Non - ionic detergents- manufacture by batch process
Amphoteric detergents
Manufacture of shampoo.

4. Environmental Chemistry

Environment – definition and introduction.
Segments of environment: Atmosphere, hydrosphere, lithosphere and biosphere
Various type of pollution

Air pollution

Introduction
Green house effect
Major sources of air pollution
Photochemical smog and acid rain
CFC and ozone depletion

Sources and effects on NO_x and SO_x

Control of air pollution

Water Pollution

Introduction

Classification of water pollution: Physical pollution, chemical pollution, biological and physiological pollution

Sources of water pollution: Sewage and domestic waste, industrial effluents, agricultural discharges, fertilizers, toxic metals, siltation, thermal pollutions, radioactive material

Water pollution control

DO, BOD and COD determination

Paper C -602: Organic Chemistry and Spectroscopy

Unit -I: Organic Chemistry

1. **Terpenoids**

   Introduction, Occurrence, Isolation, General characteristics of Terpenoids, Isoprene Rule

   Constitution and Synthesis of:

   a. Citral
   b. α-Terpineol

2. **Amino acids, Peptides and Proteins**

   Introduction, Classification of amino acids name and formula

   Synthesis of amino acids by:

   a. Amination of α-halogen acids
   b. Gabriel pthalimide synthesis
   c. Hofmann Degradation
   d. Erlen-meyer azlactone synthesis
   e. Hydantoin method

   Physical properties of amino acids, Chemical properties of amino acids, Isoelectric point

   Introduction to Polypeptides, Synthesis of Polypeptides by:

   a. Bergmann Method
   b. Sneehan's Method (use of Phthaloyl group)
   c. Fischer's Method (use of p-toluenesulphonylchloride)

   Introduction and classification of proteins, Constitution of Thyroxine, Synthesis of Thyroxine

3 **Synthetic Explosive, Perfumes and Insecticides**

   Synthesis and uses of:

   Explosives:

   a. RDX (Research Development Xplosive)
   b. TNT (Trinitrotoluene)
   c. PETN (Pentaerythritol tetranitrate)

   Perfumes:

   a. Musk Xylene
   b. Musk Ketone
   c. Musk Ambrette

   Insecticides:

   a. Baygon
   b. Carbendazin
   c. Parathion

4. **Polynuclear Aromatic Hydrocarbons**

   Introduction, Synthesis and chemical properties:

   a. Biphenyl
   b. Diphenyl methane
   c. Naphthalene
   d. Anthracene

5. **Conformational Isomerism**

   Conformation of acyclic system

Conformational analysis of ethane
Conformational analysis of n – butane
Conformation of cyclic system: Cyclohexane and cyclopentane
Conformational analysis of cyclohexane: Boat form and Chair form
Conformation of monosubstituted cyclohexane

Unit –II : Spectroscopy

1. **Nuclear Magnetic Resonance Spectroscopy**
   Introduction; Principle; nuclear quantum number; equivalent and non-equivalent protons with illustrations; enantiometric and diasteriometric protons; shielding and deshielding of protons; chemical shift; paramagnetic anisotropic effect; relative intensity of signals; spin-spin coupling and coupling constant; Deuterium labeling; applications of NMR; problems for determination of structure of organic molecules.
2. **Mass spectrometry**
   Introduction, Classification of Spectroscopy, origin and Basic principles; instrumentation; General fragmentation modes, important features for the mass spectra of alkanes
3. **Problems based on UV, IR, NMR spectroscopy** with empirical and molecular formula

Paper C 603 (Physical and Analytical Chemistry)

Unit I: Physical Chemistry

1. **Third Law of Thermodynamics**

   Nernst heat theorem

   Third law of thermodynamics

   Determination of absolute entropies of solids, liquids and gases

   Application of third law of thermodynamics (ΔS, ΔG and equilibrium constant of Chemical reaction)

