Program Level Assessment Report for 2012-2013

PROGRAM NAME, DEGREE NAME
(e.g. Organizational Leadership, B.S.): Biomedical Engineering, B.S. _________________________

COLLEGE in which PROGRAM is housed: College of Engineering and Computer Science__________

REPORT PREPARED by: Jennifer Weaver, Assistant to the Chair____________________________

A. ACTIONS TAKEN TO IMPROVE STUDENT LEARNING

During the summer of 2012, reaccreditation of the BS Biomedical Engineering program was granted by ABET through September 30, 2018.

The final statement issued by ABET in August 2012 cited a weakness with continuous improvement. The BME faculty addressed continuous improvement with regard to achievement of student outcomes with an updated outcomes assessment schedule. The assessment schedule is a 3-year rotation for data collection, analysis and implementation of any necessary changes.

2012-2013 was the first academic year under the new semester system. Faculty remapped student outcomes to semester courses and approved all assessment items to be used in data collection. Following that, a second updated schedule for 3-year cycle for collection, analysis, and implementation of necessary changes was developed, with implementation of updated 3-year cycle to begin Fall 2013.

B. STUDENT LEARNING OUTCOMES ASSESSED AND EXAMINED

Student Learning Outcomes for the BS Biomedical Engineering degree program:

Graduates of the BS Biomedical Engineering program will possess

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 within realistic constraints
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 and scientific solutions in a global, economic, environmental 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 techniques, skills, and modern engineering tools necessary for engineering practice
During the 2012-2013 academic year, assessment data were collected for the following student outcomes in the courses indicated:

<table>
<thead>
<tr>
<th>Student Outcome</th>
<th>Fall 2012</th>
<th>Spring 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>BME 3211 Biomechanics I</td>
<td>BME 4421 Biotransport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BME 4920 Senior Design II</td>
</tr>
<tr>
<td>d</td>
<td>BME 4910 Senior Design I (annual)</td>
<td>BME 4920 Senior Design II (annual)</td>
</tr>
<tr>
<td>f</td>
<td>BME 4701 Medical Imaging</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td></td>
<td>BME 4920 Senior Design II (annual)</td>
</tr>
<tr>
<td>h</td>
<td></td>
<td>BME 4920 Senior Design II (annual)</td>
</tr>
<tr>
<td>i</td>
<td>BME 4910 Senior Design I (annual)</td>
<td></td>
</tr>
<tr>
<td>j</td>
<td>BME 4550 Bioinstrumentation</td>
<td></td>
</tr>
<tr>
<td>k</td>
<td>BME 3540 Introduction to Computation for BME</td>
<td>BME 4550 Bioinstrumentation</td>
</tr>
</tbody>
</table>

**C. METHODS FOR COLLECTING DATA**

All BME students who were enrolled in each of the courses were assessed. In addition to consideration of course content, instructional delivery, and course assignment compatibility, each course selected for assessment of student outcomes was chosen, in part, because it is required for all BME students. Over time, the three year evaluation cycle for assessment of student outcomes in required departmental courses will demonstrate consistency of student outcomes achievement for all BME students.

**D. ASSESSMENT MEASURES**

The following table shows the assessment measure used in each course:

<table>
<thead>
<tr>
<th>Student Outcome</th>
<th>Assessment Term</th>
<th>Course</th>
<th>Assessment Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>Fall 2012</td>
<td>BME 3211 Biomechanics I</td>
<td>Course project</td>
</tr>
<tr>
<td></td>
<td>Spring 2013</td>
<td>BME 4421 Biotransport</td>
<td>Homework problems</td>
</tr>
<tr>
<td></td>
<td>Spring 2013</td>
<td>BME 4920 Senior Design II</td>
<td>Team project evaluation</td>
</tr>
<tr>
<td>d</td>
<td>Fall 2012</td>
<td>BME 4910 Senior Design I (annual)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spring 2013</td>
<td>BME 4920 Senior Design II (annual)</td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>Fall 2012</td>
<td>BME 4701 Medical Imaging</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Spring 2013</td>
<td>BME 4920 Senior Design II (annual)</td>
<td>Oral presentation/final report</td>
</tr>
<tr>
<td>h</td>
<td>Spring 2013</td>
<td>BME 4920 Senior Design II (annual)</td>
<td>Final report</td>
</tr>
<tr>
<td>i</td>
<td>Fall 2012</td>
<td>BME 4910 Senior Design I (annual)</td>
<td></td>
</tr>
<tr>
<td>j</td>
<td>Fall 2012</td>
<td>BME 4550 Bioinstrumentation</td>
<td></td>
</tr>
<tr>
<td>k</td>
<td>Fall 2012</td>
<td>BME 3540 Introduction to Computation for BME</td>
<td>Homework problem</td>
</tr>
<tr>
<td></td>
<td>Fall 2012</td>
<td>BME 4550 Bioinstrumentation</td>
<td>Lab report</td>
</tr>
</tbody>
</table>

