



BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE
INSTRUCTION DIVISION
SECOND SEMESTER 2015-16
course Handout (Part-II)

Date: 12/01/2016

In addition to Part-I (General Handout for all courses appended to the Time Table), this portion gives further details regarding the course.

Course No. : CHE F 421
Course Title : BIOCHEMICAL ENGINEERING
Instructor-in-charge : DR. AMIT JAIN

1. COURSE DESCRIPTION:

Biochemical and bioprocess engineering; Basics of biology from engineer's perspective; Enzyme kinetics and Immobilization; Metabolic pathways & Energetic; Stoichiometry of cell growth and product formation; Kinetics of substrate utilization, product formation, and biomass production in cell cultures; Transport phenomena in Bioprocesses; Bioreactor design and analysis; Instrumentation and control of bioreactors; Product purification and recovery; Bioprocess economics.

2. SCOPE & OBJECTIVE:

The objective of the course, as implied by the course content above, is to introduce fundamental biochemical engineering and bioprocess technology concepts and their commercial implications to the students from chemical engineering. To accommodate those students who do not have the biological background, the course will first introduce the basic concepts from microbiology, biochemistry, and the central dogma of biology. Subsequently, the emphasis will be on the application of the principles of chemical engineering to biological processes.

3. TEXT BOOK:

TB: "Biochemical Engineering Fundamentals" by James E. Bailey and David F. Ollis (1986) 2nd Ed. McGraw Hill International Edition.

REFERENCE BOOKS:

R1: "Bioprocess Engineering: Basic Concepts" by Michael L. Shuler and Fikret Kargi (2005) Third Indian Reprint, Pearson Education.

R2: "Biochemical Engineering" by Harvey W. Blanch & Douglas S. Clark (1997), Marcel Dekker, Inc., New York.

R3: "Coulson and Richardson's Chemical Engineering", Vol. 3 by J F Richardson and D G Peacock, 3rd Ed., Asian Books Private Limited, New Delhi.





4. COURSE PLAN:

S.No.	Topics	Lectures	Ref.
1.	Introduction to Biochemical Engineering & Handout Discussion	01	R1: Ch.-1
2.	Basics of Biology; Overview of Biotechnology; Diversity in Microbial Cells, Cell Constituents, Chemicals for Life.	03	TB: Ch.1-2; R1: Ch.-2
3.	Enzyme Kinetics: Introduction, Mechanistic Models, experimental determination of rate parameters, Effects of pH and temperature, insoluble substrate.	03	TB: Ch. 3; R1: Ch.-3
4.	Immobilized Enzyme Systems: Enzyme immobilization methods, their limitations & applications, Immobilized enzyme kinetics.	03	TB: Ch. 4; R1: Ch.-3
5.	Metabolic Stoichiometry and Energetics: Major metabolic pathways, Respiration, Nitrogen Fixation, Biosynthesis Transport across cell membranes, Stoichiometry of cell growth and product formation.	03	TB: Ch.-5; R1: Ch.-5 & Ch.-7
6.	Kinetics of substrate utilization, product formation, and biomass production in cell cultures.	06	TB: Ch.-7; R1: Ch.-6
7.	Transport phenomena in bioprocess systems: Gas-liquid mass transfer, determination of oxygen transfer rates, free and forced convection mass transfer.	05	TB: Ch.-8
8.	Bioreactor design and analysis: Submerged liquid fermentation bioreactors - batch, continuous, semi-continuous, combination of reactors; Reactors for enzyme reactions and immobilized cells.	06	TB: Ch.-9; R1: Ch.-9
9.	Scale-up and control of bioreactors: Scale-up and its difficulties, bioreactor instrumentation and control, sterilization.	04	TB: Ch.-10; R1: Ch.-10
10.	Product purification and recovery: Strategies, separation of soluble and insoluble products, cell disruption, purification and integration of processes.	05	TB: Ch.-11; R1: Ch.-11
11.	Analysis of multiple interacting microbial populations: Classification of interactions, competition, predation and parasitism.	03	TB: Ch.-13





5. EVALUATION SCHEME:

Component	Duration	Weightage %	Date & Time	Nature of Evaluation
Topic Presentation	15 min	20%	Regular Class	Power Point
Quiz (10)	---	10%	Regular Class	Closed Book
Mid-semester Examination	90 min	25%	17/3 9:00 - 10:30 AM	Closed Book
Comprehensive Examination	180 min	45%	3/5 FN	Closed and Open Book

*Please confirm the details with Instruction Division.

- Make-up would only be granted under special conditions as per the institute policy with prior permission from I/C.
- Chamber Consultation Hour: Saturday 11:00-11:50 AM.
- Notices: To be displayed on the chemical engineering notice board and on Nalanda.

Instructor-in-charge

CHE F 421: Biochemical Engineering

