ABET Criterion 3: Outcomes Met By Course Content

This brief content assessment should be consistent with the updated Course Syllabus.

**Course #:** ENGRD/BEE2600  
**Title:** Principles of Biological Engineering

**Semester/Year:** Fall 2009  
**Instructor:** Antje Baeumner

Identify the outcomes associated with this course.

Place a “P” or “S” in the left column and leave others blank.

**P** = Primary outcome that is assessed (suggest 2-3 Primary Outcomes)

**S** = Secondary outcome that is also assessed

<table>
<thead>
<tr>
<th>P or S</th>
<th>Outcome</th>
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<tbody>
<tr>
<td><strong>P</strong></td>
<td>(a) an ability to apply knowledge of mathematics, science, and engineering</td>
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<td></td>
<td>(b) an ability to design and conduct experiments, as well as to analyze and interpret data</td>
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<td><strong>S</strong></td>
<td>(c) an ability to design a system, component, or process to meet desired needs</td>
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<td>(d) an ability to function on multi-disciplinary teams</td>
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<td>(e) an ability to identify, formulate, and solve engineering problems</td>
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<td>(f) an understanding of professional and ethical responsibility</td>
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<td><strong>P</strong></td>
<td>(g) an ability to communicate effectively</td>
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<td></td>
<td>(h) the broad education necessary to understand the impact of engineering</td>
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<td>(i) a recognition of the need for, and an ability to engage in life-long learning</td>
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<tr>
<td><strong>S</strong></td>
<td>(j) a knowledge of contemporary issues</td>
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<td><strong>P</strong></td>
<td>(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice</td>
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<td>(ℓ-b) an ability to integrate modern biology with engineering principles</td>
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COURSE OUTCOMES ASSESSMENT MATRIX

Dept & Course No.: BEE 2600, Semester: Fall 2009  Name of Instructor: Antje Baeumner

<table>
<thead>
<tr>
<th>Course Outcomes (Specific to Course)</th>
<th>ABET a-f criteria</th>
<th>How criterion is met</th>
<th>Examples of assessment</th>
<th>Assessment* Level of achievement relative to stated goal</th>
<th>Proposed Action</th>
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<tbody>
<tr>
<td>The students learned in this class how to quantitatively analyze biological systems, such as performing mass balances, the analysis of substrate, cell mass and product concentrations in a continuously stirred tank reactor, composting, enzyme kinetics and their interactions with pesticides, food sterilization. The class built on scientific and mathematical knowledge obtained in other classes, the students were taught how to set up and solve engineering problems in a life sciences background</td>
<td>Primary (a)</td>
<td>Homework problem sets were generated that had the students understand a problem, extract the important information, set up assumptions and boundary conditions and apply all of that to the solution of the problem. (examples are given in homework sets 1 – 6). Case study 1 was a team-based work in which the students had to do a formal write up about a medical disease integrated with diffusion and microbial growth studies. The students had to derive the mathematical equations required to solve the problems. Case study 2 is not team-based, and no formal write up was required. Case study 3 is also not team-based but requires a formal write up and case study 4 is again team-based dealing with an engineering design problem. In the two prelim and final exams, the students are confronted with the same type of problems as they have seen during the homework sets. All homework, case studies and exams are graded and a statistical analysis of the grades obtained by all students in class is performed. Case study one, which indicates a very high student attainment of the outcomes desired, is a good example of ABET outcomes a, g, j, and k. The grade for CS1 was 92%. Student interactive sessions were done throughout the semester in which students were working in group solving imminent problems. This helped improving their understanding of the material as reflected in good homework and case study grade. Students were willing to submit evaluations for this class to a high degree (93%). Students learned to formulate differential equations for biological systems using basic principles of</td>
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case study and exams were graded. The students’ performance was evaluated and discussed in class.

