

Subject Code: 2SC2020302	Subject Title: Bioprocess and Industrial Microbiology
COURSE TYPE: CORE COURSE	

Course Objective:

Bioprocess and Biochemical Engineering deals with Microbial Processes that produce the product of interest ,i.e. Specialty Products, Enzymes, Vitamins, Antibiotics, Organic Acids, Alcohols, etc. It covers the fundamental aspects of Bioreactor design, Media formulations, Control of factors that affect such bioprocesses and their maintenance.

Teaching scheme (hours)per week		Credit			Theory Marks		Practical Marks		Total
Theory	Practical	Theory	Practical	Total	Uni. Assessment	Cont. Assessment	Uni. Assessment	Cont. Assessment	
4		4		4	60	40			100

Unit	Content	Lectures	Weightage
1	Unit: 1: Bioreactor Design & Formulation of Media - Basic functions of a Typical Fermenter - Design of an ideal Stirred Tank Reactor & its various auxiliary parts - Aseptic operation and Role of contaminants: Techniques for the Achievement and Maintenance of Aseptic condition during Fermentation Processes - Medium formulations for industrial fermentation processes: Different C-,N-Sources used for the formulation of media - Various media ingredients and the criteria for selection - Antifoaming agents - Media Optimization, - Aeration and agitation, Concept of $K_L a$, Non Newtonian and Newtonian fluids. - Medium sterilization: Batch & Continuous Sterilization Methods - Sterilization of Fermenter, feeds, and liquid waste - Sterilization of air.	15	25%
2	Isolation of industrially Important Organism and strain Improvement Solid State Fermentation - Solid State Fermentation Vs Submerged Fermentation for the production of Enzymes - Factors affecting enzyme production employing SSF - Use of Different Agro-Industrial Residues for the Production of Enzymes: Wheat Bran ,Sugarcane Bagasse ,Citrus Bagasse, Apple & Grape Pomaces ,Coffee Pulp & Husk - Pretreatment of substrates	15	25%

3	Downstream Processing: • Different Methods for the Removal of cells and solids • Extraction of intracellular products by cell disruption methods • Methods for the Concentration of Extracted products • Purification of fermentation products:-chromatographic techniques membrane techniques and ultra-filtration • Drying and Crystallization Quality Assurance –Bioassay of Antibiotics and Vitamins		
4	Typical Fermentation Processes-1: • Enzymes: Fermentative Production of Amylase, Protease • Organic Acids: Fermentative Production of Citric Acid, Acetic Acid • Antibiotics: Fermentative Production of Penicillin Typical Fermentation Processes-2: • Fermentative Production of Ethanol • Fermentative Production of Vitamin B₁₂ • SCP: (Single cell Protein): Production & Nutritional Significance and SCO (Single cell Oil) • Mushroom Production	15	25%

Learning Outcome:

Students will learn the basics of bioprocesses and fermentation technology. They will also learn the fundamental concepts underlying the production & applications of various products produced by industrial fermentations.

Reference Books:

1. Michael Shuler and Fikret Kargi, Bioprocess Engineering: Basic Concepts, 2nd Edition, Prentice Hall, Englewood Cliffs, NJ, 2002.
2. Pauline Doran, Bioprocess Engineering Principles, 1 Edition, Academic Press, 1995.
3. Colin Ratledge, Bjorn Kristiansen, Basic Biotechnology, 2nd Edition, Cambridge University Press, 2001.
4. Roger Harrison et al., Bioseparations Science and Engineering, Oxford University Press, 2003.
5. Principles of Fermentation Technology by R.H. Whittaker
6. Mansi, Fermentative productions of vitamin B₁₂
7. Fermentation microbiology and Biotechnology, Tylor and Francis.
8. Crueger and Crueger: Biotechnology
9. Peppler : Microbial Technology: Fermentation technology
10. L.E. Casida: Industrial Microbiology
11. Prescott & Dunn: Industrial Microbiology