

B.Tech. Biotechnology: Semester-IV	
BBT 402: BIOPROCESS ENGINEERING	
Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Credits: 4	Attendance – 12 Marks
	End Semester Exam – 70 marks

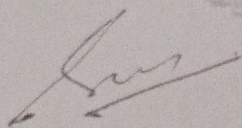
Course Objective

To understand the basic of fermentation, different bioreactor design, different media used for the fermentation of product, overview of product produced by biotechnological industries. To learn the different instrumentation used for the downstream processing of different products. To learn and have complete knowledge of type of enzymes and different fermented food products of different industries. To understand how downstream processing instrumentation works or they can use like crystallization, during, liquid-liquid extraction, centrifugation, chromatography etc. To learn the enzyme kinetics, microbial kinetics, thermal kinetics and the application of these in fermentation. To expertise in the process involved in the effluents or waste of fermentation industries by latest technologies involved in treatment of waste like, Activated sludge process, Rotating Disk Biological Contractor (RBC) etc.

Course Learning Outcomes

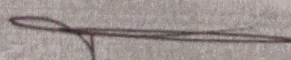
After completing the course, the student shall be able to:

- CO1: Understand various types of fermentation mode of operation and their kinetics.
- CO2: Analyze the effect of various fermentation and downstream processes involved in the synthesis of products.
- CO3: Understand the enzyme production and their application involved in modern world.
- CO4: Understand the instrumentation involved in the downstream processing of products produced by different pharmaceutical and biotechnological industries.
- CO5: Evaluate performance of different fermentation processes i.e., whose work in batch and continuous mode of operation.
- CO6: Will understand the production and application of some enzymes used in food and biotechnological industries.



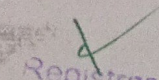
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Bareilly

Unit 1: Basic principle of Biochemical engineering

Isolation, screening and maintenance of industrially important microbes; Microbial growth and death kinetics (an example from each group, particularly with reference to industrially useful microorganisms); Strain improvement for increased yield and other desirable characteristics.

Unit 2: Concepts of basic mode of fermentation processes

Bioreactor designs; Types of fermentation and fermenters; Concepts of basic modes of fermentation - Batch, fed batch and continuous; Conventional fermentation v/s biotransformation; Fermentation media; Fermenter design- mechanically agitated; Pneumatic and hydrodynamic fermenters; Large scale animal and plant cell cultivation and air sterilization.

Unit 3: Downstream processing

Bioseparation - filtration, centrifugation, sedimentation, flocculation; Cell disruption; Liquid-liquid extraction; Purification by chromatographic techniques; Reverse osmosis and ultra filtration; Drying; Crystallization; Storage and packaging; Treatment of effluent and its disposal.

Unit 4: Applications of enzymes in food processing

Mechanism of enzyme function and reactions in process techniques; Enzymic bioconversions e.g. starch and sugar conversion processes; Enzyme kinetics; Two-substrate kinetics and pre-steady state kinetics; Allosteric enzymes; Enzyme mechanism; Enzyme inhibitors and active site determination Production, recovery and scaling up of enzymes and their role in food and other industries; Immobilization of enzymes and their industrial applications.

Suggested Readings

- Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall, Engelwood Cliffs, 1991.
- Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2nd Edition, Prentice Hall, Engel wood Cliffs, 2002.
- Stanbury RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997
- Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York, 1986.
- Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo press, Tokyo, 1973.
- Comprehensive Biotechnology: The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Young M.M., Reed Elsevier India Private Ltd, India, 2004.



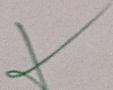
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