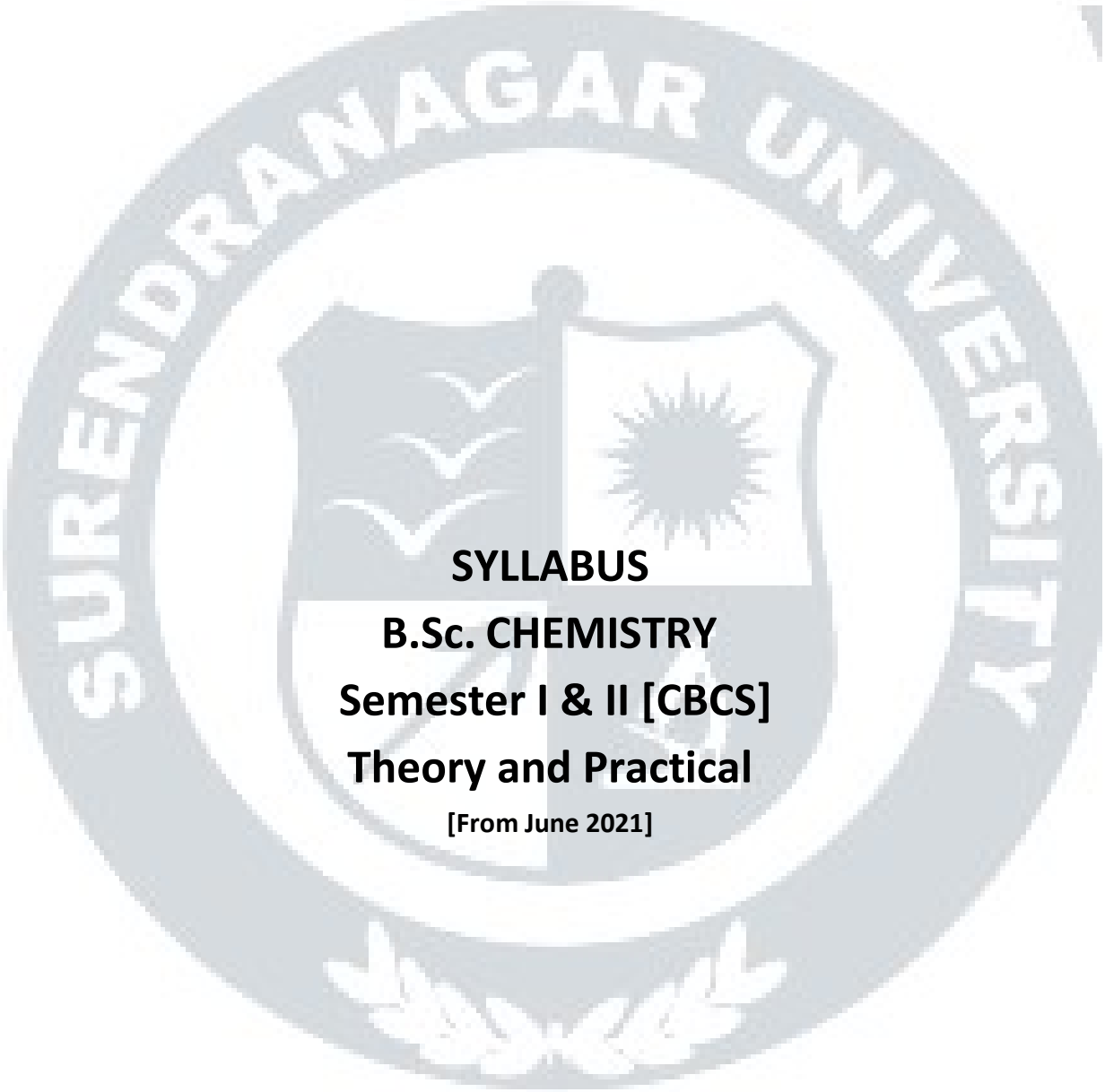
SURENDRANAGAR UNIVERSITY



SYLLABUS

B.Sc. CHEMISTRY

Semester I & II [CBCS]

Theory and Practical

[From June 2021]

B.Sc. CHEMISTRY
Semester I & II [CBCS]
Theory and Practical
[From June 2021]

- **Credits for each semester**
  - **Theory 6 Credits**
  - **Practicals 3 credits**

Note

- **BSc Chemistry Theory Syllabus for Semester I & II consists of five units each**
- **Total Marks for Chemistry Theory 100 { 70 Marks External & 30 Marks Internal}**
- **Equal weightage is given to all the units**
- **The question paper should also be drawn assigning equal weightage to all the units**
- **Total marks for Chemistry Practicals Marks 50 {35 Marks External & 15 Marks Internal}**

SEMESTER - I

SEMESTER-I: CHEMISTRY THEORY COURSE [C -101]

6- Credits: 100 Marks

UNIT-1

1. Atomic Structure and Periodic Properties **[4 Hours]**

Dual nature of electron: de-Broglie's equation, Heisenberg's Uncertainty Principle, quantum numbers, Aufbau Principle, Pauli's Exclusion Principle and Hund's Rule for electron configuration.

Periodicity in atomic properties and its causes, explanation of general trends of periodic properties: atomic and ionic radii, ionization potential, electronegativity and electron affinity.

2. Chemistry of s and p block elements **[4 Hours]**

Special characteristics such as metallic character, polarizing power, hydration energy, inert pair effect, relative stability of different oxidation state, Diagonal relationship of (1) lithium with magnesium (2) boron with silicon and (3) beryllium with aluminum, Anomalous behavior of Li, Be, Formation of complex compounds, catenation, allotropy (diamond and graphite-their structure, properties and its uses).

3. Adsorption **[4 Hours]**

Introduction, types of adsorption (physical and chemical), characteristics and factors affecting adsorption, Adsorption isotherm and Freundlich equation, Langmuir theory of adsorption: assumptions, derivation, modification in equation at very low and high pressure and applications of adsorption.

UNIT-2

4. Chemical bonding in covalent compounds **[12 Hours]**

Covalent bond: Valence bond theory and its limitations, Concept of hybridization: sp ($BeCl_2$), sp^2 (BF_3), sp^3 (SiH_4), sp^3d (PCl_5) and sp^3d^2 (SF_6).

Stereochemistry of inorganic molecules: Sidgwick Powell rule and VSEPR theory, Structure of molecules: $SnCl_2$, SO_4^{-2}, CO_3^{-2}

Basic concept of MO theory, bonding and anti-bonding molecular orbitals, gerade and ungerade molecular orbitals, σ - molecular orbital and σ* - molecular orbital, π-molecular orbital and π*- molecular orbital, Conditions for effective combinations of atomic orbitals Energy level diagrams of B_2, C_2, N_2, O_2, F_2, CO, NO, CO_2 (with s-p mixing and orbital interaction) with calculation of bond order and magnetic moment Comparison of MO theory and VB theory

UNIT-3

5. Basic Organic Chemistry and aliphatic hydrocarbons containing σ-bond **[12 Hours]**

Nomenclature of organic compounds (Only Acyclic - IUPAC-1993)

Electronic displacements: Inductive effect, electromeric effect, mesomeric effect and hyper conjugation. Applications of inductive effect to bond length, dipole-moment, reactivity of alkyl halides, relative strength of acid, basicity of amines

Homolytic and heterolytic fission, curly arrow rules
Reaction intermediates: Carbocation, carbanion, free radical, carbenes and benzynes (Formation by cleavage type, structure, relative stabilities, generation)
Types of organic reagents: Nucleophiles and electrophiles.
Types of organic reactions: Substitution, addition, elimination and rearrangement.
Nucleophilic substitution reaction mechanism (S_N1 & S_N2) for alkyl halides
Introduction to Stereochemistry: Configuration, Fischer projection formula, homomers and enantiomers, geometrical isomerism: cis–trans, C.I.P rules with E/Z notations.

UNIT-4

6. Aliphatic Hydrocarbons (Acyclic) **[12 Hours]**

Chemistry of alkanes:
Formation of alkanes: Wurtz reaction, Wurtz-Fittig reaction.
Free radical substitutions: Halogenation-relative reactivity and selectivity.
Hydrocarbons containing Carbon-Carbon π bonds:
Formation of alkene by Elimination reactions, dehydration of alcohol, dehydrohalogenation of alkyl halide, dehalogenation of vicinal and germinal dihalides
Mechanism of E1, E2, E1cb reactions, Saytzeff and Hofmann eliminations
Electrophilic addition reaction and its mechanism (Markownikov/Anti Markownikov rule)
Reactions of alkenes: Oxymercuration-demercuration, Hydroboration oxidation, Ozonolysis, Reduction (catalytic), Syn and anti-hydroxylation (oxidation), 1, 2- and 1,4 - addition reactions in conjugated dienes, Diels-Alder reaction.
Formation of alkynes: Dehydrohalogenation of vicinal and geminal dihalides, Dehalogenation of tetrahalides
Reactions of alkynes: Acidity, electrophilic addition reactions like halogenation, hydrohalogenation, hydration, hydroboration, addition of carbene and catalytic hydrogenation.
Nucleophilic addition with hydrogen cyanide and alcohol, hydration to form carbonyl compounds, alkylation of terminal alkynes.

UNIT-5

7. Catalysis **[3 Hours]**

Introduction, types of catalysis (homogeneous and heterogeneous), characteristics of catalysis, auto-catalysis, negative catalysis (Inhibitor), promoters, and catalytic poisoning
Activation energy and catalysis
Theories of catalysis: (1) Intermediate compound formation and (2) adsorption theory, active centers
Enzyme catalysis and its characteristics

8. Chemical Kinetics **[9 Hours]**

Concept of chemical kinetic: rate of chemical reaction, concentration dependence of reaction rate specific reaction rate constant, order and molecularity of the reaction.
Factors affecting rate of the reaction.
Definition, derivation of integrated rate equations for zero, first and second (same and different reactants) order reactions, their characteristics and half -life periods.