All measures were direct assessments of student work. No indirect assessment measures were used in 2012-2013.
E. SIGNIFICANT FINDINGS / F. DISCUSSION OF RESULTS / G. ACTIONS PLANNED TO IMPROVE STUDENT LEARNING

In accordance with the student outcomes assessment schedules that have been in place since summer 2012, analysis of the data collected for assessment in 2012-2013 is being completed during the 2013-2014 academic year. Results of this analysis will be discussed and shared among BME program and department faculty. In addition, the results will be reported in the 2013-2014 annual assessment report and in the next ABET self-study (2017). Any actions planned to improve student learning based on the analysis results will be implemented in the 2014-2015 academic year.

Also according to the outcomes assessment schedule, 2012-2013 would be a year of analysis for data collected in 2011-2012. However, the 2012-2013 academic year was the first year of a semester-based calendar for the BME program. Because of the significant changes to courses in the transition from quarters to semesters, any findings from analysis of data collected in 2011-2012 under the quarter calendar would not necessarily be relevant for semester courses going forward. The BME faculty elected to focus their efforts toward student outcomes achievement in semester courses rather than analyze data from quarter courses that no longer exist.

H. SUPPORTING DOCUMENTS (recommended)

Below are relevant minutes from meetings of the ABET conference committee (3), BIE Department faculty (1), and BME program committee (1), in which student outcomes assessment items for semester courses were discussed and approved.

Additionally, the student outcomes assessment schedule is also included. The schedule includes quarter course data collection from 2011-2012, the transition year 2012-2013, as well as the future semester course data collection on a 3-year cycle of data collection, analysis, and implementation of any necessary changes.

ABET Conference Committee
10/29/12

Attendees: F. Ciarallo, T. Hangartner, D. Reynolds, J. Weaver

Purpose: To coordinate outcomes assessed in common courses

Courses taken by all students in the BIE department:
- BME 3211 Human Biomechanics I
- BME 3212 Human Biomechanics II
- BME 3511 Bioelectronics I
- BME 4410 Biothermodynamics
- BME/ISE 3540 Computation for BME/ISE
- BME/ISE 4910 Senior Design I
- BME/ISE 4920 Senior Design II
- EGR 3350 Technical Communications for Engineers
  - Need to find out what is assessed in this course
  - Students who have taken ENG 102 are opting out of this course. Won’t have a full pool of students taking this course for a few years.

The faculty agreed that cross listing the following BME courses as ISE courses would make including outcomes assessments from the courses more appealing for ISE, since heavy assessment in BME courses for ISE students may not be favorable to an ISE evaluator:
- BME 3211, BME 3212, BME 3511, BME 3512 (3512 not required for ISE students, however, it is an option for them and makes more sense to cross list both courses in a sequence).
The faculty agreed that 4 data points per outcome with 2 assessment cycles between ABET visits for a total of 8 data points over 6 years would be a good idea. Each outcome would be assessed two times per course, and in 2 courses per semester when it comes up in the cycle for assessment.

Dr. Ciarallo has an optimization program that can minimize the changes to the cycle already agreed upon by the faculty and reported to ABET. Dr. Ciarallo has asked for all possible assessments for each of the ISE courses from faculty. Dr. Reynolds will do the same for BME.

BME/ISE 4920 relies on project reports, rather than specific writing assignments, so should not be used to assess outcome i (life-long learning) or j (contemporary issues).

