BCHE 4920, Spring 2013
Biochemical Engineering Capstone Design
4 Hrs (4 Design)

Professors:  
Dr. Kastner (Rm 505, Driftmier Engineering Center)  
Dr. Eiteman (Rm 408, Driftmier Engineering Center)

Time and Locations:  
Wend. 11:15 – 1:10 Rm. 305  
Wend. 3:35 – 5:30 Rm. 230

Website:  
http://www.cmbe.engr.uga.edu/bche4920/index.html

Office Hours:  
By appointment or whenever in office.

Prerequisite:  
BCHE 2910 and BCHE 3180 and permission of department

Pre or Co-requisite:  
SPCM 1100

Courses that require this course as a prerequisite:  
None

Description:  
Biochemical engineering design experience, including completion of a design project under the supervision of a project director.

Objectives:  
To provide Biochemical Engineering students with a meaningful design experience while:

1)  enhancing their critical thinking skills
2)  reinforcing the logical steps of design
3)  enhancing their understanding of engineering philosophies and procedures
4)  allowing them to synthesize knowledge gained in math, physics, computer science, chemistry, engineering, humanities and social sciences
5)  reinforcing their communication skills
6)  developing their teamwork capabilities

Text:  

Students must also purchase a design notebook from the University Bookstore and other bookstores. In the past, two varieties have been available (different in number of pages). Either one may be purchased.

Reference Texts:  

Online:  
Knovel Engineering Database – GALILEO@UGA

Online:  
Kirk-Othmer Encyclopedia of Chemical Technology  
GALILEO@UGA
Grading Scheme:

Overall Design notebooks (individual grade) 25%
Progress Reports (individual grade) 20%
Mid term status report and presentation (team grade) 10%
Final Design (team grade):
  Design solution, defining constraints, meeting engineering standards 25%
  Oral Presentation with visuals 10%
  Poster 10%

Attendance: Attendance is mandatory for all class meetings, group assessment meetings, mid-term and final presentations. Consequences for absences can include:

  1) Receiving a grade of zero on the work associated with the absence. For example, absence during a mid-term presentation will result in a zero on that assignment.
  2) Being “fired” from your group. That is, you are removed from the group to which you initially were assigned.
  3) Being dropped from the course.

Progress Reports:

  1) Individual progress reports are required from each group member following the template provided at http://www.cmbe.engr.uga.edu/bche4920/progreport%20template.docx
  2) At a minimum, progress reports are due as indicated on course calendar http://www.cmbe.engr.uga.edu/bche4920/2013/Calendar%202013.pdf
  3) Additional progress reports may be required from individuals on a case-by-case basis. That is, one student may be required to submit additional progress reports beyond those specifically scheduled.
  4) Submit program reports to both course instructors by deadline as either a Word or Adobe file (i.e., *.doc, *.docx, *.pdf) using the format: name date (e.g., file name could be Mark Eiteman 01-24-13.docx).

Design Notebooks: Each student must maintain a design notebook which records all activities completed related to your individual contribution to the design. “Activities” include notes from all meetings, notes regarding communications with stakeholders and vendors, algorithms, sketches, output from spreadsheets, sample hand calculations, relevant/condensed output from computer simulations. Your design notebook is the documentation for all that you individually have contributed to the design. Use Ink. Sign and date each entry. Also be advised:

  1) You must bring your design notebook to all course meetings and group meetings.
  2) You must submit your design notebook to the course instructors for review on 5:00 p.m. February 27, 2013.
  3) You must submit your design notebook to the course instructors for review on 5:00 pm on April 30, 2013. The design notebook will not be returned.
  4) Your design notebook is subject to review by the course instructors at any time (e.g., overnight).
Critical Components Required In Design Project:

- Meeting engineering standards
- A complete mass and energy balance
- Design basis and calculations for each unit operation
  (You and your team will be quizzed on this matter)
- A complete process flow sheet
- Process safety analysis/Pollution Control
- Capital, manufacturing, and profitability analysis

ACADEMIC HONESTY: The University of Georgia seeks to promote and ensure academic honesty and personal integrity among students and other members of the University Community. A policy on academic honesty has been developed to serve these goals. All academic work must meet the standards contained in “A Culture of Honesty.” All students are responsible to inform themselves about those standards before performing any academic work. More specific details pertaining to academic honesty may be found at the web site for The University of Georgia Office of the Vice President for Instruction (http://www.uga.edu/honesty/)

Engineering Professionalism: Engineers make great contributions to society. Engineering is a very satisfying profession that provides many rewards but is demanding and requires hard work. The engineering profession is governed by a code of ethics. Engineering faculty at the University of Georgia expect students to act in a professional manner at all times and develop the work ethics required for a successful engineering career. Engineering students at the University of Georgia are responsible for maintaining the highest standards of professionalism and professional practice.