   Test of third law of thermodynamics, Residual entropy

2. **Partial Molar Properties**

   Definition

   Concept of Chemical potential, Gibb's Duhem equation

   Variation of chemical potential with temperature and pressure

   Determination of partial molal properties by method of intercept

   Applications of chemical potential (Henry's law, Nernst distribution law & Rault's law)

3. **Activity of Electrolytes**

   Ionic Activity: introduction, derivation of $a_2 = a_+^{\nu+} a_-^{\nu-}$ and $a_2 = a_+ a_-$ for 1-1 electrolyte

   Mean activity $a_\pm$, its relation between a_+ and a_-

   Relationship between a_2 and $a_\pm$ i.e. $a_2 = a_\pm^{\nu}$

   Mean ionic activity coefficient $f_\pm$, f_+, f_-

   Ionic Strength: definition, explanation and equation

   Debye Huckel limiting law (without derivation): derivation of $\log f_\pm = A_{z+z-} \mu^{1/2}$

   Interpretation of equation

   Graph of $\log f_\pm \rightarrow \mu^{1/2}$ and its explanation/ discussion

   Emperical correction of Debye Huckel limiting law for size of ion and orientation of solvent molecules

   Methods to Determine Activity Coefficient: solubility method, emf methods: chemical cell with transference and concentration cell without transference

   Examples based on theory

4. **Electrochemistry**

   Concentration cells, Definition, Electrode Concentration Cells, Electrolyte Concentration Cell

   Concentration Cells without transference

   Concentration Cells with transference

   Liquid junction potential, Elimination of liquid junction potential

   Application of emf measurements (i) determination of solubility of sparingly soluble salts (ii) determination valency of metal ion (iii) determination of dissociation constant of a weak acid (iv) determination of transport number of ion (v) ionic product of water; (vi) degree of hydrolysis and (vii) determination of pH by using different electrodes

   Examples

Unit II Analytical Chemistry

1. **Electrochemistry (Conductometry)**

Electric transport, conductance in metals and in electrolyte solutions
specific conductance, equivalent conductance
importance of conductivity electrodes and platinisation of electrodes
Variation of specific conductance with dilution as well as area of cross section of dip electrode and distance between two plates of electrodes, etc
Kohlrausch law and its importance, cell constant and its importance,
Conductometric Titration: Strong acid –strong base; Strong acid -weak base; Weak acid – strong base; Weak acid – weak base; Mixture of strong and weak acid –strong base
Precipitation Titration: $AgNO_3$ –NaCl; $BaCl_2$ ¯ K_2SO_4 ; $Ba(OH)_2$ – $MgSO_4$
Replacement Titration: Salt of Weak acid-strong base against strong acid; Salt of Weak base-strong acid against strong base
Degree of hydrolysis and hydrolysis constant, determination of solubility and solubility product of sparingly soluble salts for the determination of conductivity,
importance of conductometry water and temperature for the measurement of conductivity

2. **Chromatography**:

Introduction
classification of chromatography - types of chromatography
detail study of:

a. Adsorption (column) Chromatography
b. Partition Chromatography - Paper and TLC
c. Gas Chromatography - GLC and GSC
d. Ion exchange chromatography

Application such as; main physical characteristics of chromatography, solubility, adsorption value, volatility, Rf value Rx value, nature of adsorption
Column chromatography: Principles, method of separation of green leaf pigment mixture of inorganic ions, vitamins, colour of flowers, separation of α, β, and γ carotenes from carrot.
Partition Chromatography: Paper Chromatograph and TLC
Paper chromatography: Principle, experimental method like ascending and descending method containing one dimensional and two dimensional method, circular method its Rf value, Rx value, circulation method, separation of amino acids, sugar, phenyl amine, glycine and Fe^{2+}, Co^{2+}, Ni^{2+} mixture using spray reagent ninhydrine and aniline phthalate
Thin layer chromatography (TLC): Principle, method of preparation of chromatoplate, experimental techniques. Superiority of TLC over other chromatographic techniques, application of TLC
Gas chromatography: introduction, principle of GLC and GSC
GLC: instrumentation, Evaluation, selection and characteristic of carrier gas, Effect of temperature and pressure of gas, application
GSC: methods and its application

