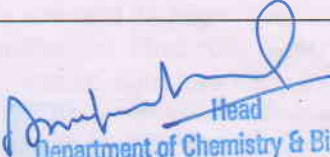


**Ph.D. Entrance Syllabus**  
**Department of Chemistry & Biochemistry**  
**Sharda School of Basic Sciences and Research**

**Subject: Chemistry**

Course	Content
<p>Physical Chemistry</p> <p style="color: blue; font-size: 1.2em; font-family: cursive;">M.B.S.</p>	<p><b>Quantum Mechanics:</b> Basic principles of quantum mechanics: Postulates; operator algebra; exactly-solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunnelling. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated <math>\pi</math>-electron systems. <b>Molecular spectroscopy:</b> Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance. <b>Chemical thermodynamics:</b> Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gasses, and solutions. <b>Electrochemistry:</b> Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations. <b>Chemical kinetics:</b> Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions. <b>Colloids and surfaces:</b> Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis. <b>Solid state:</b> Crystal structures; Bragg's law and applications; band structure of solids. <b>Polymer chemistry:</b> Molar masses; kinetics of polymerization</p>
<p>Organic Chemistry</p> <p style="color: blue; font-size: 1.2em; font-family: cursive;">Ganga</p>	<p>IUPAC nomenclature of organic molecules including regio- and stereoisomers. <b>Concept of aromaticity:</b> Benzenoid and non-benzenoid compounds. Organic reactive intermediates: Generation, stability, and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes. <b>Principles of stereochemistry:</b> Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity, and asymmetric induction. <b>Reaction mechanism,</b> common name reactions, and rearrangement; important reagents (organic, inorganic, organometallic, and</p>

	<p>enzymatic) for functional group transformation. <b>Concepts in organic synthesis:</b> Retrosynthesis, disconnection, and protecting groups. <b>Asymmetric synthesis:</b> Chiral auxiliaries, methods of asymmetric induction, Resolution – optical and kinetic. <b>Pericyclic reactions</b> – electrocyclization, cycloaddition, sigmatropic rearrangements, and other related concerted reactions. <b>Principles and applications of photochemical reactions</b> in organic chemistry. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S). <b>Chemistry of natural products:</b> Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids, and alkaloids. <b>Structure determination</b> of organic compounds by IR, UV-Vis, <math>^1\text{H}</math> &amp; <math>^{13}\text{C}</math> NMR, and Mass spectroscopic techniques.</p>
<p>Inorganic Chemistry</p> <p><i>Handwritten:</i> Halli/6 13/2/24</p>	<p><b>Chemistry of s, p, d, and f</b> block elements; Structure and bonding in homo- and heteronuclear molecules including shapes of molecules (<b>VSEPR Theory</b>); <b>Periodic properties</b>; Concepts of acids and bases; Non-aqueous solvents; <b>Organometallic compounds:</b> synthesis, bonding and structure, and reactivity; Organometallics in Homogeneous Catalysis; Cages and metal clusters; <b>Bioinorganic chemistry:</b> photosynthesis, porphyrins, metalloenzymes, oxygen transport, electron-transfer reactions; nitrogen fixation, metal complexes in medicine; <b>Characterization of inorganic compounds</b> by IR, Raman, NMR, EPR, Mössbauer, UV-vis, MS and microscopic techniques; <b>Nuclear chemistry:</b> nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis; <b>Coordination compounds:</b> structure, bonding theories, spectral and magnetic properties, reaction mechanisms.</p>

  
 Head  
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