

Educational Objectives:

1. This course has been designed to integrate the practical aspects of enzymology with the kinetic theories in order to provide a mechanistic overview of enzyme activity and regulation in different cells and organisms.

Course Outcomes:

2. By the end of this course, students will be able to:
- a. Classify and categorize the fundamentals of enzymes.
 - b. Display the techniques in kinetic analysis and application of enzymes.
 - c. Relate the enzyme techniques and technologies to the major applications in the field of medicine, agriculture, environment, food production and industrial processes.
 - d. Explain the principles of enzymatic catalysis and the factors influencing the rate of an enzyme-catalysed reaction.
 - e. Design and optimise both fixed-point and continuous monitoring enzyme assays for the purposes of enzyme or substrate determination.
 - f. Design and optimise assays using enzymes as reagents for substrate measurement.
 - g. Describe the major applications of enzymes in industry.
 - h. Safely perform enzyme assays for the purposes of enzyme and substrate determination.
 - i. Interpret analytical results and evaluate experimental error.

3. **Course Contents:**

- a. Introduction and History of Enzymes
- b. Historical Aspects
- c. Discovery of enzymes
- d. Chemistry of enzymes
- e. Function and importance
- f. Enzymes in Biotechnology

- g. Characteristics and Properties
- h. Catalytic power and specificity
- i. Enzymes as catalysts
- j. Nomenclature / Classification and Activity Measurements
- k. Activity measurements
- l. Enzyme Purification and Assay
- m. Initial velocity measurements
- n. Assay types
- o. Enzyme units of activity
- p. Turnover number and properties
- q. Purification and assessment
- r. Methods for measurement
- s. Enzyme kinetics
- t. Single Molecule Enzymology
- u. Enzyme Inhibition and Kinetics
- v. Classification of Inhibitors
- w. Classification of Reversible Inhibitors
- x. Multi-substrate Reactions and Substrate Binding Analysis
- y. Mechanism of enzyme catalysis
- z. Engineering More Stable Enzymes
- aa. Incorporation of Non-natural Amino Acids into Enzymes

Recommended Books:

1. Alan Fersht (1999) Structure and Mechanism in Protein Science, 2nd edition, W.H. Freeman & Co.
2. David Nelson and Michael Cox (2008) Lehninger: Principles of Biochemistry, 5th edition, W.H. Freeman & Co., New York.
3. Nicolas Price & Lewis Stevens (1995) Fundamentals of Enzymology, 2nd edition, Oxford Univ. Press, New York.
4. Trevor Palmer (1985) Understanding Enzymes, 2nd edition, J. Wiley & Sons, New York.
5. Donald Voet & Judith Voet (2004) Biochemistry, 3rd edition, J. Wiley & Sons, New York (Chapters 12 through 15).

6. *Reginald Garrett & Charles Grisham (2005) Biochemistry, 3rd edition, Thomson Learning, Inc., Belmont.
7. *Mary Campbell & Shawn Farrell (2006) Biochemistry, 5th edition, Thomson Learning, Inc., Belmont.
8. Robert K. Scopes (1988) Protein Purification, 2nd edition, Springer-Verlag, Berlin.
9. Athel Cornish-Bowden (2004) Fundamentals of Enzyme Kinetics, 3rd edition, Portland Press, London.
10. Carl Branden & John Tooze (1999) Introduction to Protein Structure, 2nd edition, Garland Publ., New York.