



Department of Chemistry
Theory Syllabus
Subject-Chemistry (CBCS)
B.Sc.-Part-II Sem-III



UNIT	SYLLABUS	L
UNIT-I	<p>A) Volumetric Analysis (a) Introduction: -Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance. Requirements of primary standard substance. Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. (Simple numerical expected). (b) Acid-Base titrations: - Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Modern theory (Quinoniod theory) of acid base indicators. Choice of suitable indicators for different acid base titrations. (c) Redox Titrations: -General principles involved in redox titrations (redox reactions, redox potentials, oxidant, reductant, oxidation number). Brief idea about use of KMnO_4, $\text{K}_2\text{Cr}_2\text{O}_7$ as oxidants in acidic medium in redox titrations. Use of I_2 in iodometry and iodimetry. Redox indicators-external and internal indicators. Use of starch as an indicator. Iodometric estimation of Cu (II).</p>	14
	<p>B) Gravimetric Analysis: Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as barium sulphate. Coprecipitation and post precipitation. (Definition, types and factors affecting).</p>	
UNIT-II	<p>A) P-Block Elements-Comparative study of 16th and 17th group elements with reference to electronic configuration, ionization energy and oxidation states. Oxidising properties of halogens with reference to oxidation potential. Interhalogen compounds, structure and bondings. Introduction to fluorocarbons.</p>	14
	<p>B) Chemistry of elements of transition series: Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration (ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour. Study of 4d and 5d series elements-Electronic configuration. Comparison of 3d series elements with 4d and 5d series elements with respect to size, oxidation states, magnetic properties and color.</p>	
UNIT-III	<p>A) Aldehydes and Ketones: Introduction, Structure of carbonyl group, acidity of α hydrogen in carbonyl compounds. Preparation of aldehydes and ketones from appropriate alcohol, dihalide, alkyne. Preparation of benzaldehyde from benzene (Gatterman-Koch synthesis/reaction) and toluene. Preparation of acetophenone from benzene and ethyl benzene. Chemical Reactions: Reaction with HCN, ROH, NaHSO_3, NH_2- groups derivatives. Iodoform test, Reactions of aldehydes & /or ketones: Aldol condensations Reformatsky, Mannich, Perkin, Cannizaro's, Benzoin reaction with mechanism, Knoevenagel, Stobbe, Wittig reaction only. Clemmensen, Wolff-Kishner, MPV and LiAlH_4 reductions.</p>	14
	<p>B) Carboxylic acids: Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid. Reactions: Reaction with ethanol, PCl_5, action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide. Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and $\text{C}_6\text{H}_5\text{OH}$. Hell- Vohland -Zelinsky Reaction</p>	

UNIT-IV	Stereochemistry: A) Optical isomerism: Isomerism, Types of isomerism, Stereoisomerism, Optical isomerism, assymmetric carbon atom, Element of symmetry, chirality (up to two carbon atoms), enantiomers, diastereoisomers, meso compounds, configuration, relative and absolute configurations, DL and RS nomenclature (for up to 2 chiral carbon atoms), racemisation and resolution (by chemical method). optical isomerism in allenes and biphenyls.	14
	B) Geometrical isomerism: Cis-trans & E-Z nomenclature (for up to two C=C systems) with examples and applications.	
	C) Conformational isomerism: Conformational isomers, Newman & Sawhorse projection formulae, conformations of ethane, n-butane and cyclohexane, their energy level diagrams. conformation of cyclic systems mono-substituted cyclohexanes	
UNIT-V	A) Colligative Properties of Dilute Solutions: Definition and examples of colligative properties. Importance and applications of colligative properties. Elevation of boiling point. Thermodynamic derivation of the relationship between elevation of boiling point and the molar mass of non-volatile solute. Cottrell's method for the determination of elevation of boiling point and hence the molar mass of solute. Depression of freezing point. Thermodynamic derivation of the relationship between depression of freezing point and the molar mass of non-volatile solute. Rast's method for the determination of molar mass of solute. Abnormal behaviour of solution. Van't Hoff's factor 'i'. Determination of degrees of association and degree of dissociation from Van't Hoff's factor. Numerical.	14
	B) Phase rule: Statement of Phase rule. Explanation of Phase, number of components and degrees of freedom. Application of phase rule to water and sulphur systems. Numerical.	
UNIT-VI	A) Thermodynamics: First law of Thermodynamics and its limitations, Need of Second law. Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics. Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas in terms of pressure, temperature and volume. Entropy change for an ideal gas for isothermal, isobaric and isochoric processes, Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change for reversible and irreversible processes. Entropy change as a criteria for spontaneity. Numerical.	14
	(B) Phase Equilibrium: Raoult's Law and it's limitations. Ideal and non-ideal solution. Classification of binary solutions of completely miscible liquids (I, II and III) on the basis of Raoult's Law. Phase diagrams of Phenol-Water, Triethylamine-Water and Nicotine-Water system. Nernst distribution law and its applications to association and dissociation of solute in one of the immiscible solvents. Process of extraction. Derivation of the formula for the amounts of the solute left unextracted after nth extraction. Numerical	
	*SEM: A) Appropriate use of chemicals and glassware for determination of concentration, Applications of p-block and transition series elements B) Preparation of charts for organic reactions of aldehydes, ketones, and carboxylic acids, Model creation and drawings for different stereoisomers. C) Numerical associated with colligative properties and thermodynamics, Applications of laws of thermodynamics and phase equilibrium,	
	Activities Model creation, poster, chart preparation, memory maps, class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.	

B.SC.- II (SEM -II) CBCS
PRACTICAL SYLLABUS
SUBJECT-CHEMISTRY

*** List of Practical/Laboratory Experiments/Activities etc.**

Exercise-1 Inorganic	
1	Estimation of Ba ²⁺ as BaSO ₄ .
2	Estimation of Fe ³⁺ as Fe ₂ O ₃ using china and silica crucible.
3	Estimation of Ni ²⁺ as Ni-DMG using sintered glass crucible.
4	Estimation of copper (II) in commercial copper sulphate sample by iodometric titration.
5	To determine the percentage of calcium carbonate in precipitated chalk.
6	To determine volumetrically the amounts of sodium carbonate and sodium hydroxide present together in the given solution.
7	Preparation of standard solution of an acid (oxalic acid) & a base (sodium bicarbonate) by weighing and calculation of concentrations in terms of strength, normality, molarity, molality, formality, % by weight, % by volume, ppm, ppb and mole fraction.
8	Preparation of standard solution of hydrochloric acid by dilution and calculation of concentrations in terms of strength, normality, molarity, molality, formality, % by weight, % by volume, ppm, ppb and mole fraction.
Exercise II: Physical Chemistry Experiments	
9	Determination of molecular weight of solute by Rast's method
10	To determine activation energy of a reaction between K ₂ S ₂ O ₈ and KI.
11	Determination of thermodynamic values (ΔS° , ΔH° , and ΔG°) from the dissociation of a weak acid.
12	To determine transition temperature of MnCl ₂ .4H ₂ O.
13	To study critical solution temperature (CST) of phenol water system.
14	To determine the partition coefficient of CH ₃ COOH between H ₂ O and CCl ₄
15	To determine the partition coefficient of Benzoic acid between H ₂ O and toluene.