Determination of the order of reaction: (1) Hit and trial method (Integration method) and its limitations (2) Oswald's isolation method (3) Half-life period method (4) Graph method and (5) Van't Hoff differential method, Concept of activation energy, Derivation of Arrhenius equation and determination of activation energy by integrated equation and methods.
Theories of Reaction Rates: Collision theory and absolute reaction rate theory of bimolecular reactions and qualitative comparison.
Numericals

Reference Books

- UGC Inorganic Chemistry – Volume-I H. C. Khera (Pragati Prakashan).
- Concise Inorganic Chemistry - J. D. Lee.
- Coordination Chemistry- Gurdeep Chatwal and M. S. Yadav.
- Advanced Inorganic Chemistry by S. K. Agarwal & Keemti Lal (A Pragati Edition)
- Organic Reaction Mechanism, including Reaction Intermediates, , V. K. Ahluwalia, Ane's Chemistry active series
- Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd
- Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L. D.S. Yadav, Pragati Prakashan, 8th edition-2013
- Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co. New Delhi
- Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
- Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
- Chemical Kinetics, G. R. Chatwal and Harish Mishra, Goel Publication House. Meerut.

SEMESTER - I

SEMESTER-I: CHEMISTRY PRACTICAL COURSE [C -102]

3- Credits: 50 Marks

Note Practical Examination:

- Total Marks : 50 Marks {35 Marks External & 15 Marks internal}
- Duration : 3½ hrs
- Two exercises to be performed:
  - **Exercise – I:** Organic Qualitative analysis : 20 Marks (2 Hrs)
  - **Exercise – II:** Volumetric Analysis : 15 marks (1½ Hr)

Exercise – I: Organic qualitative analysis **[20 marks]**

(Minimum 12 compounds should be given)

Compounds containing one functional group such as phenolic, carboxylic acid, ester, amide, nitro, amine, aldehyde, ketone, alcohol, halogen, anilide, carbohydrate and hydrocarbon.

List of compounds: Benzoic acid, cinnamic acid, phenol, α-naphthol, β-naphthol, acetone, ethyl methyl ketone, methyl acetate, ethyl acetate, naphthalene, aniline, nitrobenzene, benzamide, urea, thiourea, chloroform, acetanilide, carbon tetra chloride, chloro benzene, bromo benzene.

Exercise – II: Volumetric analysis **[15 Marks]**

1. Acid-base titrations

- To prepare a solution by dissolving 'x' g $NaHCO_3$ /Na_2CO_3 in 100 ml solution and determine its concentration in terms of normality and molarity using 0.1 N HCl solution.
- To determine the normality, molarity and g/lit of NaOH and HCl using 0.1 N Na_2CO_3 solution.
- To determine the normality, molarity and g/lit of each component in a given mixture of $NaHCO_3$ and Na_2CO_3 using 0.1N HCl solution.

2. Redox titrations

- To determine the normality, molarity and g/lit of each component in a mixture of $H_2C_2O_4.2H_2O$ and H_2SO_4 using 0.1 N $KMnO_4$ and 0.1N NaOH solution.
- To determine the normality, molarity and g/lit of each component in a mixture of $H_2C_2O_4.2H_2O$ and $K_2C_2O_4.H_2O$ using 0.1N NaOH and 0.1 N $KMnO_4$ solution
- To determine the normality, molarity and g/lit of $KMnO_4$ and $FeSO_4.7H_2O$ solution using 0.1 N $H_2C_2O_4.2H_2O$ solution.
- To determine the normality, molarity and g/lit of $FeSO_4$ $(NH_4)2SO_4.6H_2O$ and $K_2Cr_2O_7$ solutions using 0.1 N $KMnO_4$ solution.

SEMESTER - II

SEMESTER-II: CHEMISTRY THEORY COURSE [C -201]

6- Credits: 100 Marks

UNIT-1

1. Basics of ionic compounds **[6 Hours]**

Introduction, characteristics of ionic solids, Born Haber cycle and its application, Max Born equation, limiting radius ratio

Relation between radius ratio, co-ordination number and crystal structure

Derivation of r+/r- ratio in triangular, planar, square planar, body centered and tetrahedral crystal lattices. Defects in ionic crystals (stoichiometric and non-stoichiometric), study of N & P types of semi-conductors

2. Basics of Co-ordination Chemistry **[6 Hours]**

Werner theory, types of ligands (simple ligands, π-acid ligands, according to number of donating electrons, chelating ligands) with definition and examples

Co-ordination number and geometry related to co-ordination number.

Isomerism and its classification (structural and stereo isomerism)

Structural isomerism: (1) ionization and (2) hydration (3) co-ordination (4) co-ordination positions (5) polymerization and (6) linkage isomerism

Geometric/cis-trans isomerism in ML_4 and ML_6 types of complexes

UNIT-2

3. Chemistry of elements of 3d series **[6 Hours]**

Introduction, definition, electronic configuration, reversal of energies of 3d and 4s orbitals, physical properties such as atomic properties (atomic radii, Ionic radii, and ionization potential), metallic conductivity, melting point & boiling point, density, reducing properties, tendency of formation of alloys, catalytic properties, magnetic and spectral properties. Calculation of spin only magnetic momentum of inner orbital and outer orbital complexes $[NiCl_4]^{-2}$, $[Ni(CN)_4]^{-2}$, $[FeF_6]^{-4}$, $[Fe(CN)_6]^{-4}$

4. Solid State **[6 Hours]**

Forms of solids, unit cells, crystal systems, Bravais lattices

Laws of crystallography: (1) Law of Symmetry, (2) Law of constancy of interfacial angles and (3) law of rational indices

Miller and Weiss indices

Bragg's law X–Ray diffraction methods: Rotating crystal method and Powder method

Structures of NaCl and KCl

Numericals

UNIT-3

5. Cycloalkanes **[12 Hours]**

Introduction and classification of ring system (monocyclic and polycyclic, size, number of carbon atom common between the two rings)

IUPAC nomenclature of cycloalkanes (including simple spiro compounds, fused ring and bridged ring systems-bicyclic only)
Method of preparation of small ring cycloalkanes: Intra-molecular Wurtz's reaction, Simmons-Smith, Diels-Alder reaction
Chemical Properties of Cycloalkanes: Substitution Reactions, Addition Reactions, Baeyer's Strain Theory and its limitations (puckering)
Conformations, conformational analysis, conformation of ethane, propane and butane

UNIT-4

6. Aromatic Hydrocarbons **[12 Hours]**

Aromaticity: Criteria for (aromatic, non-aromatic and anti-aromatic), applications of Huckel's rule to simple annulene, cyclic carbocation/anion.
Electrophilic aromatic substitution reactions of benzene with mechanisms, theory of effect of substituents on reactivity and orientation (with resonating structures for activating and deactivating groups)
Electrophilic aromatic substitution reactions with mechanisms: Halogenation, nitration, sulphonation, Friedel-Crafts alkylation, Friedel-Crafts acylation

UNIT-5

7. Ionic Equilibrium **[12 Hours]**

Types of electrolytes, degree of dissociation and factors affecting degree of dissociation
Ionic product of water, dissociation constants of weak acids and bases
Common ion effect and calculation of concentrations of OH- ions (NH_4Cl+NH_4OH) and H^+ ions (H_2S+HCl),
Solubility and solubility products of sparingly soluble salts
Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis)
Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases.
Relation among Kh, Ka, or Kb and Kw. Degree of hydrolysis and pH of the solution of salts of weak acids and strong bases, salts of weak bases and strong acids and salts of weak bases and weak acids.
Buffer solutions: Definition and types of buffer solutions, Buffer action,
Derivation of Henderson-Hassel Balch equation
Numericals

Reference Books:

- UGC Inorganic Chemistry – Volume-II H. C. Khera (Pragati Prakashan)
- Coordination Chemistry- Gurdeep Chatwal and M. S. Yadav
- Advanced Inorganic Chemistry by S. K. Agarwala & Keemti Lal (A Pragati Edition)
- Concise of Inorganic Chemistry - J. D. Lee
- Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co. New Delhi

- Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
- Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
- Organic Reaction Mechanism, including Reaction Intermediates, , V. K. Ahluwalia, Ane's Chemistry active series.
- Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd
- Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L.D.S.Yadav, Pragati Prakashan, 8th edition-2013

SEMESTER - II

SEMESTER-II: CHEMISTRY PRACTICAL COURSE [C -202]

3- Credits : 50 Marks

Note Practical Examination:

- Total Marks :50 Marks {35 Marks External & 15 Marks internal}
- Duration : 3½ hrs
- Two Exercises to be performed:
  - **Exercise – I:** Inorganic Qualitative analysis : 20 Marks (2 Hrs)
  - **Exercise – II:** Volumetric Analysis : 15 marks (1½ Hr)

Exercise-I: Qualitative Analysis of Inorganic Salts: **[20 Marks]**

(Minimum 12 salts-containing two radicals)

Inorganic salts containing anion (chloride, bromide, iodide, nitrate, nitrite, sulphate, sulphite, sulphide, carbonate, phosphate (soluble & insoluble), oxide, chromate and dichromate)

Exercise-II: Inorganic volumetric analysis **[15 Marks]**

(Standard solution should be given)

