

NEW SYLLABUS

B.Sc. Part-I CHEMISTRY

PAPER-I—INORGANIC AND PHYSICAL CHEMISTRY

UNIT-I Atomic structure : Bohr's theory and its limitation, General idea of deBroglie matter-waves, Heisenberg uncertainty principle, Schrödinger wave equation, significance of Ψ and Ψ^2 , radial & angular wave functions and probability distribution curves, quantum numbers, Atomicorbital and shapes of s , p , d orbitals, Aufbau and Pauli exclusion principles, Hund's Multiplicity rule, electronic configuration of the elements.

Periodic properties : Detailed discussion of the following periodic properties of the elements, with reference to s - and p - block. Trends in periodic table and applications in predicting and explaining the chemical behaviour.

- Atomic and ionic radii,
- Ionization enthalpy,
- Electron gain enthalpy,
- Electronegativity, Pauling's, Mulliken's, Alfred Rochow's scales. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

UNIT-II Chemical Bonding I—Ionic bond : Ionic Solids - ionic structures, radius ratio & co-ordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy, Born-Haber cycle, Solvation energy and solubility of ionic solids, polarizing power & polarizability of ions, Fajan's rule, ionic character in covalent compounds: Bond moment and dipole moment, Percentage ionic character from dipole moment and electronegativity difference. Metallic bond-free electron and band theories.

UNIT-III Chemical Bonding II—Covalent bond: Valence bond theory and its limitations, Concept of hybridization, equivalent and non-equivalent hybrid orbitals. Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O , NH_3 , PCl_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2^- , XeF_2 , XeF_4 , XeF_6 , $XeOF_2$, $XeOF_4$. Molecular orbital theory, Bond order and bond strength. Molecular orbital diagrams of diatomic and simple heteroatomic molecules N_2 , O_2 , F_2 , CO , NO .

UNIT-IV Chemistry of *s*- & *p*- block elements : General concepts on group relationships and gradation properties, Comparative study, salient features of hydrides, solvation & complexation tendencies. General concepts on group relationships and gradation properties. Halides, hydrides, oxides and oxyacids of Boron. Aluminium, Nitrogen and Phosphorus. Boranes, borazines, fullerenes, graphene and silicates, interhalogens and pseudohalogens. Chemical properties of the noble gases.

Metallurgical extraction of Fe, Al and Cu : Principle of extraction of metal, the occurrence, extraction & isolation of Fe, Al, and Cu.

UNIT-V Unit V Mathematical concepts for chemists : Basic Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs. Properties of straight line, slope and intercept, Functions, Differentiation of functions, maxima and minima; integrals; ordinary differential equations; vectors and matrices; determinants; Permutation and combination and probability theory. Significant figures and their applications.

Computer for chemists : Introduction to computer, introduction to operating systems like DOS, Windows, Linux.

Use of computer programs : Running up standard programs & packages such as MS-Word, MS-Excel, Power Point. Execution of linear regression x-y plot, use of software for drawing structures and molecular formulae.

UNIT-VI Chemical kinetics : Rate of reaction, Factors influencing rate of reaction, rate law, rate constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions. Rate and Rate Law, methods of determining order of reaction, Chain reactions. Temperature dependence of reaction rate, Arrhenius theory, Physical significance of Activation energy, collision theory, demerits of collision theory, non-mathematical concept of transition state theory.

Catalysis : Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristics of catalyst. Enzyme catalyzed reactions, Micellar catalyzed reactions, Industrial applications of catalysis.