ETO: The Faculty of the College of Engineering
FROM: The Faculty of Agricultural and Biological Engineering
RE: New Course ABE 30400

The faculty of the Department of Agricultural and Biological Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ABE 30400  Bioprocess Engineering Laboratory
Sem. 2, Class 1. Lab 4. Cr. 3.
Requisites, Restrictions, and Attributes: ABE 30800 [may be taken concurrently]

Description: Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Reason: Previously, Biological Engineering students obtained 1 credit of lab in fluids (via CHE 37700), 1 credit of lab in heat and mass transfer (via CHE 37800) and 1 credit of lab in transport processes (via ABE 45400). These three, 4 credit courses (3 credit lecture + 1 credit lab) were replaced by three, 3 credit lecture courses (ABE 30700, ABE 30800 and ABE 45700). The 3 credit ABE 30400 bioprocess lab was created to cover the remaining 3 credits of lab in these topic areas. The one class hour per week covers lab preparation and introduces students to the procedures that will be used in experiment.

Bernard A. Engel, Professor and Head
Agricultural and Biological Engineering Department

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING CURRICULUM COMMITTEE

ECC Minutes #13
Date 5/10/2013
Chairman ECC
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COURSE LEARNING OUTCOMES

Understand and analyze the flow behavior in biological systems. Understand and analyze enzymatic reactions in biological systems.
Understand and analyze fermentation processes. Understand and analyze mixing and heat transfer in biological systems.
Collect and analyze rheological properties. Design and safely execute experiments in a process laboratory.
Collection and statistical analysis of experimental data. Present the results of analysis in the form of written report and oral presentation.
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ABE 30400  Bioprocess Laboratory

COURSE CONTACT INFORMATION:

Name: Jenna L. Rickus  
Phone Number: 765-494-1197  
E-mail Address: rickus@purdue.edu  
Campus Address: MJIS 2029

Catalog Description. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Concurrent: ABE 30800 Heat & Mass Transfer in Food and Biological Systems

COLLEGE LEARNING OUTCOMES ADDRESSED BY THIS COURSE

_____ X Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct.

_____ X Scientific Principles: Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions.

_____ Critical Thinking: Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems.

_____ X Communication: Demonstrate the ability to write and speak with effectiveness while considering audience and purpose.

_____ X Teamwork: Demonstrate the ability to work effectively as part of a problem-solving team.

_____ Cultural Understanding: Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own.

_____ Social Science Principles: Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community.

_____ Civic Responsibility: Demonstrate awareness of civic responsibility to community and society at large.

_____ Lifelong Learning: Demonstrate skills necessary for lifelong learning

DEPARTMENTAL/PROGRAM LEARNING OUTCOMES ADDRESSED BY THIS COURSE

_____ X an ability to apply knowledge of mathematics, science, and engineering

_____ X an ability to design and conduct experiments, as well as to analyze and interpret data.

_____ an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

_____ an ability to function on multidisciplinary teams
an ability to identify, formulate, and solve engineering problems
an understanding of professional and ethical responsibility
X an ability to communicate effectively
the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
a recognition of the need for, and an ability to engage in life-long learning
a knowledge of contemporary issues
X an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course outline of Topics/Syllabus

Fluid Flow (3 weeks)
Rheology (3 weeks)
Cellulose Hydrolysis and Fermentation (3 weeks)
Mixing (3 weeks)
Pilot Plant Demos (4 lectures)
  pumping, retort, aseptic processing, homogenization
Biological Safety (1-2 lectures)
Lab Notebooks, Data Analysis, Technical Presentations (2 lectures)
Bioprocess Unit Operations (3 lectures)
  bioencapsulation, bioseparation, large scale cell culture

Reading List/Textbook


Example syllabus

ABE 30400 Bioprocess Engineering Laboratory

Course learning objectives:

1. Understand and analyze the flow behavior in biological systems.
2. Understand and analyze enzymatic reactions in biological systems.
3. Understand and analyze fermentation processes.
4. Understand and analyze mixing and heat transfer in biological systems.
5. Collect and analyze rheological properties
6. Design and safely execute experiments in a process laboratory
7. Collection and statistical analysis of experimental data.
8. Present the results of analysis in the form of written report and oral presentation
Evaluation of Student Performance:

The final grades for the course will be determined by a total accumulation of points from all activities and assignments. Individual progress toward course objectives and final grades will be computed based on the following weights:

<table>
<thead>
<tr>
<th>Assignments</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Lab Notebooks</td>
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</tr>
<tr>
<td>Laboratory Performance</td>
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</tr>
<tr>
<td>Pre-labs</td>
<td>30</td>
</tr>
<tr>
<td>Lab Reports</td>
<td>40</td>
</tr>
<tr>
<td>Spontaneous Technical Oral Presentation</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
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Grading Scale:

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<th>% Range</th>
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<tr>
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<td>93-100</td>
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<tr>
<td>A-</td>
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<td>90.0-92.9</td>
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<td>B+</td>
<td>3.3</td>
<td>87.0-89.9</td>
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<tr>
<td>B</td>
<td>3.0</td>
<td>83.0-86.9</td>
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<tr>
<td>B-</td>
<td>2.7</td>
<td>80.0-82.9</td>
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<tr>
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<td>2.3</td>
<td>77.0-79.9</td>
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<td>C</td>
<td>2.0</td>
<td>73.0-76.9</td>
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<td>C-</td>
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<td>63.0-66.9</td>
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<tr>
<td>D-</td>
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<td>60.0-62.9</td>
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<tr>
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<td>&lt;60.0</td>
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</tbody>
</table>

Course Topical Outline:

Fluid Flow (3 weeks)
Rheology (3 weeks)
Cellulose Hydrolysis and Fermentation (3 weeks)
Mixing (3 weeks)
Pilot Plant Demos (4 lectures)
  pumping, retort, aseptic processing, homogenization
Biological Safety (1-2 lectures)
Lab Notebooks, Data Analysis, Technical Presentations (2 lectures)
Bioprocess Unit Operations (3 lectures)
  bioencapsulation, bioseparation, large scale cell culture
Lab Notebooks:

Every student will need to purchase a lab notebook from the bookstore. The notebook should be bound (not spiral) and with numbered pages. Carbon copies are not necessary. Lab notebooks will be checked midway through the semester for quality following the rubric distributed in class. Final completed lab notebooks will be collected and evaluated at the end of the semester.

Laboratory performance. A portion of your grade (10%) will also depend on laboratory performance including, but not limited to, any of the following:

- Arriving late to class
- Unexcused absences
- Being unprepared for the lab
- Not engaging with your lab teammates
- Leaving the laboratory before completing the exercise
- Failing to clean up after an experiment
- Violating safety regulations
- Conducting yourself unprofessionally

Pre-lab Assignments. The student groups are expected to submit a pre-lab report describing in detail the experimental plan and procedure which needs to be approved either by one of the instructors for the lab or by the TA. The student groups will NOT be allowed to do the lab experiments without this approval. Pre-lab expectations will be defined during lecture. Due dates are set in the course calendar.

Lab Reports. Each student group is expected to submit a lab report. The format for the lab report will be provided in lecture. Due dates are set in the course calendar.

Spontaneous Technical Oral Presentation. At any point during the lab, an instructor or TA will ask the group leader for a 2 minute oral summary of what they are working on. Every individual in the class will serve as a group leader at one point during the semester and will be evaluated on their ability to spontaneously and orally communicate a technical project. This exercise is meant to simulate an important situation that occurs frequently in the workplace. The specific expectations and a sample rubric will be provided in class.

Attendance. You should attend all classes. We understand that on rare occasions you may have legitimate business that conflicts with class. If you need to miss class, please inform Professor Rickus copying your TA in advance so you can arrange to submit your work early. Students who are absent are still responsible for knowing course material and getting assignments and announcements regardless of attendance. You are expected to be punctual and to stay for the entire class period. It is simply a matter of courtesy to your fellow students and us.