Course: MICROBIOLOGY PG

Semester	1
Paper Number	MMCB4114
Paper Title	ENZYMOLOGY, THERMODYNAMICS & CHEMICAL KINETICS
No of credits	6
Non composite/composite	Composite
No. of periods assigned	6
Course description/objective	• 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
Reference List	Biochemistry by Garret and Grisham Biochemistry by Voet and Voet Biochemistry by Stryer Biochemistry by Lehninger Understanding Enzymes by Palmer Physical Chemistry for Life Sciences by Atkins and Paula. Salwan and Sharma (2020) Physiological and Biotechnological aspects of Extremophiles. Academic Press
Evaluation	Theory: 70 (60 End sem + 10 CIA) Practical: 30 (10 End sem + 20 CIA) **Question Paper format: theory end semester** **Module 1: 30 marks** SHORT QUESTION: FROM **7** QTNS **ANSWER 5 (EACH 2 MARKS)** = 5X2=10 LONG QUESTION: FROM **6** QTNS **ANSWER 4 (EACH 5 MARKS)**= 4X5=20 **Module 2: 30 marks** SHORT QUESTION: FROM **7** QTNS **ANSWER 5 (EACH 2 MARKS)** = 5X2=10 LONG QUESTION: FROM **6** QTNS **ANSWER 4 (EACH 5 MARKS)**= 4X5=20 Viva: End sem 10 marks

ENZYMOLOGY,THERMODYNAMICS & CHEMICAL KINETICS

THEORY 70MARKS

- **Module 1**: **Enzymology(35MARKS)**

General Features of Enzyme Catalysis, Different Theories of Enzyme Catalysis, Catalytic Strategies, Detailed Study of a Model Enzyme to Understand Various Catalytic Strategies.Enzyme Kinetics: Hyperbolic Kinetics, Concept of Enzyme-Substrate Complex, Equilibrium Assumption and Michaelis-Menten Equation, Concept of Ks, Steady State Assumption and Briggs-Haldane Equation, Concept of Km, Turnover Number, Catalytic Efficiency, Kinetic Perfection, Linearized Plots: Lineweaver-Burk, Eadie-Hofstee and Hanes Plots, Bisubstrate Kinetics, Kinetics of Enzyme Inhibitions, Numericals on Enzyme Kinetics.Enzyme Regulation: Effect of Temperature and pH, *in vivo* Strategies of Regulation, Allosteric Enzymes and their Regulation. (JG)
Ribozyme (catalytic RNA), Abzyme and Isozyme, Active site determination studies.Industrial application of several enzymes. (SSC)

- **Module 2: Thermodynamics and Chemical Kinetics (35MARKS)**

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, Simple Techniques to Measure Reaction Rates, Rate Law, Rate Constant, Order, Experimental Determination of Rate Laws, Importance Initial Rate, Average and Instantaneous Rates, Integrated Rate Laws, Features of Zeroth, First and SecondOrderReactions, ConceptofHalf-Life,ReactionMechanisms, RateDeterminingStep,Molecularity,Thermodyamicvs.KineticControl,Numericals on Integrated Rate Laws and ArheniusEquation.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, Thermodynamics of Folding and Unfolding of Macromolecules, Standard Free Energy Change and Equilibrium Constant, Thermodynamics of Membrane Transport, Donnan Membrane Equilibrium, Energy rich compounds,Coupled reactions and additive nature of standard freeenergychange. (JG)

PRACTICAL: 30 MARKS

1. Thermodynamics: Numericals on Biological Thermodynamics (JG)
2, Chemical Kinetics: Numericals on Chemical Kinetics (JG)
3. characterization of enzymes from microbial, plant, animal sources-beta D glucosidase from E.coli, cellulase from fungi, polyphenol oxidase from leaves, alkaline phosphatase from chicken liver(SSC)
4. Determination of kinetic parameters of enzymes(SSC)
5. Case study on industrially relevant enzyme (microbial source)(SSC)
6.Enzyme assay of certain extremophiles and anti-oxidant properties and recyclableproperties(AKM)

REFERENCES

1. Biochemistry by Garret andGrisham
2. Biochemistry by Voet andVoet
3. Biochemistry byStryer
4. Biochemistry byLehninger
5. Understanding Enzymes byPalmer
6. Physical Chemistry for Life Sciences by Atkins and Paula.
7.Salwan and Sharma (2020) Physiological and Biotechnological aspects of Extremophiles. AcademicPress.