- Quantitative estimation of Cu^{2+} in a given $CuCl_2.2H_2O$ solution using 0.01M EDTA solution
- Quantitative estimation of Ni^{2+} in a given $NiSO_4.7H_2O$ solution using 0.01M EDTA solution
- Quantitative estimation of Zn^{2+} in a given $ZnCl_2$ solution using 0.01M EDTA solution
- Quantitative estimation of Fe^{2+} by dichromate method (Internal indicator method)
- Determination of total hardness of water by EDTA
- Determination of acetic acid in a commercial vinegar using 0.1M NaOH solution
- Determination of alkali in antacid using 0.1M HCl solution
- Analysis of some industrial product based on volumetric analysis

PAPER STYLE

INSTRUCTIONS

- B. Sc. Chemistry Syllabus for Semester I & II consists of FIVE units
- All units carry equal weightage (14 Marks each)
- There must be one question from each unit
- Each subtopic must be given due weightage in question paper
- 70 Marks for Semester End Examination (External) & 30 marks for Internal Examinations
- Time duration: 2 ½ Hours

Question 1: Answer the following (UNIT-1) **Total Marks: 14**

a) Four objective questions each of one Mark : 1x4 = 4
b) Answer any one out two each of two Marks: 1x2 = 2
c) Answer any one out two each of three Marks:1x3 =3
d) Answer any one out two each of five Marks: 1x5= 5

Question 2: Answer the following (UNIT-2) **Total Marks: 14**

a) Four objective questions each of one Mark : 1x4 = 4
b) Answer any one out two each of two Marks: 1x2 = 2
c) Answer any one out two each of three Marks:1x3 =3
d) Answer any one out two each of five Marks: 1x5= 5

Question 3: Answer the following (UNIT-3) **Total Marks: 14**

a) Four objective questions each of one Mark : 1x4 = 4
b) Answer any one out two each of two Marks: 1x2 = 2
c) Answer any one out two each of three Marks:1x3 =3
d) Answer any one out two each of five Marks: 1x5= 5

Question 4: Answer the following (UNIT-4) **Total Marks: 14**

a) a Four objective questions each of one Mark : 1x4 = 4
b) Answer any one out two each of two Marks: 1x2 = 2
c) Answer any one out two each of three Marks:1x3 =3
d) Answer any one out two each of five Marks: 1x5= 5

Question 5: Answer the following (UNIT-5) **Total Marks: 14**

a) a. Four objective questions each of one Mark : 1x4 = 4
b) Answer any one out two each of two Marks: 1x2 = 2
c) Answer any one out two each of three Marks:1x3 =3
d) Answer any one out two each of five Marks: 1x5= 5

Surendranagar University, Surendranagar

BSc Semester III & IV
Chemistry Syllabus
[With effect from June 2022]

BSc Chemistry Semester III & IV
[2022-23]

CREDITS PER SEMESTER

THEORY: 06 Credits

PRACTICALS: 03 Credits

THEORY - UNIT WISE DISTRIBUTION

Unit-I	Inorganic Chemistry	[12-hours]
Unit-II	Inorganic Chemistry	[08-hours]
Unit-II	Organic Chemistry	[04-hours]
Unit-III	Organic Chemistry	[12-hours]
Unit-IV	Organic Chemistry	[04-hours]
Unit-IV	Physical Chemistry	[08-hours]
Unit-V	Physical Chemistry	[12-hours]
	Total	**: 60 hours**

BSc SEMESTER III CHEMISTRY SYLLABUS [C-301]

Unit-I

1. **Basics of Wave mechanics and Applications to MO theory [12 hours]**

Introduction of wave Mechanics, Postulates of wave Mechanics, Interpretation of ψ, ψ^2, $\psi\psi^*$, Derivation of Schrodinger's equation in three dimensions (Cartesian Coordination), Eigen function & Eigen value, Orthogonal & Normalized wave function and problems on it, Concept of Molecular Orbital Theory, Characteristic of Molecular Orbital, Wave function of H_2^+ & H_2, Potential energy and Schrodinger's equation for H_2^+ & H_2, Derivation of normalized wave function of H_2^+ based on M.O.T., Hybridization ; Derivation co efficient of wave function of sp, sp^2 & sp^3 Hybridization.

Unit-II

2. **Basics of Lanthanide Elements [8 hours]**

Introduction, Position in the periodic table, Occurrence & Important ores, Isolation of Lanthanide Elements from ore, Individual Isolation by (I) Ion Exchange Method (II) Solvent Extraction Method, Electronics Configuration with necessary Explanation, Oxidation State & their Stability, Magnetic properties, Color, Isotopes, spectral properties, Lanthanide Contraction, Misch Metal, Uses of Lanthanides & their Compounds.

3 **Aryl halides: [4-hours]**

Preparation (by direct halogenation, from diazonium salts)

Physical Properties of Aryl Halides

Chemical Reactions of Aryl Halides: Nucleophilic aromatic substitution S_NAr (Benzyne mechanism or Elimination- Addition mechanism)

Other reactions of Aryl halides: Wurtz-Fittig and Fittig reaction, Ullmann reaction, Formation of Organometallic Compounds

Relative reactivity of alkyl halides vs allyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Unit-III

4. **Alcohols, Phenol, Ethers & Epoxides [7-hours]**

Alcohols Preparation of Monohydric alcohols: from alkyl halides; using Grignard reagent; by reduction of aldehydes, ketones, carboxylic acid and esters.

Physical Properties of alcohols

Chemical Reactions: Reaction with sodium, with carboxylic acids (esterification), with acid chloride & anhydride; Reaction with HX, reaction with PX_5, PX_3, $SOCl_2$; Dehydration of alcohols and Oxidation (with alkaline $KMnO_4$, acidic dichromate, conc. HNO_3)

Distinction between Primary, secondary & tertiary alcohols: Lucas test Victor Meyer Test

Diols: oxidation of diols by periodic acid and lead tetraacetate

Phenol :(Phenol case)
Physical properties; Acidity and factors affecting it;
Reactions: Electrophilic substitution (Nitration, halogenation and sulphonation),
Ethers: Preparation of Ethers by Williamson Synthesis
Reactions: Substitution Reaction [Reaction with Cl_2 in dark & Reaction of Cl_2 in light], Reactions involving C-O bond cleavage [hydrolysis, reaction with H_2SO_4, cold HI & hot HI]
Epoxides: Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$.

5. **Organic Compounds of Nitrogen: [5-hours]**

Amines: Classification of amines (Aliphatic and Aromatic)
Basicity of amines, effect of substituent on basicity of amines
Preparation of amines (by reduction of nitro compounds, ammonolysis of halogen compounds, Reduction of amides, Hoffmann bromamide degradation)
Reactions of primary alkyl & aryl amines: [Reaction with acid chlorides, aryl sulphonyl chlorides, alkylhalides, HNO_2]
Chemical reactions of Aniline: Electrophilic substitution (nitration, bromination, sulphonation), Diazotization of Aniline and reactions of Diazonium salt
Hinsberg Reaction to distinguish between Primary, Secondary and Tertiary amines
Preparation and important reactions of **nitro compounds, nitriles and isonitriles**

Unit-IV

6. **Name Reactions and Rearrangements [4-hours]**

Name Reaction: Reimer-Tiemann reaction, Kolbe's Schmidt reaction, Carbylamine reaction
Rearrangement: Pinacol-Pinacolone Rearrangement, Fries Rearrangement, Claisen Rearrangement,

7. **Phase Equilibrium & Phase Rule: [8 hours]**

Introduction, Criteria of phase equilibrium, Explanation of terms: Phases, Components and Degrees of freedom of a system , Gibbs Phase Rule, Limitations of Phase Rule, Phase Diagram, Phase diagrams of one-component systems (water and sulphur)
Two component systems: Condensed Phase Rule, Eutectics system (Lead-Silver) and Park method of desilverization, Congruent melting point system (Mg – Zn) and Incongruent melting point system (Na - K).

Unit - V

8. **Solutions of Non- Electrolytes: [8 hours]**

Introduction, Factors affecting solubility, Types of solutions, Types of liquid – liquid solutions
Miscible Liquid Pair: Ideal solutions and Raoult's law, Deviations from Raoult's law (Non-ideal solutions), Vapour pressure - composition curves of ideal and non-ideal solutions, Temperature - composition curves of ideal and non-ideal solutions.

Distillation of ideal and non-ideal solutions, Lever rule, Fractional column and Bubble cap tower, Azeotropes.

Immiscible Liquid Pair: Introduction, Principle of steam distillation and its applications.

Numericals,

Solution of Gas in Liquid: Factors affecting solubility of a gas., Effect of pressure (Henry's Law), Numericals.

9. Nernst Distribution Law: [4 hours]

Introduction, Nernst Distribution Law, Its limitations, Modified Nernst Distribution Law [Solute associate in the solvent, Solute dissociate in the solvent, Solute enters into chemical reaction with solvent], Applications, Solvent extraction Numericals

BSc SEMESTER IV CHEMISTRY SYLLABUS [C-401]

Unit-I

1. **Basic Concepts of Organometallic compounds [6 hours]**

   Introduction, Classification based on nature of M-C Bond and heptacity.

   Preparation, Properties and uses of Organo Lithium compounds and organo magnesium compounds

   Preparation, bonding & structure of: Zeise Salts, Tri Methyl aluminium (dimer), Ferrocene

2. **Bioinorganic chemistry [6 hours]**

   Metalloporphyrins, structure and roll of Hemoglobin in biological system, myoglobin, structure of chlorophyll and its importance, toxicity of arsenic, mercury, lead and cadmium, reason for toxicity.

Unit-II

3. **Chemistry of Rare Gas Compounds [8 hours]**

   Introduction, Occurrence, Compounds of inert gas;

   Preparation, structure (VBT) and properties of XeF_2, XeF_4, XeF_6, $XeOF_4$, XeO_2F_2, $XeOF_2$, KrF_2, oxide of xenon – XeO_3, XeO_4, use of Noble gases.