Outcomes will be assessed in Fall 2012 as already scheduled. Spring 2013 moving forward is still to be determined, based on results of Dr. Ciarallo’s optimization program.

Faculty members (rather than TAs) should be grading work that assesses student outcomes, for consistency’s sake.

BME Senior design assessment of outcome g (communicate effectively):
- Fall-written proposal
- Spring-midterm oral presentation
- Spring-final written presentation
- Spring-final oral presentation

The faculty agreed that outcomes d (multi-disciplinary teams), g (communicate effectively), and h (broad education to understand impact of engineering solutions) will be assessed in senior design, yearly, during spring semester.

**ABET Conference Committee**

**11/15/12**

Attendees: F. Ciarallo, T. Hangartner, D. Reynolds, J. Weaver

Dr. Ciarallo ran a program for optimal selection of courses for outcomes assessment (see accompanying spreadsheets).
- 24 letter/course combinations
- Spreadsheets were reviewed by the committee
- Added f to BME 4701; need an ISE counterpart (keep in sr design for now)
- j: add to 4910; remove from 4920
- c: possibly remove from BME 4410
- Goal: 2-4 data points for each outcome
- Check with Dr. Kashou regarding outcome i (something he already has in the course to assess?)
- EGR 3350: Dr. Finkelstein will provide data to departments for any outcomes assessed in the course
- BME only assessments:
  - b: BME 3512;
  - c: BME 4421
  - f: BME 4701;
  - j: BME 4550
- ISE only assessments:
  - b: ISE 2212;
  - j: ISE 1110 (can also be used for traditional BMEs)
  - need to find an f in one course
  - need to add the best c of ISE 4711 or ISE 4310
- Common course assessments:
  - a: ISE 2211, BME 3511
Dr. Ciarallo will rerun the program with the changes discussed.

Next meeting: Thursday, December 6, 10 a.m.

**ABET Conference Committee**

12/6/12

Attendees: F. Ciarallo, T. Hangartner, D. Reynolds, J. Weaver

Review of updates to new outcomes assessment schedule

- **Outcome f:**
  - ISE needs to add an item
  - Discussion of possibilities for using a portion of the CITTI training as a graded item in ISE 4320
  - To be assessed in ISE 4320, BME 4701, BME/ISE 4910

- **Outcome k:**
  - Dr. Ciarallo added k to ISE 2212 assessment because of the JMP tool.

- **Outcome c:**
  - Removed from BME 4410

- **Outcome j:**
  - To be assessed in BME 4550, ISE 1110, BME/ISE 4910

- **Common courses:**
  - Outcome f to be assessed in 4910 (not 4920).
  - Outcome i to be assessed in 4910 and (3540 OR 3511).
  - Have instructors (Kender, Kashou) bring their “i” questions to a faculty meeting so one can be decided on by the faculty for inclusion in the schedule.

- Jen will create the updated table and send to faculty.
  - Instructors of courses containing assessment items will send detailed descriptions of their two questions/items to Jen to be compiled for a designated faculty meeting for evaluation/approval.

**BIE Faculty Meeting**

March 4, 2013

**Faculty Present**
C. Cao, F. Ciarallo, M. Fendley, S. Ganapathy, T. Goswami, T. Hangartner, P. He, N. Kashou, D. Kender, D. Reynolds, J. Tritschler

**Staff Present**
J. Weaver
Dr. Hangartner called the meeting to order at 11:15 a.m.

Special meeting called specifically to review ABET student outcomes assessment items to be used in BME/ISE common courses
- Identical or similar or questions should be used for outcomes assessments in years to come.

Outcome a: ISE 2211, D. Kender
- Keep all three questions, but eliminate item d from Question 1 (too tricky).

