



Department of Chemistry
Theory Syllabus
Subject-Chemistry (CGS)
B.Sc.-Part-III Sem-VI



UNIT	SYLLABUS	L
UNIT-I	A] Kinetic Aspects of Metal Complexes: Thermodynamic and kinetic stability of the complexes, factors affecting stability of complexes. Brief idea about substitution reactions, SN1 -dissociative and SN2 -associative mechanism. Labile and inert complexes. Factors affecting lability of complexes namely arrangement of d-electrons (on the basis of VB theory), size of central metal ion, charge of central metal ion, geometry of complexes. Substitution reactions in square planar complexes mechanism.	6
	B] Analytical Chemistry: 1) Spectrophotometry and Colorimetry: Concept of ϵ_{max} , Beer-Lambert's law (Only statement and final equation, no derivation). Calibration curve and its importance. Validity and limitations of Beer-Lambert's law. Verification of Beer's law. Block diagram of colorimeter and spectrophotometer with brief description of each component and its function. Difference between colorimetric and spectrophotometric technique for determination of concentration of metal ion (Example of determination of Cu (II)). 2) Paper Chromatography: Definition and classification of chromatographic techniques. Principle of differential migration. Principle and technique of paper chromatography - ascending, descending and circular, Rf value and factors affecting Rf value.	8
UNIT-II	A] Organometallic Chemistry: Definition, nomenclature and classification of organometallic compounds. Metal carbonyls- definition and classification. Preparation, properties, structure and bonding in Ni(CO) ₄ , Fe(CO) ₅ , Cr(CO) ₆ . Nature of M-C bond in metal carbonyls.	5
	B] Inorganic Polymers: Definition and classification. Silicones: preparation, properties structure and bonding and applications. Phosphonitrile halides polymers- preparation, properties, structure and bonding in cyclic polymers.	5
	C] Bio-inorganic Chemistry: Essential and trace elements in biological processes. Biological role of Na ⁺ , K ⁺ , Ca ²⁺ and Mg ²⁺ ions. Metalloporphyrins-Haemoglobin and Myoglobin and their role in oxygen transport.	4
UNIT-III	A] Electronic spectroscopy: Introduction, theory, instrumentation, types of electronic transitions, presentation of electronic spectrum, terms used- chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect and hypochromic effect, Applications in the structure determination of dienes, α,β -unsaturated aldehydes and ketones, aromatic compounds.	7
	B] Infrared spectroscopy: Introduction, Types of molecular vibrations- stretching and bending, Calculation of vibrational modes, force constant, instrumentation, interpretation of IR, H-stretching, triple bond, double bond and Finger print regions, IR spectra of H ₂ O, CO ₂ , C ₂ H ₅ OH, CH ₃ CHO, CH ₃ COOH and CH ₃ CONH ₂ .	7

UNIT-IV	A] NMR spectroscopy: Introduction, spin quantum number, instrumentation, Aspects of NMR- number of signals(equivalent and non-equivalent protons), positions of signals(chemical shift), intensities of signals, splitting of signals(spin-spin coupling), coupling constant, applications.	8
	B] Mass spectroscopy: Introduction, theory, instrumentation-(ion sources), Mass spectra of neopentane and methanol, molecular ion peak, base peak, metastable peak, Rules of fragmentation, applications.	6
UNIT-V	Elementary Quantum Mechanics (i) Limitations of classical mechanics. Plank's quantum theory (postulates only). Photoelectric effect - Experiments, observation and Einstein's explanation. Compton effect and its explanation. (ii) de Broglie hypothesis of matter waves. de Broglie's equation. Heisenberg's uncertainty principle. (iii) Classical wave equation, derivation of time independent Schrodinger's wave equation in one-dimension and its extension to a three-dimensional space. Well behaved wave function, physical significance of wave function (Born interpretation). (iv) Application of Schrodinger wave equation to a particle in one dimensional box and its extension to a three-dimensional box. Concept of atomic orbital. (v) Numericals.	14
UNIT-VI	A] Electrochemistry: (i) Types of electrode - Standard hydrogen electrode, Calomel electrode, Quinhydrone electrode and Glass electrode. Principle of Potentiometric titration. Study of acid-base, redox and precipitation titration. (ii) pH of a solution and pH scale. Determination of pH of a solution using hydrogen, quinhydrone and glass electrodes. Advantage and disadvantage of these electrodes. pH-metric titrations. Determination of pka of a weak acid by pH-metric measurement. (iii) Concentration cells - Types of concentration cells, concentration cell without transfer and determination of its emf. (iv) Numericals	6
	B] Nuclear Chemistry: (i) Shell model of a nucleus - Assumptions, evidences for existence of magic numbers, advantages and limitations. (ii) Liquid drop model of a nucleus - Assumptions, similarities between nucleus and liquid drop, advantages and limitations, explanation of nuclear fission reaction on the basis of liquid drop model. (iii) Nuclear force and its explanation on the basis of Meson theory. (iv) Characteristics of nuclear reaction, difference between nuclear and chemical reactions. Calculation of Q value of a nuclear reaction. (v) Characteristics of nuclear fission reaction, fission yield. Fission reaction as an alternative source of energy. (vi) Nuclear fusion reaction - Characteristic of a nuclear fusion reaction. Thermonuclear reactions as a source of energy of sun and other stars. Fusion reactions as a potential future source of energy. (vii) Applications of radio isotopes in industry, agriculture, medicines and bio-sciences with two examples each. (viii) Numericals.	8

B.SC.-III (SEM -VI)
PRACTICAL SYLLABUS
SUBJECT-CHEMISTRY

Laboratory sessions

Exercise I: Organic Chemistry Experiments
1. Estimation of formaldehyde.
2. Estimation of glycine.
3. Estimation of ascorbic acid (vitamine C).
4. Estimation of phenol by bromination method.
5. Estimation of aniline by bromination method.
6. Estimation of urea by hypobromite method.
7. Estimation of unsaturation by bromination method.
8. Determination of iodine value of oil.
9. Determination of equivalent weight of an ester by saponification.
10. Separation of a mixture of methyl orange and methylene blue by thin layer chromatography (using benzene).
11. Separation of a mixture of 2,4-dinitro phenyls of acetaldehyde and benzaldehyde by thin layer chromatography (using benzene : petroleum ether = 3:1).
12. Separation of a mixture of dyes by thin layer chromatography (using cyclohexane: ethyl acetate = 8.5:1.5).
13. Separation of a mixture of 2,4-dinitro phenyls of acetaldehyde and benzaldehyde by thin layer chromatography (using toluene: petroleum ether).
Exercise II: Physical Chemistry experiments
1. To determine dissociation constant of weak acid by conductometry.
2. To determine dissociation constant of weak acid by potentiometry.
3. To study potentiometric titration of KCl and AgNO ₃ .
4. To determine dissociation constant of dibasic acid by pH-metry.
5. To verify Beer's Lambert's law using KMnO ₄ /K ₂ Cr ₂ O ₇ .
6. To determine pH of a soil sample by pH-meter.
7. To determine solubility and solubility product of sparingly soluble salts conductometrically.
8. To study strong acid and strong base titration by pH-metry.