DEPARTMENTAL GRADING POLICY REGARDING COMMUNICATION SKILLS: Thirty percent (30%) of the grade on all written assignments (lab reports and papers) and oral presentations will be based on quality of communication. Spelling, grammar, punctuation, and clarity of writing are evidence of written communication quality. Enunciation, voice projection, clarity and logical order of the presentation and effective use of visual aids are evidence of oral communication quality.

Topic Outline:

1. Introduction to Process Design
2. Defining the Project
3. Flow Sheet Preparation
4. Equipment Design
5. Economic Analysis
6. Process Simulation – SuperPro Designer
7. Process Safety/Pollution Control
**Tentative Class Schedule:** Designed for a Wednesday Class

<table>
<thead>
<tr>
<th>Outline</th>
<th>Topic</th>
<th>Reading Assignment Chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design Problem – Statement and Expectations/ Process Flowsheet/SuperPro</td>
<td>1/2</td>
</tr>
<tr>
<td>2</td>
<td>Process Flowsheet/ Energy Balances/ Plant Site Visit – Terrapin, Athens GA</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Group Project Discussion on Project/ Plant Site Visit – Rhodia Chemicals</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Group Assessment</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Batch Processing/ Flow Sheet Preparation/ Industry Presentation</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Economic Analysis/ Site Visit Merial, Athens GA</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Economic Analysis</td>
<td>6/8</td>
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<tr>
<td>8</td>
<td>Group Assessment</td>
<td></td>
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<tr>
<td>9</td>
<td>Process Safety/ Industry Presentation</td>
<td>10</td>
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<tr>
<td>10</td>
<td>Mid-Term Presentations</td>
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<tr>
<td>11</td>
<td>Group Assessment</td>
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<tr>
<td>12</td>
<td>Group Assessment</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Final Presentation/ Final Report</td>
<td>12</td>
</tr>
</tbody>
</table>

**Key Dates:**

- January 16: 3:30 – 5:30 Site Visit – Terrapin and Discussions
- February 27: 11:30 – 1:15 Mid-Term Presentations
- April 30: TBD Final Presentations

**Course Learning Objectives Matrix:**

<table>
<thead>
<tr>
<th>Course Learning Objectives: Upon Successful Completion of this Course the Student Will Be Able To:</th>
<th>Course Assessment</th>
<th>Extent of Coverage of Program Outcomes (ABET Criterion 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance critical thinking skills</td>
<td>A, E</td>
<td>c-xxx</td>
</tr>
<tr>
<td>Logical Engineering Design</td>
<td>A, B, C, D, E, G</td>
<td>c-xxx</td>
</tr>
<tr>
<td>Enhance Engineering Practice/ Method</td>
<td>B, C, D, E, G</td>
<td>c-xxx, h-xxx, i-xx, j-xx, k-xxx</td>
</tr>
<tr>
<td>Synthesize Knowledge</td>
<td>B, C, D, E, G</td>
<td>k-xxx</td>
</tr>
<tr>
<td>Enhance Communication Skills</td>
<td>A, D, E, F, G</td>
<td>f-x, g-xxx</td>
</tr>
<tr>
<td>Develop Teamwork Capabilities</td>
<td>A, B, C, D, E, G</td>
<td>d-xxx, g-xxx</td>
</tr>
</tbody>
</table>

*a Course Assessment Methods
A- Interaction and Feedback from Mentor, B- Design Notebooks, C- Progress Reports, D-Mid Term and Final Report, E- Oral Presentations, F- Poster, G- Rubrics

Extent of Coverage – Weighting Factors: $x$ – some, $xx$ – moderate, $xxx$ - extensive
ABET EC-2000 Criterion 3 Program Outcomes:

a) Ability to apply knowledge of mathematics, science, and engineering
b) Ability to design and conduct experiments, as well as to analyze and interpret data
c) Ability to design a system, component, or process to meet desired needs
d) Ability to function on multi-disciplinary teams
e) Ability to identify, formulate, and solve engineering problems (open ended problems)
f) Understanding professional and ethical responsibility
g) Ability to communicate effectively
h) Broad educational background necessary to understand the impact of engineering solutions in a global and societal context
i) Recognition of the need for, and an ability to engage in life-long learning
j) Knowledge of contemporary issues
k) Ability to use techniques, skills and modern engineering tools necessary for engineering practice

Overall Course Contribution to Program Outcomes

a) Extensive
b) Moderate (analyze and interpret data)
c) Extensive
d) Extensive
e) Extensive
f) Some
g) Extensive
h) Some
j) Some
k) Extensive