Syllabus Template Microbiology 6

Semester: VI				
Course: Microbiology				
Paper Title: Bioenergetics, Reaction Kinetics and Enzymology				
Paper code: C3MB230621T			**Credits:4**	
Hours/week :4				
Category: Core/MDC/SEC/VAC :Core (Major)				
Theory / Practical / Composite :Theory				
No of Modules :No Modules				
Course Overview: **This course offers a thorough understanding of the concepts of thermodynamics crucial for the understanding of the intracellular biochemical reactions. Thecourse provides a clear idea about the reaction kinetics of chemical reactions to help students understand and hence aid them in their transition to biochemistry. This course also emphasizes on bio-catalysts – enzymes, their structures, properties, mechanisms of catalysis and kinetics.** **Students will be assisted in their apprehension of the basic phenomena associated with biochemical reactions, to secure their concepts regarding biochemistry.**				
Course Outcome:				
1. To know biochemical reaction kinetics, rate, equilibriumand thermodynamics				
2. To know general characteristics, functions and applications of enzymes.				
3. To determine the isolation, characterization and application of enzymes available from different sources				
Prerequisites: *Basic knowledge about any prior course*				
SYLLABUS				
UNIT/Module				
	CONTENT	**HOURS or NUMBER OF CLASSES**	**CO Mapping**	**COGNITIVE LEVEL**
I.	**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,	**8**	**CO1**	**K1,K2,K4**

	Thermodynamics of Membrane Transport, Donnan Membrane Equilibrium.			
II.	**Energy Rich Compounds:** Coupled reactions and additive nature of standard free energy change. Numericals on thermodynamic aspects of biochemicalreactions.	**5**	**CO1**	**K1,K2,K3,K4,K5**
III.	**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.	**6**	**CO1**	**K1,K2,K4**
IV.	**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.	**10**	**CO1**	**K1,K2,K3,K4,K5**
V.	**Enzymes:** 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.	**12**	**CO2**	**K1,K2,K4**
VI.	**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:	**14**	**CO2, CO3**	**K1,K2,K3,K4,K5**

	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.			

Textbooks:

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.**

Suggested Readings:

SAME AS ABOVE

Web Resources:

Evaluation:
Theory
CIA: 30; Semester Exam:70

Paper Structure for Theory Semester Exam Module:

Full marks 70
Short questions: 10 (each 2 marks) from 12 (10x2=20)
Long questions: 5 (each 10 marks) from 7 (5x10=50)

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	**To know biochemical reaction kinetics, rate, equilibriumand thermodynamics**	K1,K2,K3,K4 and K5
CO2	**To know general characteristics, functions and applications of enzymes.**	K1,K2,K3 and K4
CO3	**To determine the isolation, characterization and application of enzymes available from different sources**	K1,K2,K3,K4 and K5