Biological & Irrigation Engineering

BIE 5810/6810, Biochemical Engineering

Elective Course

Course Description:

BIE 5810: Biochemical Engineering. Biochemical processes, reactors, thermodynamics, and kinetics are used in the application of engineering principles to analyze, design, and develop processes using biocatalysts. Processes of interest include those that are involved in the formation of desirable compounds and products or in the transformation, or destruction of unwanted and/or toxic substances. 3 credits, F.

Prerequisites: BIE 3200, BIE 3670

Textbook: *BIOPROCESS ENGINEERING: Basic Concepts*, Second Edition, Michael L. Shuler and Fikret Kargi, (Prentice Hall), 2002.

References:

1) Understanding Biotechnology (A. Borem et al. 2003, Prentice Hall)
2) Nanotechnology (M. Ratner and D. Ratner, 2003, Prentice Hall) for Bioethics issues.
3) Biology, Biologists, and Bioethics. (S. Dumontet and H. Grimme, Foxwell & Davis Italia 2004).

Course Outcomes:

1. Know data requirements, analysis, and interpretation for biokinetic, thermodynamic, and stoichiometric calculations used in biochemical engineering.
2. Conduct an analysis on the biological factors that are important in the design, operation, performance, and/or monitoring of a biological process.
3. Apply kinetic calculations to biochemical reactor design and operation.
4. Conduct thermodynamic analysis for reactor design and operation.
5. Know some bioethics issues and ethical aspects of biological engineering.
6. Know major metabolic pathways important for biochemical engineers.
7. Calculate biochemical stoichiometry requirements and apply results to the design and operation of biochemical processes.
8. Know some contributions of biochemical engineering to global society.
9. Participate in work groups to solve biochemical engineering problems.
10. Communicate biochemical engineering concepts through the use of engineering media, verbally, and in writing.

Topics Covered:

1. Introduction to biochemical engineering
2. Biochemical Engineering Reactors: Design and operation
3. Enzyme kinetics (biochemical engineering catalysis)
4. Stoichiometry of biochemical reactors
5. Major metabolic pathways for biochemical engineers
6. Thermodynamics of living systems relevant to bioreactors
7. How biological cells grow and the chemostat
8. Scale-Up of Bioreactors

9. Ethics issues related to biochemical engineering

Class Schedule: Two 75-minute classes per week, T-H. (10:30-11:45 AM)

Contribution of course to meeting the professional component: This course covers the principles and applications of biochemical engineering components and methods for the analysis, design, operation, and monitoring of biochemical engineering processes and reactors.

Relationship of course outcomes to program outcomes for ABET:

Course Outcome	Program Outcome
1.	b. Shown a capacity for investigation and experimentation including the analysis and interpretation of data
2., 3., 4., 6., 7.	c. Demonstrated the ability to design a biological system or component of one that achieves a cost-effective solution,
9.	d. Exercised their skills within the framework of a multi-disciplinary team or work group
2., 3., 4., 6., 7.	e. Demonstrated the ability to solve engineering problems, utilizing fundamental engineering principles as well as the latest technologies and engineering tools, in the process of engineering analysis and design
5., 8.	f. Ethical conduct, issues in biological engineering, and professional responsibility
2., 10.	g. Demonstrated the capability to communicate verbally, in writing, and through engineering communication media
5., 8.	h. Exhibited an understanding of the role that Biological Engineering plays in our modern global society, that much is to be learned from the past and applied to the present, and that responsible engineers are ethical and will continue to increase their knowledge throughout their professional career

Prepared by: Ronald C. Sims, August 20, 2007