

CM4710**Biochemical Processes****Fall 2005****Course No. 83927**

Biochemical processes are those that use living cells or biomolecules to carry out a biochemical transformation leading to the production and ultimate recovery of valuable products.

Catalog

Description: The primary objective of this course is to present an introduction to fundamental and applied aspects of industrial biochemical processing. Topics of lectures include cell structure and composition, cellular metabolism, enzymes and their use in industry, bioreactor analysis and design, bioseparations for product recovery, bioprocess design tools, industrial applications, and an introduction to molecular biology techniques for enhancing productivity.

Course Learning Objectives:

- Objective 1: To identify major classes of biochemicals, and understand basic elements of cellular metabolism, protein synthesis, and cell growth.
- Objective 2: To perform chemical engineering analyses in the design and operation of industrial bioreactor and bioseparation processes.
- Objective 3: To understand basic tools of molecular biology and genetic engineering, and know important applications of this technology in pharmaceuticals, specialty chemicals, and bulk chemical manufacturing.

Instructors: Professor David R. Shonnard (202I, CSEB)
Chemical Engineering Department
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Time: MWF 1205 - 1255 (12:05 pm - 12:55 pm)

Location: Room 102, CSEB (Bldg. 19)

Text: Required: Shuler and Kargi, Bioprocess Engineering: Basic Concepts, 2nd Edition, Prentice Hall P T R, 2002.

Webpage: <http://www.chem.mtu.edu/~drshonna/cm4710f05/index.html>

Course Outline

- I. Biochemical Fundamentals (portions of Chapters 1-5) week 1-4
 - A. Cell structure and composition (Chapter 2)
 - B. Enzymes (Chapter 3)
 - 1. structure of enzymes and kinetics of enzyme-catalyzed reactions
 - 2. Why use enzymes?
 - 3. Enzymes in industrial processes
 - C. Metabolism
 - 1. DNA Replication to Protein synthesis
 - 2. Metabolic pathways and their regulation

- II. Bioreactor Design and Analysis (Chapters 6-7, 9-10) week 5-8
 - A. Microbial Growth Kinetics (Chapter 6 and 7)
 - 1. Batch Growth Characteristics
 - 2. Modeling of Continuous Culture
 - 3. Stoichiometry of Microbial Growth
 - B. Bioreactor Design (Chapter 9)
 - 1. Suspended Cell Systems
 - 2. Immobilized Cell Systems
 - 3. Sterilizing Process Fluids and Equipment

- III. Product Recovery (Chapter 11, handouts) week 9-12
 - A. Bioseparations: Recovery and Purification of Products
 - 1. Separating Insoluble Products (Centrifugation, Filtration)
 - 2. Separating Soluble Products
 - 3. Purification Steps

- IV. Genetic Engineering Basics and Applications (Chapters 8, 14) week 13-15
 - A. Basic elements of Genetic Engineering (Ch. 8)
 - B. Utilizing Genetic Engineered Organisms (Ch. 14)

Course Policies and Procedures

Reserve Reference Material

On reserve in the library will be several texts which may be used by students as sources auxiliary reading materials. These reference sources will be posted by the instructor as the need arises and will be announced in class.

Homework

Homework will be assigned weekly at the discretion of the instructor. One week will be allowed for each assignment. Homeworks will be graded, and, examinations may be based on homework materials in addition to the lecture and required text. The use of engineering paper for homeworks is highly recommended. Neatness and logical development of work is a high priority and points will be deducted for sloppy or unreadable work.

Examinations

There will be three exams. All examinations will be closed-book and will have equal weight in calculating the final grade for the course (20% of the final grade for each examination). Make-up exams will be given only for valid written excuses prior to the exam, subject to the arbitrary judgment of the instructor.

Writing Project

One writing project will be assigned near the middle of the semester and will be due at the end of the semester. The report for the writing project will comprise 20% of the course grade. A handout will be provided early in the term describing potential topics, report organization, and other related issues.

Course Grade Policy

The weighting of the examinations and report will be as follows

Mid-term I	(end of September)	20%	100 pts
Mid-term II	(end of October)	20%	100 pts
Mid-term III	(start of December)	20%	100 pts
Writing Project (due end of semester)		20%	75 pts report; 25 pts oral talk
Homework (Collectively)		20%	100 points
		Total	500 pts

Letter Grades will be assigned following this schedule

90-100%	A	70-75%	C
85-90%	AB	65-70%	CD
80-85%	B	60-65%	D
75-80%	BC	<60%	F