4. **Active methylene compounds: [4-hours]**

   Definition, Keto-enol Tautomerism in Ethyl acetoacetate,

   Preparation of Ethyl acetoacetate [Claisen Condensation with reaction mechanism]

   Chemical Reactions of Ethyl acetoacetate: [Reduction, hydrolysis (with dil. H_2SO_4, with ethanolic KOH), with sodium ethoxide, reaction with alkylhalide, Reaction with $NaHSO_3$ and HCN, reaction with Aldehydes]

   Synthesis from Ethyl acetoacetate

   - Monocarboxylic acid: Butyric acid and Valeric acid
   - Ketone: 2-Pentanone and 3- Methyl 2-pentanone
   - α, β – unsaturated acid: Crotonic acid
   - Dicarboxylic acid: Adipic acid
   - Diketone: Acetyl acetone and Acetonyl acetone,
   - Keto acid: Levulenic acid

Unit-III

5. **Chemistry of Carbonyl Compounds (Aldehydes & Ketones): [6-hours]**

   Structure, reactivity, Nature of carbonyl group,

   Preparation of aldehydes: by oxidation of alcohols, from alkenes, from acid chlorides and from nitriles.

   Preparation of Ketones: by oxidation of alcohols, from alkenes, from acid chlorides, by Fries Rearrangement.

   Reactions of Aldehydes & Ketones: Nucleophilic additions (with HCN, ROH, $NaHSO_3$), Nucleophilic addition-elimination reactions (with ammonia derivatives with mechanism), oxidations and reductions (Clemmensen, Wolff-Kishner, $LiAlH_4$, $NaBH_4$,)

6. **Chemistry Carboxylic Acids and their Derivatives: [6-hours]**

Carboxylic acids:

Acidity of Carboxylic acids, Effect of substituents on Acidity of carboxylic acids
Preparation of monocarboxylic acids (by hydrolysis of acid derivatives)
Reactions of monocarboxylic acids: Salt formation, Decarboxylation, Reduction, α-Halogenation – Hell Volhard Zelinsky Reaction

Carboxylic acid derivatives

Preparation of Acid chlorides, Anhydrides, Esters and Amides from carboxylic acids and their inter-conversion
Mechanism of Esterification
Hydrolysis of Esters ($B_{AC}2$ Mechanism)

Unit-IV

7. **Name Reaction and Rearrangements-II: [4-hours]**

Name Reaction: Aldol condensation, Perkin Reaction, Wittig reaction
Rearrangement: Beckmann Rearrangement, Benzil-Benzilic acid Rearrangement, and Hofmann bromamide degradation.

8. **Study of Physical Properties [8-hours.]**

Introduction

Types of Physical Properties: Additive and Constitutive Properties
Molar Volume: Kopp's Law, Atomic Volume
Surface Tension: Explanation of Surface Tension, Name of Methods to Determine Surface Tension, The Drop Weight Method
Parachor: Macleod Equation and $P_1/P_2 = V_1/V_2$, Atomic Parachor, To Determine Structure of (i) Quinine (ii) Benzene (iii) Isocyanides group (iv) Nitro group
Viscosity: Explanation (Briefly), Unit and Factors Affecting the Viscosity, Measurement of Viscosity (Derivation of $\eta_1 / \eta_2 = d_1t_1 / d_2t_2$), Ostwald's Viscometer
Refractive Index and Refractivity: Introduction, Specific and Molecular Refractivity, Abbe Refractometer, Molecular Refractivity and Chemical Constitution
Optical Activity: Polarization of Light, Optical Activity,Factors Affecting Angle of Rotation, Specific Rotation, Polarimeter
Dipole Moment: Polar and Non-polar molecule,Electric Polarization (Polarizability of Molecules), The Mosotti Clausious Equation, Kinds of Molar Polarization [Electron & Nuclear Polarization, Orientation Polarization (Permanent Dipole Moment)]; Application of Dipole Moment: Identification of Polar and Non-polar molecules, Molecular Structure :(i) Mono atomic molecules, (ii) Diatomic molecules (iii) Triatomic molecules (CO_2, H_2O, SO_2) (iv) Tetratomic molecules (NH_3, BCl_3) (v) Aromatic Compounds (Benzene) (vi) Resonance Structure (N_2O) (vii) Cis-Trans Isomer (viii) Orientations in Organic Molecules (o, m and p substitution),
Numericals

Unit - V

9. **Thermochemistry & Thermodynamics: [12 hours]**

Introduction, Limitations and Advantages of Thermodynamics, Types of Systems State Variables, properties of System: Extensive and Extensive Properties, Types of Processes, State and Path Functions, Exact and Inexact Differential Concept of Heat, Work and Internal Energy, First Law of Thermodynamics: Statements, Mathematical derivation, Heat absorbed at constant volume, Perpetual Machine of First Kind, Enthalpy, Heat Capacity: Its types and derivation of relation ($C_p - C_v = R$), Isothermal Reversible and Irreversible Work of Ideal Gas, Proof: $W_r > W_{irr}$, Relations between P – V, V – T and T – P for Adibatic Process, Adiabatic Reversible and Irreversible work of Ideal Gas, Joule Thomson Effect, Joule Thomson Coefficient, Joule Thomson of Ideal Gas, Zeroth Law (Only Statement and Explanation), Variation of Enthalpy with Temperature (Kirchhoff Equation), Flame and Explosion Temperature, Numericals

REFERENCE BOOKS:

1. Quantum chemistry by A. K. Chandra
2. Basic Concept of Quantum Chemistry by R. K. Das.
3. UGC Inorganic Chemistry - H. C. Khera (Pragati Prakashan)
4. Principles of Inorganic chemistry – Puri, Sharma & Kalia.
5. Concise Inorganic Chemistry - J. D. Lee
6. Advanced Inorganic Chemistry- Cotton and Wilkinson
7. Basic Inorganic Chemistry - Gurdeep & Chatwal
8. Organic Chemistry Vol-I&II, by Dr. Jagdamba Singh & Dr. L.D.S. Yadav (Pragati Prakashan)
9. Organic Chemistry (Volume I, II & III) by S.M. Mukherji, S.P. Singh and R.P. Kapoor
10. A Text Book of Organic Chemistry (II Edition) by Raj K. Bansal
11. Organic Chemistry by Clayden
12. Name Reactions in Organic Synthesis by Dr. A.R.Parikh et. al
13. Organic Reaction Mechanisms by V.K. Ahluwalia
14. Reactions and Rearrangements by Gurdeep Chatwal
15. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co.. New Delhi.
16. Elements of Physical Chemistry, Late B.R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
17. Principles of Physical Chemistry, Samule H. Maron and Carl F. Prutton, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
18. Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
19. Elements of Physical Chemistry, Samuel Glasstone and David Lewis, Macmillan & Co.
20. Molecular Physical Chemistry by McQuarrie

PAPER STYLE – THEORY [C-301 & C-401]

INSTRUCTIONS TO PAPER SETTERS

1. B. Sc. Chemistry Syllabus for Semester III & IV (WEF 2020-2021) consists of **FIVE** units
2. All the units carry equal weightage (14 Marks each)
3. There must be one question from each unit.
4. Each subtopic must be given due weightage in question paper (as per the No. of hours of classroom teaching allocated for each unit)
5. 70 Marks for Semester Examination & 30 marks for Internal Examinations.
6. Time duration: 2 ½ Hours

Question 1: Answer the following (UNIT-I)

a. Four objective questions each of one Mark : 1x4 = 4
b. Answer any one out two each of two Marks : 1x2 = 2
c. Answer any one out two each of three Marks : 1x3 = 3
d. Answer any one out two each of five Marks : 1x5 = 5

Total Marks: 14

Question 2: Answer the following (UNIT-II)

a. Four objective questions each of one Mark : 1x4 = 4
b. Answer any one out two each of two Marks : 1x2 = 2
c. Answer any one out two each of three Marks : 1x3 = 3
d. Answer any one out two each of five Marks : 1x5 = 5

Total Marks: 14

Question 3: Answer the following (UNIT-III)

a. Four objective questions each of one Mark : 1x4 = 4
b. Answer any one out two each of two Marks : 1x2 = 2
c. Answer any one out two each of three Marks : 1x3 = 3
d. Answer any one out two each of five Marks : 1x5 = 5

Total Marks: 14

Question 4: Answer the following (UNIT-IV)

a. Four objective questions each of one Mark : 1x4 = 4
b. Answer any one out two each of two Marks : 1x2 = 2
c. Answer any one out two each of three Marks :1x3 = 3
d. Answer any one out two each of five Marks : 1x5 = 5

Total Marks: 14

Question 5: Answer the following (UNIT-V)

a. Four objective questions each of one Mark : 1x4 = 4
b. Answer any one out two each of two Marks : 1x2 = 2
c. Answer any one out two each of three Marks : 1x3 = 3
d. Answer any one out two each of five Marks : 1x5 = 5

Total Marks: 14

CHEMISTRY PRACTICALS
(No of Credits: 3 for each semester)

CHEMISTRY PRACTICALS

CHEMISTRY PRACTICALS SEMESTER III [C 302]

1. **Organic Qualitative Analysis [minimum 10]**
   [Minimum ten organic mixtures should be analyzed & recorded by the students; of which minimum should be six bifunctional]
   Identification of an organic compound through the functional group analysis and determination of melting point or boiling point

2. Organic Volumetric Estimation: [Standard solution to be given]

1. To determine the amount of $-CONH_2$ in the given Acetamide solution
2. To determine the amount of Phenol / m-cresol in the given solution
3. To determine the amount of Aniline / p-toludine in the given solution
4. To determine the amount of Ester in the given solution
5. To determine the amount of Glucose in the given solution
6. To determine the amount of –COOH in the given carboxylic acid

