Semester	**6**
Course	**Major**
Paper Code	
Paper Title	**Bioenergetics, Reaction kinetics and Enzymology**
No. of Credits	**4**
Theory / Practical / Composite	**THEORY**
Minimum No. of preparatory hours per week a student has to devote	4 hours/week
Number of Modules	No modules
Syllabus	**UNIT 1**: **Basic Concepts:** First and second laws of Thermodynamics, Definitions and Significances of Gibb's Free Energy, Enthalpy and Entropy and their Changes, and Mathematical Relationship among them, Thermodynamic aspects of water as a biological solvent, Thermodynamics of Folding and Unfolding of Macromolecules, Standard Free Energy Change and Equilibrium Constant, Thermodynamics of Membrane Transport, Donnan Membrane Equilibrium, **UNIT 2: Energy rich compounds** Coupled reactions and additive nature of standard free energy change. Numericals on thermodynamic aspects of biochemical reactions. **UNIT 3: Basic theories of reaction rate:** Concept of Rate, Purpose of Studying Reaction Rate, Factors Influencing Reaction Rate, Role of a Catalyst, Theories of Reaction Rate: Collision Theory – Arhenius Equation, Transition State Theory – Eyring Equation, **UNIT 4: Applications of reaction kinetics:** Simple Techniques to Measure Reaction Rates, Rate Law, Rate Constant, Order, Importance of Initial Rate, Average and Instantaneous Rates, Integrated Rate Laws, Features of Zeroth, First and Second Order Reactions, Concept of Half-Life, Reaction Mechanisms, Rate Determining Step, Molecularity, Thermodyamic vs. Kinetic Control, Numericals on Integrated Rate Laws and Arhenius Equation. **UNIT 5: Enzyme**: Structure of enzyme, Active site models of enzyme, Lock and key model, and Induced Fit model, Holoenzyme, Apoenzyme, cofactors, coenzyme, Classification and nomenclature of enzyme. **UNIT 6: Mechanism, regulation and application of enzymes**: Transition state complex and activation energy, Significance of hyperbolic, double reciprocal plots of enzyme activity, Km, and Vmax, Allosteric mechanism. Example and mechanism of action; covalent modification of enzyme, Feedback mechanism of enzyme, Enzyme unit, specific activity and turnover number, Multienzyme complex, Isozyme:

	Ribozyme and abzyme, Effect of pH and temperature on enzyme activity, Enzyme inhibition: Reversible (competitive, noncompetitive and uncompetitive) and irreversible inhibition Applying basic theories of chemical kinetics to enzyme kinetics and catalysis, Catalytic efficiency, Kinetically perfect enzymes, Numericals on enzyme kinetics, Multiple views of enzyme catalysis.	
Learning Outcomes	• To know general characteristics, functions and applications of enzymes • To know biochemical reaction kinetics, rate, equilibrium and thermodynamics • To determine the isolation, characterization and applications enzymes available from different • sources	
Reading/Reference Lists	1. Biochemistry by Garret and Grisham 2. Biochemistry by Voet and Voet 3. Biochemistry by Stryer 4. Biochemistry by Lehninger 5. Understanding Enzymes by Palmer 6. Physical Chemistry for Life Sciences by Atkins and Paula. 7. Salwan and Sharma (2020) Physiological and Biotechnological aspects of Extremophiles.Academic Press.	
Evaluation	Theory CIA: 30 Semester Exam:70	Practical (if applicable) CA: Semester Exam:
Paper Structure for Theory Semester Exam	**Full marks 70** Short questions: 10 (each 2 marks) from 12 (10x2=20) Long questions: 5 (each 10 marks) from 7 (5x10=50)	