Syllabus

SYLLABUS

ABE 580
Process Engineering of Renewable Resources
Spring 2019
MWF 10:30 – 11:20 a.m.
Grissom 103

Instructor: Nathan S. Mosier
Department of Agricultural and Biological Engineering
Laboratory of Renewable Resources Engineering
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Office Hours: Wednesdays, 5:00 – 6:00pm in POTR 220

Text: **Modern Biotechnology: Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals,** John Wiley and Sons, NY, 2009. Nathan S. Mosier and Michael R. Ladisch

Other papers from the peer-reviewed literature will be assigned and provided through Blackboard.

Software: Excel, MathCAD, or MatLab

Objectives of the course:

The goal is to introduce students to biotechnology and tools that enable engineers and process scientists to connect innovations in industrial microorganisms and bioprocess unit operations to the engineering fundamentals, fundamentals of systems biology, and biological tools for design, modeling and evaluation of manufacturing facilities for the production of biofuels, bioproducts and biotherapeutics using a case study approach combined with computer modeling. After completing this course a student should be able to:

1. Analyze bioprocesses using engineering design principles, bioreactor simulations, application of basic separations methods, and applying engineering economic analysis (SO 1, 2)
2. Develop process models for batch and continuous fermentation, cell culture, and enzymatic bioreactors (SO 1, 2)
3. Analyze the impact of fundamental advances in bio-sciences on bioprocess engineering and the environment, and the potential of these advances to solve societal problems (SO 2, 4)
4. Understand the impact of biosafety and regulatory considerations on process design (SO 4)

Prerequisites

Senior or graduate student status (no exceptions), and ABE 301 or ChE 348.

Grading

Grades will be based on three midterm exams (200 points each) and homework assignments (totaling approximately 200 points). There will be no final exam. One or more homework assignments will be longer modeling and analysis projects based upon reading and applying concepts and data from that primary, peer-reviewed literature that may be completed in teams. All team members will receive the same grade.

Unexcused late assignments will be accepted for ½ credit until the graded assignments are returned to the students (approximately 1 week after the due date).

This course will use the following grade scale based on the points you have earned as a % of the maximum possible points:

A	> 89.9%
B	80.0 – 89.9%
C	70.0 – 79.9%
D	60.0 – 69.9%
F	< 60.0%

Statement on Academic Honesty:

Honesty requires that ideas, data, figures, tables, equations or derivation of equations, process concepts, wording of explanations, or other forms of intellectual property of others must be fully acknowledged. The use of such property in reports and papers is acknowledged by citing the source (ALL of the authors; title, journal or other publication in which the information appeared; volume and number; editor(s), if appropriate; publishing house, city, state, if the information is from a book; beginning and ending page numbers of the publication; and year). Property which is conveyed through a letter or other form of personal communication is to be indicated as such. Again, give the authors, title (if appropriate), "Personal Communication," and date.

The offering of materials assembled, collected, or created by others or reported by others in the form of projects, books or parts of books, periodicals, speeches, or the writings of other students as one's own is plagiarism. Dishonesty of any kind with respect to examinations or alterations of records is cheating.

Class notes provided by the instructor are considered to be 'derivative works' of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. As such, they cannot be sold or bartered without the instructor's express written permission.

Plagiarism and/or cheating is sufficient for an F. See student handbook for University rules.

As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern

investigate the concern.

Adaptive Services. Students with disabilities must be registered with Adaptive Programs in the Office of the Dean of Students before classroom accommodations can be provided.

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or through its counselors physically located in the Purdue University Student Health Center (PUSH) during business hours.

Emergency Statement. In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Here are ways to get information about changes in *this* course. Blackboard web page, my email address: mosiern@purdue.edu, and my office phone: 494-7022.

ABE 580 Spring 2019 Lecture Schedule
This lecture schedule and exam times are subject to change.
All changes will be announced in class and through Blackboard!

Week	Lecture Topic
1	Introduction and Chapter 4: Microbial Fermentations - classification of fermentation type, basic metabolism unstructured modeling of fermentation
2	Chapter 5: Modeling and Simulation – Unstructured Modeling of cell growth and bioproduct formation in anaerobic bioreactors
3	Chapter 5 continued – Type II fermentation models, batch versus chemostat bioreactors
4	Chapter 6: Aerobic Bioreactors
5	Chapter 6 continued: Butanediol case study **Exam 1**
6	Chapter 7 Enzymes: properties, classification system, assays, Michaelis-Menten kinetics, thermal stability
7	Chapter 8 Enzyme Kinetics: Rapid equilibrium vs pseudo steady-state kinetics. King Altman method; integrated vs initial rate equations
8	Chapter 8 Continued: Enzymes for industrial bioreactors
9	Chapters 9-11: Metabolism and Microbial Energetics **Exam 2**
	Spring Break – No Class
10	Chapters 9-11 continued: Auxotrophs and industrial bioproduct production (amino acids case study)
11	Chapter 12-14: Genes and Genetic Control – tools for gene manipulation, application of molecular biology for industrial bioproduct production
12	Chapter 12-14 continued: Cellular engineering, metabolic engineering
13	Bioseparations: Recovery of Soluble Products
14	Bioseparations continued **Exam 3**
15	Emerging Topics in Biotechnology