PAPER STYLE – PRACTICALS

CHEMISTRY PRACTICALS SEMESTER III [C 302]

Internal Evaluation [CCA]: 15 Marks

[Based on: performance in the laboratory, submission of record book, journal writing & submission and attendance]

External Evaluation [SSE]: 35 Marks

[Duration of Examination- 3 ½ hours]

Exercise – I: Organic Qualitative Analysis - 20 marks

Exercise – II: Organic Volumetric Estimation- 15 marks

CHEMISTRY PRACTICALS SEMESTER IV [C 402]

1. **Inorganic Qualitative Analysis**:
   [Minimum ten inorganic mixtures should be analyzed and recorded by the students]
   Qualitative Analysis of an inorganic mixture containing four radicals, excluding PO_4^{-3}, CrO_4^{-2}, $Cr_2O_7^{-2}$, AsO_3^{-3}, AsO_4^{-3}, BO_3^{-3} and S^{-2}

2. **Physicochemical Exercise**
   1. To determine the specific reaction rate of the hydrolysis of methyl acetate / Ethyl acetate catalyzed by H^+ ion at room temperature.
   2. To study the rate of reaction between $K_2S_2O_8$ and KI.
   3. To study the rate of reaction between $KBrO_3$ and KI.
   4. To determine the temperature coefficient and Energy of activation for the hydrolysis of ester at two different temperatures.
   5. To determine the temperature coefficient and Energy of activation for the reaction between $K_2S_2O_8$ and KI at two different temperatures
   6. To determine the rate of adsorption of the given organic acid using animal charcoal.
   7. Distribution Law: To study the partition co-efficient of benzoic acid between water and benzene / kerosene and hence study the molecular condition of benzoic acid in the solution.
   8. To study the partition co-efficient of acetic acid between water and chloroform and hence study the molecular condition of acetic acid in the solution.

PAPER STYLE – PRACTICALS

CHEMISTRY PRACTICALS SEMESTER IV [C 402]

Internal Evaluation [CCA]: 15 Marks

[Based on: performance in the laboratory, submission of record book, journal writing & submission and attendance]

External Evaluation [SSE]: 35 Marks

[Duration of Examination- 3 ½ hours]

Exercise – I: Inorganic Qualitative Analysis - 20 marks

Exercise – II: Physicochemical Exercise- 15 marks

SURENDRANAGAR UNIVERSITY

B.Sc. SEMESTER – V CHEMISTRY

[C-501] SYLLABUS

INORGANIC CHEMISTRY AND INDUSTRIAL CHEMISTRY

UNIT-1

Chapter-1: Multi Electron System [12 Hours]

- Introduction
- Concept of spectral terms and term symbols
- s-s coupling, l-l coupling, l-s coupling, j-j coupling and L-S coupling with vector diagram.
- Derivation of spectral term symbol for P^1, P^2, P^3, & d^1 to d^9
- Micro states: Definition, calculation and derivation of microstates for p^1, p^2, d^1 & d^2
- Hole-Pigeon diagram
- Hund's rule for the determination of ground state spectral term
- All type of examples including calculation of S. Ms, L, M_L, J, M_J and microstates.
- Hole formalism
- Splitting of D and F ground terms using hole formalism
- Orgel Diagram of D and F states

UNIT-2

Chapter-2: Crystal Field Theory [12 Hours]

- Introduction
- Concept of crystal field theory
- d-orbitals splitting and CFSE in octahedral and tetrahedral filed with examples
- Weak field and strong field ligands
- Factor affecting splitting energy.
- Jahn-Teller effect: Statement and explanation
- Tetragonal distortion with example
- Splitting of d-orbital in square planar complexes with examples
- High spin and low spin complexes with paring energy with Examples
- Magnetic behaviour of transition metal complexes
- Orbital angular momentum contribution to magnetic momentum of complexes

UNIT-3

Chapter-3: Basics of Electronic Spectra of Transition Metal Complexes [06 Hours]

- Introduction to the concept
- Selection rules for d-d transition
- Relaxation in selection rules
- Characteristics of Absorption Spectrum
- Types of electronic transition in metal complexes
- Discussion of Absorption spectrum of Ti^{+3}, Cu^{+2} & Ni^{+2}

Chapter-4: Glass [06-hours]

- Introduction
- Physical and chemical properties of glass
- Raw materials for glass manufacture
- Chemical reactions involved in glass manufacture
- Manufacture process: Formation of batch material, Melting, Shaping,
- Annealing, and Finishing.
- Special type of glass: Fused silica glass, High silica glass, optical glass, borosilicate glass, lead glass, glass wool, Pyrex glass, photochromic glass, insulating glass, rare earth glass, vitreosil glass, photosensitive glass.

UNIT-4

Chapter-5: Fertilizers [12 hours]

- Introduction to fertilizers, role of plant nutrients.
- Classification and properties of fertilizers.
- Nitrogenous fertilizers.
- Manufacturing process of (1) Ammonium nitrate (by prilling method), (2) Ammonium sulphate (sindri process), (3) Urea (from Ammonium carbonate), (4) Calcium cyanamide(by electro carbonate) and action of fertilizers(of all above).
- Phosphate fertilizer: (1) Normal super phosphate and its manufacturing process, (2) Triple super phosphate and its manufacturing process, (3) manufacture of mono ammonium and diammonium phosphate.
- Potassium fertilizer: NPK fertilizers and nomenclature, Murate of potash and Karnelite from sea water
- Comparison of Natural and Synthetic Fertilizers

UNIT-5

Chapter-6: Cement **[12 hours]**

- Introduction and type of cement.
- Raw materials and manufacturing process (1) Dry process (2) Wet process.
- Setting of cement (1) Hydrolysis (2) Hydration.
- Properties of cement.
- Testing of cement and ISI specification of cement.
- Mortar, concrete, RCC
- Curing and decay of cement.
- Uses of cement.

CHEMISTRY [C-502] SYLLABUS
ORGANIC CHEMISTRY AND SPECTROSCOPY
EFFECTIVE FROM JUNE-2022

UNIT-I:

1. Name Reactions and Rearrangements: [6 hours]

Reactions

a) Arndt Eistert reaction
b) Bischler Napieralski reaction
c) Perkin Reaction
d) Reformatksy Reaction
e) Oppenauer Oxidation

Rearrangements

a) Favorskii Rearrangement
b) Curtius rearrangement
c) Bayer-villiger oxidation

2. Alkaloids [6 hours]

Introduction, Occurrence, classification, Isolation, Constitution, Properties and synthesis of

a) Coniine
b) Nicotine
c) Papaverine

UNIT-II:

1. Carbohydrates [8 hours]

Introduction, classification and nomenclature, [general reaction of monosaccharides (with reference to Glucose and Fructose) for reference only]

Inter-conversions of monosaccharides:

a) Conversion of Aldose to the corresponding ketose via osazone formation
b) Conversion of Ketose to the corresponding Aldose
c) Step-up reaction (Ascending in Aldose series): Kiliani reaction, Swoden nitromethane reaction
d) Step-down reaction (Descending in Aldose series – Aldohexose to Aldopentose) by Ruff's method

Configuration of monosaccharides- Glucose and Fructose

Ring structure of Aldoses

Determination of ring size of Glucose by

a) Methylation method
b) Periodic oxidation method

Mutarotation of D (+) glucose

2. Polynuclear Aromatic Hydrocarbons **[4 Hours]**

Introduction, Classification of Polynuclear hydrocarbon, Synthesis and chemical properties:

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

UNIT-III:

1. Synthetic Drugs, Dyes and Sweetening Agents **[3 hours]**

Synthesis and applications of

Drug:

a) Ibuprofen
b) Atenolol
c) Adrenaline

Dyes:

a) Orange II
b) Crysoidine G
c) Auramine O

Sweetening agent:

a) Saccharin
b) p-anisylurea
c) Aspartame

2. Conformational Isomerism **[3 Hours]**

Conformation of cyclic system: Cyclohexane

Conformational analysis of cyclohexane: Boat form and Chair form

Conformation of mono-substituted and di-substituted cyclohexane

3. Ultraviolet and Visible Spectra **[6 hours]**

Introduction: Theory

Instrumentation- UV Spectrophotometer

Types of transition in organic molecules

Transition Probability: Allowed & Forbidden transitions

Chromophore Related terms:

a) Chromophore
b) Change in position and intensity of absorption: Bathochromic shift, Hypsochromic shift, hyperchromic effect and hypochromic effects
c) Auxochrome

Effect of Conjugation on UV spectral bands

Effect of Solvent on UV spectral bands

Woodward – Fieser Rules for Calculation of Absorption Maxima (λ_{max})

Calculation of λ_{max} in:

i. Conjugated dienes
ii. Enones
iii. α, β -aromatic carbonyl system

Factors affecting of UV spectral bands

Application of UV spectroscopy to Organic Chemistry

UNIT-IV: **[12 hours]**

1. Molecular Symmetry

Introduction

Symmetry elements and symmetry operations with illustrations

Definition of symmetry point group, subgroup and classes

Products of symmetry operations

Symmetry point group [C_1, C_s, C_i, C_n, C_{nv}, D_n, D_{nh}, D_{nd}, C_v, $D_{\alpha h}$, Td, Oh];

Multiplication tables for C_{2v}, C_{3v} and C_{2h} point groups.

