CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Proteins and Enzymes	04	02	00	02	Class XII with Science	NIL

Learning Objectives

The objective of this course is to provide an overview of protein biochemistry to undergraduate students with diverse science backgrounds, since proteins are the most versatile functional entities in life with applications in various life sciences research as well as in industry and biomedicine. The biochemical, structural, functional and aspects of interaction of proteins will be introduced in this course. The course also aims to provide knowledge about enzyme kinetics, regulation of enzyme activity and diverse applications of enzymes in disease diagnosis and therapy as well as in industry.

Learning outcomes

On successful completion of the course students will be able to:

- Familiar with unique features and characteristics of proteins.
- Aware of the relationship between three-dimensional structure of proteins and their functions.
- Gain insight into the thermodynamic and molecular basis of catalysis by enzymes and the underlying basis of their specificity.
- Understand the kinetics of enzyme catalyzed reactions and clinical importance of enzyme inhibitors.
- Also learn to appreciate how enzymes are regulated and the physiological importance of enzyme regulation in the cell.

- Gain insight into the applications of enzymes in research and medicine.

B.Sc. (HONOURS) BIOCHEMISTRY (NEP STRUCTURE) BCH-GE-4: PROTEINS AND ENZYMES
Semester – III

2.2 Course Contents

THEORY – Total 30

Hours

UNIT I: Introduction to proteins (8 Hours)

Amino acids and their properties. Peptides and their biological significance - hormones, antibiotics and growth factors. Diversity of proteins and their functions. Conjugated proteins, multimeric proteins and metalloproteins. Organization of protein structure - primary, secondary, tertiary and quaternary structures. Bonds in protein structures - covalent and non- covalent. Dihedral angles. Ramachandran map, Secondary structure - alpha-helices, beta- strands, beta-sheets and turns.

UNIT II: Three-dimensional structures and protein folding (7 Hours)

Characteristics of tertiary and quaternary structures. Structure-function relationship in proteins. 3D structures of globular and fibrous proteins – myoglobin, hemoglobin, collagen and keratin. Protein folding - denaturation and renaturation (Ribonuclease A). Role of chaperones. Protein misfolding diseases - Alzheimer's and Cruetzfeldt-Jakob disease.

UNIT III: Introduction to enzymes and enzyme kinetics (8 Hours)

General characteristics of enzymes; nature of enzymes - protein and non-protein. Cofactor and prosthetic group, apoenzyme, holoenzyme. Classification and nomenclature of enzymes. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. Relationship between initial velocity and substrate concentration, equilibrium constant, steady state kinetics. Michaelis-Menten equation, Km and Vmax, Lineweaver-Burk plot. Enzyme

inhibition, reversible inhibition (competitive, uncompetitive, non-competitive and mixed) and irreversible inhibition. Examples - FdUMP and penicillin.

UNIT IV: Regulation of enzyme activity and applications of enzymes (7 Hours)

Control of activities of single enzymes and metabolic pathways: feedback inhibition, allosteric modulation (aspartate transcarbamoylase). Regulation by reversible covalent modification (glycogen phosphorylase). Zymogens (chymotrypsinogen).Enzymes as reagents (glucose oxidase), marker enzymes in diagnostics (SGPT, SGOT); Enzyme therapy (streptokinase); Enzymes in research (Taq polymerase, restriction endonucleases).

PRACTICALS – 60 Hours

1. Estimation of proteins by Biuret method.
2. Estimation of proteins by Lowry's method.
3. Determination of isoelectric pH of casein.
4. Determination of activity of an enzyme by continuous assay.
5. Determination of activity of an enzyme by discontinuous assay.
6. To plot a progress curve for an enzyme.
7. Determination of K_m and V_{max} of an enzyme using Lineweaver-Burk plot.

2.3 Essential Readings

1. Nelson, D.L., Cox, M.M. (2017). *Lehninger: Principles of Biochemistry* (7th ed.). New York, WH: Freeman and Company. ISBN13: 9781464126116, ISBN10: 1464126119
2. Stryer, L., Berg, J., Tymoczko, J., Gatto, G. (2019). *Biochemistry* (9th ed.). New York, WH: Freeman ISBN-13: 9781319114671
3. Voet. D., Voet. J.G. (2013) Bi*ochemistry* (4th ed.). New Jersey, John Wiley & Sons Asia Pvt. Ltd. ISBN : 978-1-11809244-6.
4. 2. Nicholas, C.P., Lewis, S. (1999). *Fundamentals of Enzymology* (3rd ed.). New York, Oxford University Press Inc. ISBN:0 19 850229 X.

Suggested Readings

1. Whitford, D. (2004). *Protein Structure and function*. Southern Gate, Chichester, West Sussex: John Wiley & Sons, Inc. ISBN-13: 978-047149894 ISBN-10: 0471498947.

2. Schulz, G.E., Schirmer, R.H. (1979). *Principles of protein structure*. Springer, ISBN 978-1-4612- 6137-7.

3. Keywords

Proteins, Enzymes, Protein structure, Protein folding, Enzyme kinetics, Enzyme regulation

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.