

SYLLABUS

JUNIOR LAB ASSISTANT (CHEMISTRY)

•Inorganic Chemistry

Chemical periodicity; Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory); Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents; Main group elements and their compounds: Allotropy, synthesis, structure and bonding; Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms; Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications; Organometallic compounds: synthesis, bonding and structure, and reactivity; Organometallics in homogeneous catalysis; Analytical chemistry - separation, spectroscopic, electro- and thermoanalytical methods; Industrial importance of the inorganic compounds; Environmental chemistry; Data analysis: Mean and standard deviation; absolute and relative errors; linear regression.

•Physical Chemistry

Basic principles of quantum mechanics: Postulates; operator algebra; exactly-solvable systems: particle-in-a-box, harmonic oscillator; Elementary concepts of MO and VB theories; Huckel theory for conjugated π -electron systems; Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; Le Chatelier principle; Phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions; Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations; Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; Catalysis; Photochemical reactions; Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; Solid

state: Crystal structures; Bragg's law and applications; Polymer chemistry: Molar masses; kinetics of polymerization

•Organic Chemistry

IUPAC nomenclature of organic molecules including regio- and stereoisomers; Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereoselectivity, enantioselectivity, and asymmetric induction; Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions; Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes; Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; Pericyclic reactions – Basic understanding; Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids; Structure determination of organic compounds by IR, UV-Vis, ^1H & ^{13}C NMR and Mass spectroscopic techniques.

- General English, Quantitative Aptitude, Analytical Reasoning & General Knowledge / Current Affairs.