Course Code	Course Name	L-T-P-Credits	Year of Introduction
BT204	**Industrial Bioprocessing**	**4-0-0-4**	**2016**

Prerequisite : Nil

Course Objectives

- To give an insight into the essential concepts of industrial bioprocessing.
- To familiarize the manufacturing techniques of various biotechnology industry products in a very cost effective manner.

Syllabus

Review of industrial fermentation, Role of a bioprocess engineer in bioprocess industry, Process flow sheeting for common bioproducts, Isolation and improvement of microbial strains, Recombinant DNA technology for overproduction of primary and secondary metabolites, Cost estimation, GMP and cGMP, Production and purification of enzymes and its applications, Manufacture of Diagnostic and therapeutic bioproducts.

Expected outcome

Upon successful completion of this course, the students should be able to

- Appreciate the use of microorganisms for the production of value added commodities.
- Describe key industrial bioprocesses, from the traditional to the recently evolved.
- Understand the biological and engineering principles involved in the production of bioproducts and enzymes.

Reference Books

1. Michael L Schuler and Fikret Kargi, *Bioprocess Engineering Basic Concepts*, Prentice Hall PTR, 2002.
2. S. C. Prescott, C. G. Dunn, *Industrial Microbiology*, Agrobios, 2005.
3. K. Buchholz, V. Kasche, U.T. Bornscheuer, *Biocatalysts and Enzyme Technology*, WILEY-VCH, 2005.
4. Moo-Young. M, *Comprehensive Biotechnology*, Volumes 1-3, Pergamon Press (Oxford), 2004.
5. Ratledge, Colin and Bjorn Kristiansen, *Basic Biotechnology*, 2/e, Cambridge University Press, 2001.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	A review of industrial fermentation and enzymatic processes and products - Role of a bioprocess engineer in bioprocess industry- Outline of the various unit operations involved in the upstream and downstream operations of a bioprocess plant-Process flow sheeting- Isolation, preservation and improvement of industrial strains- Recombinant DNA technology for overproduction of primary and secondary metabolites. Regulation of enzyme activity and synthesis, Catabolite and phosphate regulation.	10	15%

II	Market Economics relating to modem Industrial Biotechnology in India - Capital cost estimation - operating cost estimation - profitability analysis - GMP and cGMP - Utilities in a bioprocess plant - Energy conservation and audit in a bioprocess plant.	8	15%
FIRST INTERNAL EXAM			
III	General purification methods for enzymes - Biosynthesis by microorganism - important engineering problems involved in the manufacture of the following products with flow diagram - Organic acids: Citric acid, lactic acid, Gluconic acid, acetic acid- Amino acids: Glutamic acid, Lysine, Aspartic acid- Alcohols :acetone, ethanol and butanol	9	15%
IV	Secondary metabolites: Production of secondary metabolites of Industrial Importance – antibiotics: penicillin and cephalosporin - aminoglycosides: streptomycin, kanamycin – Aromatic antibiotics: chlorcphenicol, griseofulvin - Vitamins: B12, Riboflavin	8	15%
SECOND INTERNAL EXAM			
V	Application of enzymes in - Starches, Sugars and Syrups Industry - Fruit and Vegetable Juice manufacture - Brewing, Textiles and Laundry Detergents, Pulp and Paper industry - Tanning Industry.	8	20%
VI	Manufacture of human insulin - Interferon, Erythropoietin, Streptokinase, Interleukin, Blood factor VIII - Hepatitis B Vaccine - Vitamin B12 - Monoclonal antibodies for therapeutics, Xanthan gum and PHB	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 hours

The question paper consists of Part A, Part B and Part C.

Part A consists of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer two questions (15×2=30 marks).

Part B consists of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer two questions (15×2=30 marks).

Part C consists of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer two questions (20×2=40 marks).

Note : Each question can have a maximum of 4 subparts, if needed.