Ion Exchange Chromatography: introduction, principle, types of resins, properties of ion exchange resins, Basic requirement of useful resins, methods of separation with illustration curve, application of ion exchange resins

3. **Introduction of Complexometric titration**

Method of preparation of standard EDTA solution, Velcher's Law; Explanation of ppm EDTA volume; Graph with stability constant volume,

Types of EDTA titration: direct titration, back titration, substitution titration, alkalimetry titration, titration of mixtures with the help of masking and de masking agent

Principle of metal ion indicator,Use of EBT, calcon, muroxide with structure and characteristic.

4. **Potentiometry and pH metry:**

Introduction and interpretation of Potentiometry and pH metry

Importanc of indicators and reference electrode in the measurement of EMF and pH

EMF method: study of acid base titration, redox titration, Argentometric titration including mixture of Cl^{1-}, Br^{1-}, and I^{1-} with graph and proper explanation

pH metry: definition, interpretation of various methods of determination of pH value like pH paper method, potentiometirc method using only hydrogen electrode as indicator electrode and calomel electrode as reference electrode to determine pH value.

Weak acid- strong base titration with curve and determination of dissociation constant (ka) of weak acid

BSc CHEMISTRY SEMESTER –VI
[PRACTICALS]

Chemistry Semester VI Practical [Total Marks: 75 marks]

1. **Inorganic Qualitative Analysis (six radicals) [30 marks]**
   [Minimum 12 inorganic mixtures should be analyzed]
   To analyze the given inorganic mixture containing six radicals
2. **Organic Synthesis [20 marks]**
   (% age of yield, crystallization, melting point)
   [Minimum 8 syntheses should be done]

I. Acetylation / Benzoylation:

1. Acetylation of salicylic acid
2. Acelytation of aniline
3. Acelytation of phenol
4. Benzoylation of aniline
5. Benzoylation of phenol

II. **Aliphatic Electrophilic substitution**:

1. Preparation of iodoform from ethanol
2. Preparation of iodoform from acetone

III. **Aromatic Electrophilic Substitution:**

Nitration:

1. Preparation of m-dinitrobenzene,
2. Preparation of nitro acetanilide.

Halogenation:

1. Preparation of p-bromo acetanilide,
2. Preparation 2:4:6 -tribromo phenol

IV. Diazotization / Coupling:

1. Preparation of methyl orange
2. Preparation of methyl red

V. Oxidation: Preparation of benzoic acid from benzaldehyde

VI. Reduction: Preparation of aniline from nitrobenzene

3. **Physicochemical Exercise [25 marks]**
   [Minimum 12 exercises should be done]

Potentiometry

1. To determine normality and dissociation constant of benzoic acid using 0.1N NaOH.
2. To determine normality of given acid xN HCl using NaOH solution.
3. To determine concentration of xN FAS using $K_2Cr_2O_7$.
4. To determine normality of each halide in the mixture using 0.1N $AgNO_3$ solution.

Polarimeter

1. To determine specific rotation of three different concentration (10%, 5%, 2.5%) of dextrose solution. From graph find out the unknown concentration by plotting concentration v/s rotation angle.

2. Study the inversion rate of sugar in presence of 1N HCl and determine the rate of reaction.

Surface tension

1. Find the surface tension of the liquids A, B, and C by using Drop-weight method. Find the value of Parachor of liquids and CH_2 group.

Thermodynamics

1. Calculate entropy of vapourization (ΔSv) of a given liquid by plotting a graph of log (1/time) vs (1/temperature).

Chromatography

1. To determine Rf value of individual and mixture of amino acid by ascending paper chromatography.
2. To determine Rf value of individual and mixture of amino acid by circular paper chromatography.
3. To determine Rf value of individual and mixture of amino acid by thin layer chromatography (TLC).
4. To determine Rf value of individual and mixture of metal ions by ascending paper chromatography.
5. To determine Rf value of individual and mixture of metal ions by circular paper chromatography.