Name of the Programme: M.Sc. Part-I (Biochemistry)

Course Code: CHB-504 **Title of the Course:** Enzymology

Number of Credits: 4

Effective from AY: 2022-23

Pre-requisites for the Course:	Students should have graduate level knowledge either in chemical or life sciences or should have qualified change of discipline test.	
Course Objectives:	1. To introduce enzymes and the important role they play in metabolism 2. To develop knowledge regarding basic concepts of enzyme such as enzyme activity, kinetics and mechanism of action. 3. To develop understanding about techniques used for purification of enzymes.	
Content:		**No of hours**
	1. Introduction to enzymes a. Types of enzymes: Simple enzymes, conjugated enzymes. b. Cofactors and prosthetic groups: Coenzymes and cofactors and their role in enzyme activity, prosthetic group, metalloenzymes. c. Nomenclature and classification of enzymes. d. Structure and specific sites: Enzyme structure, enzyme-substrate complex, binding sites, concept of active site, stereo-specificity. e. Enzymes as catalysts: lock and key model, induced fit model, role of enzymes to increase reaction rates: transition state theory and activation energy.	10
	2. Enzyme Kinetics and Enzyme-substrate interactions a. Enzyme activity, Enzyme Assay, specific activity (Definition and units). b. Enzyme kinetics: Michaelis-Menten Equation: formula and derivation, Line-Weaver Burk plot for one substrate reactions. c. Significance of Vmax and Km. d. Kinetics of bi- or multi reactant system. e. Effect of pH, temperature on enzymes. f. Enzyme inhibition: reversible (competitive, uncompetitive, mixed inhibition) and irreversible inhibition. g. Enzyme turnover: Ks, Kd and measurement of enzyme turnover. h. Correlation between the rates of enzyme turnover and structure and function of enzymes, significance of enzyme turnover. i. Mechanism of enzyme degradation.	16
	3. Mechanism of Enzyme Action and Enzyme regulation a. Mechanism of Enzyme catalysis, Determination of active centre. b. Identification of functional groups, Factors affecting catalytic efficiency: proximity, orientation, strain, Enzyme catalytic strategies: covalent, acid -base catalysis, metal ion catalysis.	14

	c. Enzyme Regulation: control of enzyme activity, control of enzyme availability, inhibitor or enhancer molecules. d. Mechanisms of enzyme regulation and their significance in metabolism: i. Allosteric regulation (aspartate transcarbamylase). ii. Reversible covalent modification (glycogen phosphorylase, glutaminesynthetase). iii.Feedback inhibition and feedback repression.	
	4. Enzyme systems a. Zymogens and Isozymes. a. Multienzyme systems: disassociated system (catabolic enzymes), multienzyme complex (pyruvate dehydrogenase) membrane-bound system (electron carrying enzymes). b. Nucleic acid as catalysts: Ribozyme, DNAzyme; Abzyme. c. Mechanism of action of lysozyme, chymotrypsin, aspartate protease, RNase A.	12
	5. Enzyme purification techniques a. Isolation of intracellular and extracellular enzymes from plant and animal tissues and microbial cells. b. Separation and purification of enzymes by differential centrifugation, salt precipitation, dialysis, ultrafiltration, molecular exclusion chromatography, affinity chromatography, ion exchange chromatography. c. Determination of Enzyme activity, Specific activity and fold purification as criteria of purity of enzymes. d. Zymograms. e. Molecular weight determination by PAGE, SDS-PAGE.	8
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References/ Readings:	1. D.T. Plummer, An introduction to practical biochemistry. TATA McGraw Hill, 2006. 2. R.O. Oktore, Essentials of Enzymology. Xlibris-US, 2015. 3. T.D.H. Bugg, Introduction to enzymes and coenzyme chemistry. Wiley, 2012. 4. J.M.Berg, L.Stryer, J. Tymoczko, G. Gatto, Biochemistry. W.H. Freeman, 2019. 5. N. Price and L. Stevens, Fundamentals of Enzymology. Oxford University Press, 1999. 6. D.L.Nelson, M.M. Cox, A.L. Lehninger, Principles of Biochemistry. WH Freeman 2017.	
Course Outcomes:	1. The students will be able to classify enzymes 2. The students will be able to discuss different types of enzymes, regulation and kinetics. 3. The students will be able to describe the mechanism of action of enzymes and the strategies they use for catalysis 4. The students will be able to determine and choose biochemical techniques for purification of enzymes.	