

Course	Discipline Specific Elective
Semester	V
Paper Number	MBTDS5022T & MBTDS5022P
Paper Title	BIOPHYSICAL METHODS and CHEMISTRY 3
No. of Credits	6
Theory/Composite	Composite
No. of periods assigned	4 Theory + 3 Practical
Course description/objective	<p>1. Students will be introduced to fundamentals of organic reaction mechanisms.</p> <p>2. Students will study the application of various kinds of reaction mechanisms to biotechnological and biological systems.</p> <p>3. An overview of bioinorganic chemistry and its application to biological systems will be provided.</p> <p>4. In the practical module students will study various aspects of enzyme kinetics and enzyme action.</p>
Syllabus	<p>Theory</p> <p>Module A: (25 marks)</p> <p>Biophysical methods:</p> <p>UNIT-I: Electron microscopy (EM); different fixation and staining techniques for EM, freeze-etch and freeze fracture methods for EM.</p> <p>UNIT-II: Spectroscopy: Lambert-Beer Law; Sedimentation and density gradient techniques; GLC; hydroxyapatite chromatography; viscosity; mass spectrometry; GC-MS and LC-MS; isoelectric focusing;</p> <p>No. of Classes: 2/week</p> <p>Module B: (25 marks)</p> <p>Unit III: Fundamentals of Organic Reaction Mechanism: Bond cleavage and bond formation. Reaction intermediates - Structure, stability, formation and fates of carbon radicals, carbocations, carbanions. Types of reagents - electrophiles, nucleophiles. Classification of reactions.</p> <p>Nucleophilic Substitution Reactions: Nucleophilic substitution reactions of alkyl halide (S_N1, S_N2), Effect of substrate structure, solvent, leaving group, nucleophiles, Substitution involving NGP.</p> <p>Elimination Reactions: E1, E2, E1cB mechanism, Reactivity, Substitution vs. elimination.</p> <p>Electrophilic and Nucleophilic Aromatic Substitution Reactions: Mechanisms, Reactivity, π-complexes and σ-complexes, Orientation effect of groups.</p> <p>Addition Reactions: Electrophilic addition to C=C - Mechanism, Reactivity, Electrophilic addition of halogens, Electrophilic addition of hydrogen halides. Hydration of alkenes, Hydration of alkynes. Nucleophilic addition to carbon-carbon multiple bonds - Mechanism, Reactivity, Cyanoethylation, Michael addition.</p> <p>Nucleophilic addition to C=O bond: Addition of HCN, acetylides, NaHSO₃, alcohols, Formation of acetal, ketal. Cannizzaro reaction, Internal</p>

	<p>Cannizzaro reaction, Aldol condensation, Claisen condensation.</p> <p>Unit IV: Bioinorganic Chemistry: A brief introduction to Bioinorganic chemistry. Elements of life, Essential major, trace and ultra-trace elements. Role of metal ions present in biological systems (Na^+, K^+, Ca^{2+}, Mg^{2+}, $\text{Fe}^{3+}/\text{Fe}^{2+}$, $\text{Cu}^{2+}/\text{Cu}^+$, Zn^{2+}). Metalloproteins and Metalloenzymes. Oxygen carrying proteins- structure and physiological role of haemoglobin, myoglobin. Electron transport proteins- iron-sulfur proteins, cytochromes. Redox enzymes- Fe, Cu, Zn-containing redox enzymes. Hydrolytic enzymes- carboxypeptidase A, carbonic anhydrase. Phosphate transfer and metabolic energy.</p> <p>No. of Classes: 2 Classes/week</p> <p>Practical (Spectrophotometric analysis of enzymes)</p> <ol style="list-style-type: none"> 1. To study activity and specific activity of an enzyme (alkaline phosphatase) under optimum conditions. 2. Determination of K_m and V_{max}. 3. Determination of turnover number (K_{cat}). 4. Determination of pH_{optima} 6. Effect of inhibitor EDTA on the enzyme activity.
Readings	<p>Theory Module -A</p>
	<p>Module B</p> <ol style="list-style-type: none"> 1. S.K. Ghosh, Advanced General Organic Chemistry- A Modern Approach, New Central Book Agency (P) Limited, 2010. 2. P. Sykes, A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988). 3. G.N. Mukherjee and A. Das, Elements of Bioinorganic Chemistry, U. N. Dhur & Sons Pvt. Ltd., 3rd edition, 2008.
Evaluation	<p>Theory: Continuous Internal Assessment: 10 marks End-Semester Theory Examination: 50 marks</p> <p>Practical: Continuous Internal Assessment: 32 marks End-Semester Examination: 8 marks</p>
Paper Structure for End Semester Theory	<p>Module A (25 marks)</p> <p>Section A: Any one from two questions with subparts: $15 \times 1 = 15$ marks. Section B: Any one from two questions with subparts: $10 \times 1 = 10$ marks. (No subpart will be less than 1 mark or more than 5 marks)</p> <p>Module B (25 marks)</p> <p>Q.5. Compulsory Objective questions of 5 marks. Any two questions of 10 marks from Q.6- Q.8. No part would be of more than 5 marks.</p>