

Semester: VI	Title: Fermentation Technology	Credit: 4
Course Code: BTM361 (T)		4hr/week

Course Outcomes

After successful completion of this course, students will be able to:

CO1 Describe the historical development, basic concepts, and economic aspects of industrial fermentation.

CO2 Explain the methods used for isolation, screening, and genetic improvement of industrial microorganisms

CO3 Formulate fermentation media using appropriate raw materials, and optimize media composition.

CO4 Understand the design, functions, and aseptic operations of different fermenters.

CO5 Compare batch and continuous fermentation processes along with sterilization techniques.

CO6 Explain various downstream processing steps including cell separation, cell disruption, and product recovery methods.

CO PO mapping

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO-1	3	2	2	1		2		
CO-2	2	3	1	1			1	1
CO-3					1		2	3
CO-4					1	3	3	
CO-5	3		2	3		2		
CO-6		2	1		2			1

Unit I: Basics of Fermentation Technology

Teaching hours 15

- Introduction, History and significance of fermentation technology
- Range and component parts of Fermentation Processes
- Isolation & improvement of industrially important microorganisms
 1. Primary & Secondary Screening: Isolation methods using selection of desired characters
 2. Improvement of industrially important microbes: Application of protoplast fusion and recombinant DNA technology
- Economic aspects of fermentation industry

Unit II: Design and Aseptic Operation

Teaching hours 15

- Introduction and basic functions of fermentor
- Types of bioreactors
- Aeration and Agitation
- Fermentation process: Batch Fermentation, Continuous fermentation and their comparative advantages and disadvantages
- Sterilization process in fermentation industries:
 1. Fermenter sterilization, 2. Medium sterilization, 3. Sterilization of air and feed
- Aseptic operation and Containment

Unit III: Formulation of Fermentation media

Teaching hours 15

- 1. Introduction to media formulation
- 2. Types of fermentation media: A] By composition- complex media, crude media, synthetic media B] By state: liquid media, solid state media, media for submerged cultures
- Raw materials:
 - Crude Carbon- molasses, corn steep liquor, whey, sugar cane juice, starch, hydrocarbons
 - Nitrogen sources- A] inorganic ammonia, ammonium sulfate, diammonium hydrogen phosphate, and urea) or organic (such as yeast extract, peptone, soybean meal, corn steep liquor, and amino acids)
- Minerals, Precursors, Growth Regulators, Buffers, Antifoam agents
- Inoculum Medium
- Media Optimization: OVAT and Placket Burmann

Unit IV: Downstream Strategies

Teaching hours 15

- Methods of Cell separation: Broth conditioning, Precipitation, Sedimentation, Centrifugation, Filtration
- Techniques of Cell Disruption: Mechanical and Non mechanical methods
- Product Recovery: Liquid-liquid extraction, Solvent recovery, Two Phase aqueous extraction, Super critical fluid extraction
- Physical, Chemical and Biological assay of fermentation products

Reference Books

1. Industrial Microbiology By Casida L. E.
2. A text book of industrial microbiology, 2nd edition By Wulf Crueger & Anneliese Crueger
3. Industrial Microbiology By A.H. Patel

4. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology Vol. 1 & 2
By
V.K. Joshi & Ashok Pandey
5. Biotechnology By M.D.Treva
6. Principles of Fermentation Technology By Stanbury & Whittaker : 2nd edition