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<tr>
<th>Effective written communication was required especially in three of the four case studies where a formal write up was included</th>
<th>Primary (g)</th>
<th>Two Preliminary Examinations (75 mins)</th>
<th>Students learn to prepare technical reports to that effectively communicate the set of steps needed to solve engineering problems. This is shown in case studies #1 and #4.</th>
<th>Grade means: 92% and 85.2%</th>
<th>Goal: 90% of students should score over 70%. (Goal Met)</th>
<th>None</th>
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<tbody>
<tr>
<td>The students’ knowledge on MATLAB was refreshed which was needed to solve some homework and case study problems and a scientific literature search using peer reviewed references had to be used for their case study 4</td>
<td>Primary (k)</td>
<td>Programming assignment 5</td>
<td>Students learn to use Matlab and Excel as tools to solve problems and prepare graphical representations of solutions. In addition, students learn how to perform a scientific literature search. Homework 2 and case study #1 used MATLAB, case study #4 requires a literature search.</td>
<td>grades 92%, 92.5%, and 85.2%, respectively.</td>
<td>Goal: Student average should be over 70%. (Goal Met)</td>
<td>Improve literature competency in class by intensifying the literature search component.</td>
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<td>Contemporary issues were brought into the class by two invited guest lecturers with topics of, food safety and biosensor development</td>
<td>Secondary (j)</td>
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<td>Students were introduced to design principles</td>
<td>Secondary (c)</td>
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<td>All students earned a quiz grade above 70%; Class grade on the relevant exam problem above 80%; All students achieved a grade above XX% on a case study relevant to the stated criteria. This must be a quantitative assessment</td>
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Course Enhancement Questionnaire

As part of on-going self-assessment for ABET accreditation, instructors are asked to complete this questionnaire for each course they teach each semester. Questionnaires from previous years will be provided to new instructors when the course instructor changes.

Please return to Undergraduate Program Coordinator when grades are submitted.

Dept & Course #:  _BEE 2600_ (3 credit)________________________

Course Title:  ____Principles of Biological Engineering____

Instructor:  ____Antje Baeumner__________________________

Semester:  __Fall 2009______________________________________

Report Date: ____________________________________________

Please _briefly_ answer the following questions

1. In this offering of your course, have you made any of the following changes?

   (a) Y / N – New or updated material is being taught (if Y, please describe)

   No – only minor updates/changes were done in the section of nanobiotechnology and biosensors in order to remain more relevant and at the forefront of the field and to better introduce the topic to students.

   What motivated you to make this change? What impact has this change had on the outcomes in your course?

   Desire to remain up to date.

   What student feedback have you received in response to this change?

   None

   (b) Y / N - Different or new technology is being used (i.e. presentations, web (if Y, please describe)

   No

   What motivated you to make this change? What impact has this change had on the outcomes in your course?

   What student feedback have you received in response to this change?
2. Have you made any of the following changes to your course this term?

(a) Y / N - I have taken new steps to solicit student feedback (if Y, please describe)

(b) Y / N - I have made other changes (if Y, please describe)

I have included more student interactive sessions in the class room. While frequently questions and feedback is sought, I have increased group-based problem solving in the class room in increase active participation.

3. Are you planning changes in the course for the next time it is taught?

I am planning on increasing the intensity of the literature competency of the class. This will be implemented with the case studies and will teach students in a staged process how to become literature competent in a scientific and engineering application.

4. What is the motivation for the planned changes stated in 3? What impact(s) do you expect the changes to have on the outcomes in your course?

Feedback received for the literature requirement and information sessions was typically mediocre. While students appreciated the information sessions, they did not learn enough and could not apply it well enough in the case studies. This feedback was sought especially in personal communications with students in the class.

I will implement this in case studies #2, #3 and #4. I will use new technology to integrate this into the class room by developing web-based tutorials.

I expect that the students will learn how to do a scientific literature search, how to synthesize information and how to evaluate their source material.
Appendix A

ABET Program Outcomes

Criterion 3. Program Outcomes and Assessment
Engineering programs must demonstrate that their graduates have:

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

Additional Outcome (ℓ-b)* specific to Biological Engineering:
(ℓ-b) An ability to integrate modern biology with engineering principles

Additional outcome (ℓ-e)* specific to Environmental Engineering:
(ℓ-e) an ability to create sustainable solutions in the context of a complex natural environment

*Some courses may find it appropriate to include both outcomes (ℓ-b) and (ℓ-e)