

**Objectives:**

- (a) To understand the atomic structure and wave-like behaviour of electrons
- (b) To develop an understanding of chemical bonding and molecular structure
- (c) To develop an understanding of the basic characteristics of the gaseous, liquid and solid states .
- (d) To learn about the electronic effects in organic molecules and the reaction mechanisms involved thereof

**Unit I: Atomic Structure & Periodic Properties**

[5]

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of  $\psi$  and  $\psi^2$ , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rules. Electronic configurations of the elements, effective nuclear charge.

Atomic and ionic radii, ionization energy, electron Affinity and electronegativity: definition, method of determination, trends in periodic table and applications.

**Unit II: Chemical Bonding**

[7]

Covalent Bond – Valence bond theory and its limitations, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{H}_3\text{O}^+$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_2$  and  $\text{H}_2\text{O}$ . MO theory, homonuclear diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference. Weak Interactions – Hydrogen bonding, Van der Waals forces.

**Unit III: Gaseous & Liquid States of Matter**

[8]

Postulates of kinetic theory of gases, deviation from ideal behavior, van der waals equation of state. Law of corresponding states. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule Thomson- effect) Intermolecular forces, structure of liquid. Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid . Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

**Unit IV:        Introductory Organic Chemistry**

[7]

IUPAC nomenclature: Alkanes, cyclo-alkanes, alkenes, alkynes, halogen compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids, nitro compounds. Hybridization and Geometry of Molecules: methane, ethane, ethylene, acetylene. Electronic Effects: Inductive, resonance, hyper conjugation and steric effect. Cleavage of bonds: homolytic and heterolytic C-C bond fission. Reaction Intermediates and their stability: carbocations, carbanions and free radicals.

**Unit V: Basic Organic Synthesis and Principles**

[8]

Alkanes: preparation by reduction of alkyl halides, Wurtz reaction and Kolbe's electrolytic methods with mechanism; Alkenes: preparation by dehydration of alcohols, dehydrohalogenation of alkylhalides, dehalogenation of vic-dihalides and by Kolbe's electrolytic method. Alkynes: Preparation by dehydrohalogenation of vic-dihalides and gem-dihalides, dehalogenation of tetrahalides and Kolbe's electrolytic method. Reactions: addition reactions with hydrogen, halogens, hydrogen halide (Markovnikov's rule, peroxide effect), hydroboration, ozonolysis, hydroxylation with  $\text{KMnO}_4$ , allylic substitution by NBS. Conjugated Dienes; Electrophilic addition of dienes: 1,2, & 1,4 addition, Diels . Alder reaction