UNIT-V:

1. Infrared Spectroscopy **[12 hours]**

Introduction: Range of IR

Theory of IR / Requirements for IR absorption (Not mathematical theory)

IR Instrumentation

Modes of fundamental vibrations

Factors influencing Vibrational Frequencies:

a) Coupled vibrations & Fermi resonance
b) Electronic effects
c) Hydrogen bonding

Force constant

Position and Intensity of IR spectral bands: Finger print region

Applications of IR Spectroscopy to Organic Compounds

Limitations of IR spectroscopy

Determination of structure of organic molecules from IR spectra

Interpretation of IR for given molecules and problems

SURENDRANAGAR UNIVERSITY

B.Sc. SEMESTER – V CHEMISTRY

[C-503] SYLLABUS

PHYSICAL CHEMISTRY AND ANALYTICAL CHEMISTRY

EFFECTIVE FROM JUNE-2022

UNIT-I:

1. Second law of thermodynamics [12 hours]

- Limitations of first law of thermodynamics
- Spontaneous process
- Carnot cycle & theorem
- Statements of second law of thermodynamics
- Perpetual motion machine of the second kind (briefly)
- Concept of entropy, Definition and Characteristics of Entropy
- ΔS in reversible & irreversible (spontaneous) process
- ΔS in physical transformations
- ΔS in ideal gases
- ΔS of mixture of ideal gas
- Entropy and second law of thermodynamics
- Examples based on theory

UNIT-2

1. Electrochemistry-1 [8 hours]

- Introduction to basic concepts related to electrochemistry (e.g. oxidation, reduction, redox reaction, electrolytes and their types, oxidation number, oxidation potential, reduction potential etc)
- Differences between “electrochemical cell” and “electrolytic cell”.
- Electrode, Half-cell, electrochemical cell
- standard half-cell, standard electrochemical cell
- Types of electrodes such as Metal-Metal ion electrode, Metal-metal insoluble salt electrode, Metal-Metal amalgam electrode, Gas electrode and Inert (Redox type) electrode
- Conventional sign and representation of electrochemical cell (Galvanic cell)
- Standard electrode potential and its measurement

- emf series
- Hydrogen electrode, calomel electrode, glass electrode

- Reversible cell and Irreversible cell
- Nernst equation for the calculation of single electrode potential
- Examples based on theory

2. Phase rule [4 hours]

- Three component system, maximum degree of freedom and minimum degree of freedom for three component system
- Method of graphical presentation
- Different types of three component systems

(1) One pair of partially miscible liquids: Effect of adding third component, Nature of tie line, Plait point, Binodal curve, Characteristics of phase diagram,

(2) Formation of two pairs of partially miscible liquids, effect of temperature on phase diagram

(3) Formation of three pairs of partially miscible liquids

- Application of ternary liquid diagram

UNIT-3

1. Free energy and chemical equilibrium [8 hours]

- Work function: its physical significance and variation with V and T
- ΔG for ideal gases, Gibbs Helmholtz equation and its applications
- Free Energy: its significance & variation with P and T
- Criteria for the reaction to be spontaneous or in chemical equilibrium state with respect to different thermodynamic function like E, H, A, S and G
- Law of mass action and its derivation with help of Vant Hoff equilibrium box
- Vant Hoff isotherm equation
- Derivation of Vant Hoff isochor equation and its integral form
- Clausius-Clapeyron equation and its integral form
- Effect of pressure on (i) the melting point of ice, (ii) the boiling point of water and (iii) the melting point of paraffin wax
- Examples based on the theories

2. Colourimetry [4 hours]

- Introduction
- Grotthuss Draper law, lambert's law, Beer's law, lambert's-beer's law and

Derivation, application & deviation of lambert's law

- Spectrophotometric titration with graph and proper explanation
- Deficit of absorbance by product and titrant
- Deficit of absorbance by product and reagent
- Deficit of absorbance by reagent and titrant
- Deficit of absorbance by product only

UNIT-4

1. Conductometry [9 hours]

- Electric transport, Ohms law, resistance in metals and in electrolyte solution conductance, specific resistance, specific conductance, equivalent conductance, Molecular conductance in electrolyte solution,
- Importance of conductivity electrodes and platinization of electrodes etc.
- Effect of dilution on different type of conductance
- Introduction to conductivity cell, different types of conductivity cells area of cross section of dip type electrode and distance between two plates of electrodesetc.
- Kohlrausch law and its importance,
- cell constant and its importance.
- Importance of conductivity water and temperature for the measurement of conductivity

- **<u>Conductometry Titrations:</u>**
  - (1) Strong acid - strong base
  - (2) Strong acid - Weak base
  - (3) Weak acid – Strong base
  - (4) Mixture of (strong acid + Weak acid) versus strong base / weak base
- **<u>Precipitation Titration:</u>**
  - (1) $AgNO_3$ – NaCl (2) $BaCl_2$ – K_2SO_4 (3) $Ba(OH)_2$ – $MgSO_4$
- **<u>Replacement Titration:</u>**
  - (1) Salt of weak acid – strong acid
  - (2) Salt of weak base – strong base

❖ **<u>Applications of conductometry titrations:-</u>**

- To determine degree or hydrolysis and hydrolysis constant
- To determine degree of dissociation and dissociation constant
- To determine solubility and solubility product of sparingly soluble salt

2. Introduction of complexometry titration [3 hours]

- Introduction to different terms related to complexometry titrations; like complex, chelate, legand, different type of valency of metal ion, coordination number etc.
- Method of preparation of standard EDTA solution
- Velcher's law explanation, Graph of "pM versus volume of EDTA", stability constant value.
- Different types of EDTA titration e.g. (i) Direct titration, (ii) Back titration, (iii) Replacement titration (iv) Alklimetry titration
- Masking and demasking
- Principle of metal ion indicator,
- Brief introduction to metal-ion indicators with structure and characteristics; e.g. EBT, calcon, muroxide.

UNIT-5

1. Volumetric analysis with example of calculation based on pH, normality, molarity, Ksp etc. [12 hours]

- Ostwald's law- Regarding indicator – necessary derivation and formula of indicator used in Neutralization, redox, precipitation titration.
- Primary and secondary standard explanation

Explanation of neutralization titration with graph

- Strong acid - Strong base titration
- Weak acid - Strong base titration
- Strong acid – Weak base titration
- Poly protic acid - Strong base titration

Redox Titration

- Principle of external and internal indicator in redox titration. e.g. Diphenyl amine, starch & $K_3[Fe(CN)_6]$
- Redox Titration with graph and calculation
- Iodometry and Iodimetry titration
- Preparation of standard sodium thiosulphate solution

Precipitation Titration

- Argentometric Titration (I) Mohr's method (II) Fazan's method (III) Volhard's method with use of proper indicator, graph and its practical application
- Examples of calculation based on pH, Normality, Molarity, Ksp etc...

Surendranagar University

B.Sc. SEMESTER – V

CHEMISTRY PRACTICALS [C-504] SYLLABUS

[Practical Exam. would be conducted for 1 ½ days]

[Total Marks: 105 marks]

EFFECTIVE FROM JUNE-2022

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 [30 marks]**

   [Minimum 8 exercises should be done]

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

   i. Iodometry and Iodimetry

   (a) 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.

   (b) 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 EDTA solutions.
   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 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 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/ 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 $KMnO_4$ solutions.

iv. Water Analysis

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

v. To determine the purity of $NaHCO_3$ in the given sample

3. Physicochemical Exercise [30 marks]

[Minimum 10 exercises should be done]

1. Conductometry

i. To determine normality and gms/lit of xNHCl and also determine specific conductance by conductometry.

ii. To determine normality and gms/lit of the mixture of HCl+CH_3COOH by conductometry.

iii. To determine the normality of weak acid by conductometry

iv. To determine the concentration of Ni+2 using 0.1M EDTA solution.

v. To determine the normality of $xNAgNO_3$ using 0.5N NaCl b y Conductometry.

2. Thermodynamics:

i. Calculate entropy of vaporization (ΔS_v) of a given liquid by plotting a graph of log (1/time) vs (1/temperature)

3. Refractometer

i. To determine specific refractivity and molecular refractivity of given pure liquid A, B, C, D.

ii. To determine specific refractivity and molecular refractivity of glycerine (10%, 5%, 2.5%) and unknown glycerine solution.

4. Viscosity

i. To determine relative and absolute viscosity of pure liquid A, B, C, D by Ostwald's viscometer.

ii. Preparation 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 Ostwald's viscometer.

5. Colourimetry

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

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

6. Polarimeter

i. To determine specific rotation of three different concentration (10%, 5%, 2.5%) of dextrose solution. From graph find out the unknown.

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

4. Viva-voce; **[15 marks]**

- Organic Separation: **5 marks**
- Inorganic Volumetric Analysis: **5 marks**
- Physicochemical Exercise: **5 mar**

SURENDRANAGAR UNIVERSITY

B.Sc. SEMESTER – VI CHEMISTRY

[C-601] SYLLABUS

INORGANIC CHEMISTRY AND INDUSTRIAL CHEMISTRY

UNIT-1

Chapter-1: Wave Mechanics [12 hours]

- Concepts of wave mechanics.
- Operators:
  Algebra Operator (Addition, Subtraction, multiplication), commutative property, linear operation, commutation operation, the operator ∇ and ∇^2, momentum operator and Hamiltonian operator.
- Particle in one dimensional box; normalised wave equation and energy related to particle moving in one dimensional box, energy equation and its interpretation with energy levels, linear polyenes as one dimensional box model, examples based on one dimensional box model.
- Particle in three dimensional box; Derivation of normalised wave equation, energy related with it, energy levels and degeneracy example.
- Wave equation for hydrogen atom: To derive the relation between Cartesian and polar coordinates, Schrodinger equation in polar coordinates,
- Separation of variables to derive R(r), $\theta(\theta)$ and $\phi(\phi)$ equations.
- Energy of 1s orbital, normalisation condition and problems on it (in polar coordinates for three dimension)

UNIT-2:

Chapter- 2: Magneto Chemistry [12 Hours]

- Introduction (Magnetic field, Magnetic pole, Intensity of magnetization) Magnetic induction, Magnetic Permeability, intensity of magnetism, magnetic susceptibility, molar magnetic susceptibility
- Magnetic behaviour: Diamagnetism, Paramagnetism, Ferromagnetism and Antiferromagnetism
- Effect of temperature on magnetic behaviour of substances
- Derivation of equation for total angular magnetic momentum and diamagnetic Momentum

- Determination of magnetic susceptibility by Gouy method, NMR method and Faraday method.
- Examples on Magnetic induction, Magnetic Permeability, intensity of magnetism, magnetic susceptibility, molar magnetic susceptibility

UNIT-3

Chapter-3: Transition Metal Complexes of π-acid Ligands [6 hours]

- Metal carbonyls: Definition, preparation, physical and chemical properties, nature of M-CO linear bond based on MO theory with spectral support,
- classification of metal carbonyls, type of CO group and detection of CO group, using IR spectra
- Structure of $Fe(CO)_5$, $Fe_2(CO)_9$, $Co_2(CO)_8$, and $Mn_2(CO)_{10}$
- Metal Nitrosyls: Structure and bonding in complexes of NO^+, NO^- and NO.

