REFERENCES

1. D. Kleppner, R. J. Kolenkow (1973). An introduction to Mechanics. McGraw Hill.
2. N. K. Bajaj (2008). The Physics of Waves and Oscillations. 5th edition. Tata McGraw Hill.
3. Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill.
4. David Freifelder (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Bioogy. 2nd edition. W.H. freeman and Company.

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DISCIPLINE SPECIFIC CORE

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		
Protein Structure and Enzymology (BS-DSC-302)	**4**	**2**	**0**	**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**Should have studied Chemistry of Biomolecules**

Learning Objectives

The Learning Objectives of this course are as follows:

- Designed with an aim to introduce the students to proteins, most remarkable biomolecules in terms of diversity of structure and function
- Impart knowledge regarding various techniques employed to purify and characterize proteins
- Introduce them to the world of enzymes, biological catalysts with remarkable properties
- Enable them to understand important aspects of enzyme kinetics, mechanism of enzyme action and their regulatory properties
- Introduce the role of proteins and enzymes in medicine

Learning outcomes

Upon completion of the course, the students will be able to:

- Describe the functional diversity of proteins and the different levels of structural organization of proteins
- Explain the relationship between protein structure and function.
- Appreciate and analyse the data from techniques used to purify and characterise proteins.
- Explain enzyme classification, activity, kinetics, inhibition, regulation and mechanism of action of different classes of enzymes
- Acquire knowledge about the application of enzymes in medicine and industry.

SYLLABUS OF DSC- 8

Theory

Unit I: Protein structure and folding 11 Hours

Amino acids: structure and their properties; Peptides and proteins; Diversity of proteins; Organization of protein structure- primary, secondary, tertiary and quaternary structures; Protein sequencing- Edman degradation. Peptide bond- dihedral angles; Ramachandran plot; Secondary structure elements: Helices, sheets and turns. Motifs and domains; Structures of myoglobin and Hemoglobin. Oxygen binding curves of myoglobin and hemoglobin Influence of 2,3-BPG, CO_2. Denaturation and renaturation of proteins and introduction to thermodynamics of folding. Role of chaperones in protein folding.

Unit II: Purification and analysis of proteins 4 Hours

Ammonium sulphate fractionation, dialysis. Chromatographic techniques: Ion exchange chromatography, molecular sieve chromatography. Gel electrophoresis: SDS-PAGE.

Unit III: Introduction to Enzymes and enzyme kinetics 8 Hours

Protein and non-protein nature of enzymes. Cofactor and prosthetic groups. Classification of enzymes; Fischer's lock & key and Koshland's induced fit hypothesis. Enzyme activity and specificity. Enzyme Kinetics-Michaelis-Menten equation and Lineweaver-Burk plot. Determination of Km, Vmax, Kcat. Types of enzyme inhibitions- competitive, uncompetitive, non-competitive, mixed.

Unit IV: Mechanisms of enzyme action and regulation 7 Hours

Acid-base and covalent catalysis (chymotrypsin); Allosteric regulation and feedback inhibition (ATCase); reversible covalent modification (glycogen phosphorylase); Zymogen; Multi-enzyme complex (PDH). Isoenzymes. Applications of enzymes in medicine, industry and research

PRACTICALS (60 Hours)

1. Introduction to spectrophotometer and verification of Beer law.
2. Estimation of proteins by Biuret method.
3. Estimation of proteins by Lowry's method.
4. Ammonium sulphate fractionation of crude homogenate from germinated mung beans.

5. Assay for acid phosphatase activity and specific activity.
6. Progress curve of enzyme
7. Effect of pH on enzyme activity.
8. Determination of Km and Vmax using Lineweaver-Burk plot.
9. Calculation of Ki for an enzyme

REFERENCES

1. Nelson, D.L., Cox, M.M. (2021). Lehninger: Principles of Biochemistry (8th ed.). New York, WH: Freeman and Company. ISBN: 13: 978-1319381493 / ISBN-10:1319381499.
2. Voet, D., Voet. J. G. (2013). Biochemistry (4th ed.). New Jersey, John Wiley & Sons Asia Pvt. Ltd. ISBN: 978-1-11809244-6.
3. Cooper, T. G. (2011) The Tools of Biochemistry (2nd ed.), Wiley-Interscience Publication (New Delhi); ISBN13: 9788126530168.
4. Price, N. C. and Stevens, L. (1999). Fundamentals of enzymology (3rd ed). Oxford: Oxford University Press; ISBN13: 978-0198502296

Additional Resources

1. Sheehan, D. (2013). Physical biochemistry: Principles and applications (2nd ed). Chichester: Wiley-Blackwell; ISBN13: 978-0470856024

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