

# **SYLLABUS**

## **RBT403: ENZYME ENGINEERING**

### **UNIT I**

Introduction to enzymes: Holoenzyme, apoenzyme, prosthetic group. Interaction between enzyme and substrate- lock and key model, induced fit model. Features of active site, activation energy, enzyme specificity and types. IUB system of classification and nomenclature of enzymes. Kinetics of single substrate reactions; Derivation of Michaelis -Menten equation, turnover number; determination of  $K_m$  and  $V_{max}$  (LB plot, ED plot), Importance of  $K_m$  &  $V_{max}$ ; Numerical related to enzyme kinetics, Multi-Substrate reaction mechanisms.

### **UNIT II**

Factors affecting the velocity of enzyme catalyzed reaction- enzyme concentration, temperature, pH, substrate concentration, inhibitors and activators. Enzyme inhibition: irreversible; reversible (competitive, uncompetitive and non competitive inhibition); Substrate and Product inhibition, Allosteric regulation of enzymes, concerted & sequential model; Deactivation Kinetics.

### **UNIT III**

Extraction of crude enzyme from plant, animal and microbial source; some case study. Purification of enzymes by the help of different methods. Methods of characterization of enzymes; criteria of purity. Unit of enzyme activity - definition and importance. Development of enzyme assays.

### **UNIT IV**

Enzyme Immobilization: Adsorption, Matrix entrapment, Encapsulation, Cross linking, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques. Structure & stability of immobilized enzymes, kinetic properties of immobilized enzymes- partition effect, diffusion effect. Overview of applications of immobilized enzyme systems.

### **UNIT V**

Enzyme Biosensors: elements of biosensors, three generations of biosensors, Types of biosensors: calorimetric, potentiometric, amperometric, optical and piezoelectric. Design of enzyme electrodes and their applications as biosensors in industry, health care and environment. Design of Immobilized Enzyme Reactors- Stirred tank reactors (STR), Continuous Flow Stirred Tank Reactors (CSTR), Packed- bed reactors (PBR), Fluidized-bed Reactors (FBR); Membrane reactors.