Chapter-4: Oil and Fats [6 Hours]

- Introduction
- Distinction between oils and fats and their classification
- Properties of Oils and Fats
- Manufacturing of cotton seed oil by (i) Expression method and (ii)Solvent extraction method
- Refining of crude vegetable oil; Hydrogenation of oils, Optimum conditions for the
- process, Dry process, Wet process
- Analysis of oils and fats; Saponification value, Acid value, Iodine value, Reichert-
- Meissl-Wollny (RM) value.

UNIT-4

Chapter-5: Environmental Pollution [12 Hours]

- Environment: Definition and introduction
- Segments of environment: Atmosphere, Hydrosphere, Lithosphere, Biosphere
- Air Pollution: Introduction, Greenhouse effect, Major sources of air pollution, Photochemical smog and acid rain, CFC and ozone depletion, Sources and effects of NOX and SOX, Control of Air pollution
- Water pollution: Introduction and Classification of water pollution (Physical pollution, Chemical pollution, Biological pollution, Physiological pollution); Sources of water

pollution (Sewage and domestic waste, Industrial effluents, Agricultural discharges, Fertilizers, Toxic metals, Siltation, Thermal pollutions, Radioactive aterials); Water Pollution Control, Dissolved Oxygen (DO) determination, Chemical oxygen Demand (COD) determination, Biological Oxygen Demand (BOD) determination

UNIT-5

Chapter- 6: Soaps and Detergents [12 Hours]

- Introduction to soap, Types of soap (Toilet soap, Transparent soap, Shaving soap, Neem soap, Liquid soap)
- Manufacturing of soap (Batch process, Continuous process)
- Recovery of glycerine from spent lye.
- Introduction to detergents
- Principal group of synthetic detergents
- Biodegradability of surfactants
- Classification of surface active agents
- Anionic detergents (Manufacture of anionic detergents (i) Oxo Process (ii) Alfol Process (iii) Welsh Process)
- Cationic detergents (Manufacture process)
- Non Ionic detergents (Manufacture by batch process)
- Amphoteric detergents
- Manufacture of shampoo

CHEMISTRY [C-602] SYLLABUS
ORGANIC CHEMISTRY AND SPECTROSCOPY
EFFECTIVE FROM JUNE-2022

UNIT-I:

1. Heterocyclic Compounds containing One and Two Heteroatoms [12 hours]

Heterocyclic Compounds containing one hetero atom

Structure, Aromaticity, synthesis (any two methods) & chemical properties of

1. Furan
2. Thiophene
3. Pyrrole
4. Pyridine

Basicity of Pyridine

Relative Basicity of Pyridine, Pyrrole and Aliphatic amines

Heterocyclic Compounds containing two hetero atoms [Only Synthesis]

Synthesis of heterocyclic compounds containing two hetero atoms (Two method of each)

1. Pyrazole (from Acetylene & Diazomethane, from propiolaldehyde & hydrazine, from dicarbonyl compounds & hydrazine)
2. Isoxazole (from propiolaldehyde, from 1,3 – diketones, from α, β-unsaturated ketones)
3. Thiazole (from chloroacetaldehyde & thioformaldehyde, from 2-formyl amino thioacetamide)
4. Pyrimidine (from 1,3 -diamino propane & formaldehyde, from malonic esters & urea, from formylacetic acid and urea)
5. Oxazine (from diethanolamine, from β, β'- dichloro diethyl ether & NH_3, from β, β'- diamino diethyl ether)
6. Thiazine (from β, β'- diamino diethyl thioether, from β, β'- dichloro diethyl thioether, from 2-amino ethane thiol & ethylene glycol
7. Dioxane (from ethylene glycol, from β, β'- dibromo diethyl ether & NaOH, from ethylene glycol and 1,2 dihaloalkane)

UNIT-II:

1. Synthetic Explosive, Perfumes and Insecticides [3 Hours]

Synthesis and uses of: Explosives:

a) RDX (Research Department Explosive)

b) TNT (Trinitrotoluene)

c) PETN (Penta erythritol tetranitrate) Synthesis and uses of Perfumes:

a) Musk Xylene

b) Musk Ketone

c) Musk Ambrette

Synthesis and uses of Insecticides:

a) Baygon

b) Carbendazim

c) Parathion

2. Amino acids, Peptides and Proteins **[9 hours]**

Introduction, Classification of amino acids name and formula

Synthesis of amino acids by:

a) Amination of α-halogen acids

b) Gabriel pthalimide synthesis

c) Erlenmeyer azlactone synthesis

Physical properties of amino acids, Chemical properties of amino acids

Isoelectric point

Introduction to Polypeptides

Synthesis of Polypeptides by:

a) Bergmann Method (use of carbobenzyloxy group)

b) Sheehan's Method (use of Phthaloyl group)

c) Fischer's Method (use of p-toluene sulphonylchloride)

Introduction to proteins, Colour Reactions of Proteins

Constitution of Thyroxine, Synthesis of Thyroxine

UNIT-III:

1. Terpenoids: **[6 hours]**

Introduction

Occurrence & Isolation

Isoprene Rule

Constitution and Synthesis of:

a) Citral

b) α-Terpineol

2. Mass Spectrometry **[6 Hours]**

Introduction: Basic principle

Instrumentation: Components of Mass Spectrometer

Types of ions produced in a Mass Spectrometer

General fragmentation modes

Retro Diel's Alder

Fragmentation

Mc Lafferty Rearrangement

Important features for the mass spectra of alkanes

General Rules for interpretation of Mass Spectra

Applications of Mass Spectrometry

(No problems on Mass spectrometry)

UNIT-IV

1. Nuclear Magnetic Resonance Spectroscopy **[12 Hours]**

Introduction: Principle

Nuclear quantum number

Instrumentation: NMR Spectrophotometer

Interpretation of NMR Spectra:

a) Number of Signals: Equivalent and non-equivalent protons with illustrations, Enantiomeric and diasteroiomeric protons

b) Position on PMR signals: Chemical shift, Shielding and deshielding of protons, Measurement of chemical shift, TMS as the reference compound, Factors affecting Chemical shift: Inductive effect, Anisotropic effect, Hydrogen bonding

c) Relative intensity of signals

d) Spin- spin coupling and coupling constant

Applications of NMR Spectroscopy

Problems based on determination of structure of organic molecules from NMR spectral data Limitations of NMR Spectroscopy

UNIT-V

1. Problems based on UV, IR, NMR spectroscopy [12 Hours]

Reference Books

1. Organic Name reactions by Gautam Brahmachari
2. Organic Reaction Mechanisms by V.K. Ahluwalia
3. Reactions and Rearrangements by Gurdeep Chatwal
4. Name Reactions in Organic Synthesis by A.R. Parikh et. al
5. Chemistry of Organic Natural Products (Volume I & II) by O.P Agrawal.
6. Organic Chemistry of Natural Products by Gurudeep Chatwal
7. Pharmaceutical Chemistry by Axel Kleemann & Jugen Engel
8. Heterocyclic compounds by Gurdeep Chatwal
9. Chemical Application of group theory by F Albert Cotton
10. Symmetry in Chemistry by H.N. Jhaffe
11. Spectroscopy by Gurdeep R. Chatwal & Sham K. Anand
12. Spectroscopy by Pavia, Lampman, Kriz, Vyvyan
13. Spectrometric Identification of organic compounds by Silverstien, Bassler and Morril
14. Elementary organic spectroscopy by Y.R Sharma
15. Spectroscopy of organic compounds by John R Dyer
16. Spectroscopy of organic compounds by PS Kalsi

SURENDRANAGAR UNIVERSITY

B.Sc. SEMESTER-VI

CHEMISTRY [C-603] SYLLABUS

Physical Chemistry and Analytical Chemistry

UNIT-I

1. Activity of Electrolytes [8 Hours]

- Ionic Activity: Introduction
- Derivation of $a_2 = a_+^{\vartheta +} a_+^{\vartheta -}$ and $a_2 = a_+ a_-$ for 1-1 electrolyte.
- Mean activity and its relation with a_+ and a_-
- Relationship between a_2 and $a_\pm$ i.e. $a_2 = at$
- Mean ionic activity coefficient f_t and f_+, ionic strength : Definition, explanation, equation Debye Huckel limiting law (without derivation) Derivation of $- \log f_\pm = Az_+z_-\mu^{1/2}$
- Interpretation of equation
- Graph of $- \log f_\pm \rightarrow \mu 1/2$ and its explanation/discussion
- Empirical correction of Debye Huckel limiting law of (i) Size of ion and (ii) Orientation of solvent molecules, Methods to determine Activity coefficient
- Solubility method
- Emf method

Examples based on theory

2. Third Law of Thermodynamics [4 Hours]

- Nernst heat theorem
- Third law of thermodynamics
- Determination of absolute entropies of solids, liquids and gases
- Applications of third law of thermodynamics (ΔS^0, ΔG^0 and equilibrium constant of chemical reaction)
- Tests of third law of thermodynamics, Residual entropy.

UNIT II

1. Electrochemistry-2 [12 Hours]

- Concentration cells: Definition, (1) Electrode concentration cells (2)Electrolyte concentration cells

- Concentration cells without transference
- Concentration cells with transference
- Liquid junction potential, Elimination of liquid junction potential.
- Applications of emf measurements:

  Determination of

  - Solubility of sparingly soluble salts
  - Valency of metal ion
  - Dissociation constant of weak acid
  - Transport number of ion
  - Ionic product of water
  - Degree of hydrolysis
  - pH by different
- electrodes Example

UNIT III

1. Partial Molar Properties [4 Hours]

- Definition
- Concept of chemical potential, Gibbs-Duhem equation Variation of
- chemical potential with temperature and pressure Determination of
- Applications of chemical potential (Henry's law, Rault's law and Nernst's partial molar properties by method of intercept distribution law)

2. Error and statistics [8 Hours]

- Introduction, Explanation of errors & mistake
- Classification of errors, Determinate and indeterminate errors, Operational and personal error, Instrumental errors and reagent errors, additive and proportional error.
- 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 completeInterpretation
- Mean and standard deviation , variance and coefficient of variance
- Absolute error and relative error, mean value, deviation and relativeMean

deviation. Gausian curve and its explanation

- Importance of Q– test and T -test (Student T-test)
- Example on errors, significant figures, Q test & T-tests.

UNIT IV

1. Chromatography **[12 Hours]**

- Introduction of Chromatography

  Chromatography: Classification, principle and efficiency of the technique.

  Detail study of Mechanism of separation

  (a) Adsorption (Column) chromatography

  (b)Partition chromatography¯ paper and TLC.

  (c)Gas chromatography- GLC & GSC

  (d)Ion exchange chromatography

- Application such as main physical characteristic of chromatography: Solubility, adsorption value, volatility, Rf value, Rx value, nature of adsorption etc.

  Qualitative and quantitative aspects of various chromatographic methods of analysis

  a. **Column chromatography:**Principle, Method of separation of green leafpigment, mixture of inorganic salts, vitamins,colors of flowers etc. separation of$\alpha.\beta,\Upsilon$ carotene from carrot.

  b. **Partition chromatography:**
     - **Paper chromatography:**Principle of paper chromatography, Experimental methods like :Ascending and Descending method containing one dimensional and two dimensional method; circular method and its Rf value , Rx value; circular method, separation of amino acids and metal ions(Fe^{+} , Co^{+2}, $Ni^{+2)}$ mixture using spray reagent ninhydrine and aniline phthalate
     - **TLC:**Principle, Method of preparation of chromatoplate, Experimental techniques, superiority of TCL over other chromatographic Techniques, Application of TLC.

  c. **Gas chromatography; P**rinciple of GLC and GSC,
     - GLC: Instrumentation, Evaluation selection and characteristic of

carrier gas, Effect of temperature& pressure of gas, application

- GSC:Methods and its application.

d. Ion Exchange chromatography: Principle, Type of resins, Properties of ion exchange resins, Basic requirement of useful resins, Method of separation with illustration curve, Application of ion exchange resins

UNIT V

1. Basic principle of qualitative analysis [3 Hours]

Separation of the following in presence of each other

(i) Cl^{-1} , Br^{-1} , I^{-1} (ii) NO_2^{-1} ,NO_3^{-1} , Br^{-1}

(iii) S^{-2} , SO_3^{-2} , SO_4^{-2} (iv) PO_4^{-3} , AsO_3^{-3} , AsO_4^{-3}

(v) CO_3^{-2} , SO_3^{-2} , S^{-2} (vi) Cu^{+2} , Cd^{+2}

2. Electro analytical methods [9 Hours]

- Introduction & Classification of Electro analytical methods
- Basic principle of pH metric, potentiometric and conductometric titrations.
- Importance of indicator and reference electrode in the measurement of EMF and pH
- E.M.F. method:
  - (i) Study of acid-base Titration
  - (ii) Redox Titration
  - (iii) Argentometric titration includes mixture of Cl^-, Br^-, I^- with graph and proper explanation.
- pH metry:

  Definition, Interpretation of various methods of determining pH value like pH paper method, potentiometric method using only hydrogen electrode as indicator electrode and calomel electrode as reference electrode to determine pH value
- Techniques used for the determination of equivalence points.
- Techniques used for the determination of pK_a values of Weak acid-strong base

Reference Books for Physical Chemistry

1. Elements of Physical Chemistry by Samuel Glasstone and D lewis
2. Principles of Physical Chemistry by SH Maron and CF Prutton
3. Thermodynamics for Chemists by Samuel Glasstone
4. Elements of Physical Chemistry by BR Puri, LR Sharma, MS Pathania
5. Advanced Physical Chemistry by JN Gurtu
6. Physical Chemistry by N Kundu and SK Jain
7. Physical Chemistry by KL Kapoor
8. Physical Chemistry by BK Sharma
9. Thermodynamics by Gurudeeep Raj
10. Introduction to electrochemistry by S. Gladstone

Reference Books for Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J.• & Denney,
2. R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
3. Willard, H.H., Merritt, L.L., Dean, J.• & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
4. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley• & Sons, New York, 2004.
5. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.•
6. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International• Publisher, 2009. Skoog, D.A. Holler F.J.• & Nieman, T.A.
7. Principles of Instrumental Analysis, Cengage Learning India Ed. Mikes, O.
8. Laboratory Hand Book of Chromatographic• & Allied Methods,
9. Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
10. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974
11. Fundamental of analytical chemistry by Skoog& West
12. Instrumental Method & Chemical Analysis by B.K. Sharma Analytical
13. Water Analysis and Water pollution by V.P. Kudesia
14. Instrumental Method & Chemical Analysis by ChatwalAnand
15. Thin layer chromatography by Egal Stall
16. Book for Water Analysis by R. K. Trivedi, V. P. Kudesia

17. Analytical Chemistry by Dick
18. Inorganic Qualitative analysis by Vogel and Gehani Parekh
19. Electrometric Methods of analysis by Browning
20. Principle of instrumental analysis by Skoog

SURENDRANAGAR UNIVERSITY

B.Sc. SEMESTER-VI

CHEMITRY PRACTICAL [C-604] SYLLABUS

[Practical Examination Would Be Conducted For 1 ½ Days]

[TOTAL MARKS: 105 MARKS]

EFFECTIVE FROM- JUNE-2022

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** **[30 marks]**

   (Percentage 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

3. Physicochemical Exercise [30 marks]

[**Minimum 10 exercises** should be done]

i. pH metry

1. To determine normality and gms/lit. of xNHCl by pH metry
2. To determine normality and dissociation constant of weak acid ($xNCH_3COOH$) by pH metry.
3. To determine normality and dissociation constant of dibasic acid (xN oxalic acid/malonic acid/maleic acid) using 0.1N NaOH solution.

ii. Potentiomentry

1. To determine normality and dissociation constant of benzoic acid used 0.1N NaOH.
2. To determine normality of given acid xNHCl 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.

iii. 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 liquid and CH_2 group.

iv. 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.

4. Viva-voce; **[15 marks]**

- Inorganic Qualitative Analysis: **5 marks**
- Organic Synthesis: **5 marks**
- Physicochemical Exercise: **5 mark**

SURENDRANAGAR UNIVERSITY
B.Sc. SEMESTER- VI
PAPER STYLE – THEORY
EFFECTIVE FROM- JUNE-2022

Instructions to paper setters

1. B. Sc. Chemistry Syllabus for Semester V & VI consists of **FIVE** units each
2. All the units carry equal weightage (14 Marks each)
3. There must be one question from each unit.
4. Each subtopic must be given due weightage in question paper
5. 70 Marks for Semester Examination & 30 marks for Internal Examinations.
6. Time duration: 2 ½Hours

Question 1: Answer the following (UNIT-I)

a. Four objective questions each of one Mark :1x4 = 4
b. Answer any one out two each of two Marks :1x2 = 2
c. Answer any one out two each of three Marks :1x3 = 3
d. Answer any one out two each of five Marks :1x5 = 5

Total Marks: 14

Question 2: Answer the following (UNIT-II)

a. Four objective questions each of one Mark :1x4 = 4
b. Answer any one out two each of two Marks :1x2 = 2
c. Answer any one out two each of three Marks :1x3 = 3
d. Answer any one out two each of five Marks :1x5 = 5

Total Marks: 14

Question 3: Answer the following (UNIT-III)

a. Four objective questions each of one Mark :1x4 = 4
b. Answer any one out two each of two Marks :1x2 = 2
c. Answer any one out two each of three Marks :1x3 = 3
d. Answer any one out two each of five Marks :1x5 = 5

Total Marks: 14

Question 4: Answer the following (UNIT-IV)

a. Four objective questions each of one Mark :1x4 = 4
b. Answer any one out two each of two Marks :1x2 = 2
c. Answer any one out two each of three Marks :1x3 = 3
d. Answer any one out two each of five Marks :1x5 = 5

Total Marks: 14

Question 5: Answer the following (UNIT-V)

a. Four objective questions each of one Mark :1x4 = 4
b. Answer any one out two each of two Marks :1x2 = 2
c. Answer **a**ny one out two each of three Marks :1x3 = 3
d. Answer any one out two each of five Marks :1x5 = 5

Total Marks: 14