Outcome a: BME/ISE 3511, D. Kender
- Keep Questions 1 and 2
- Drop transformer question
- D. Kender will revise and give to Jen

Outcome b: BME/ISE 3540, N. Kashou
- Includes rubric
- Needs to recalculate using the 85% benchmark
- Make question 2 self-standing
- Concern that it's not a good question to assess outcome b. As is, the question better assesses outcome a, c, or k
  - Remove from outcome b assessment in common courses.
- Can assess outcome b in:
  - ISE 2211 per DK
  - ISE 3511 per DK
  - BME 4550 per PH
  - ISE 4300 per CC

Outcome c: BME/ISE 3211, T. Goswami
- Separate BME and ISE (crosslist not done yet as of F12)
- Assessment item not reviewed in meeting

Outcome d: BME/ISE 4910, F. Ciarallo
- Paper assignment
- Doesn’t address the “function” part

Outcome d: BME ISE 4920, P. He
- Team evaluation is used (does not include presentation)

Outcome e: ISE 2211, D. Kender
- Approved 3 questions, as presented

Outcome e: BME 4410, D. Reynolds
- Midterm, 3questions: Q1 and Q2 ok; Q3: more of a math question—will be removed
- Final, 4 questions: Q1 ok; Q2, Q3, Q4 not chosen

Outcome f: BME/ISE 4910, F. Ciarallo
- Discussion thread (I-35W bridge collapse, for example)
- Rubric still to be developed
- Dr. Ciarallo may change Q to add “please refer to code of ethics?"

Outcome g: BME/ISE 4910 F. Ciarallo
- Written documents—design proposal
- Separate grade for content delivery—faculty to create a unified rubric

Outcome g: BME/ISE 4920, P. He
- Final report
- Oral presentation

Outcome h: BME/ISE 3211, T. Goswami
- Dr. Goswami developing assessment items for this outcome

Outcome h: BME/ISE 4920, P. He
- From syllabus: 7c

Outcome i: BME/ISE 4910, F. Ciarallo
- Paper—How will you focus your efforts in life-long learning over the next 5-10 years?
- Rubric included with assignment

Outcome j: BME/ISE 4910, F. Ciarallo
- Paper assignment

Outcome k: BME/ISE 3212, T. Goswami
• Dr. Goswami developing assessment items for this outcome

**BME 3540 will assess outcome k**, not outcome b (can use same assessment item—not necessary to create a new one).

**Outcome c: BME/ISE 4920, P. He**
- Because applicable, but not to be used officially for ABET
- Final product evaluation rubric—different rubrics for BME and ISE

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**BME Program Committee**

_**March 18, 2013, partial minutes**_

**ABET Student Outcomes**

**Outcome b**
- BME 3512: Kender
- BME 4550: He—will bring to next meeting
- At least one needs to include a design component

**Outcome c**
- BME 4421: Reynolds; approved at the last meeting, will bring rubric to the next meeting

**Outcome f**
- BME 4701: Hangartner; presented at previous meeting

**Outcome j**
- BME 4550: He; item presented previously, will bring rubric to next meeting

_for outcomes assessment, use rubrics to grade, but only final grades are required_

Spring 2013 data collection needs were distributed.

*Dr. Hangartner stated that if the outcome is not listed on the new assessment table, collection is not necessary.*

**Outcome h**
- BME 3211: Goswami; will bring to next department meeting

**Outcome k**
- BME 3212: Goswami; will bring to next department meeting

**Outcome i**
- BME 3511: Kender; needs help with what to include in class for this item. ISE program committee discussed having students attend a function of IEEE or another professional organization.
## Optimized data collection map (approved Spring 2013)

<table>
<thead>
<tr>
<th></th>
<th>Fall</th>
<th>Spring</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BME</td>
<td>BME/ISE</td>
<td>ISE</td>
<td>BME</td>
</tr>
<tr>
<td>a</td>
<td></td>
<td>ISE 2211</td>
<td>BME/ISE 3511</td>
<td>ISE 2211</td>
</tr>
<tr>
<td>b</td>
<td>BME</td>
<td>4550</td>
<td>ISE 4300</td>
<td>BME/ISE 3512</td>
</tr>
<tr>
<td>c</td>
<td>BME</td>
<td>ISE 3211</td>
<td>ISE 4310</td>
<td>BME 4421</td>
</tr>
<tr>
<td>d</td>
<td>BME</td>
<td>ISE 4910</td>
<td>BME/ISE 4920</td>
<td></td>
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<tr>
<td>e</td>
<td></td>
<td>ISE 2211</td>
<td>BME 4410</td>
<td>ISE 2211</td>
</tr>
<tr>
<td>f</td>
<td>BME</td>
<td>4701</td>
<td>BME/ISE 4910</td>
<td>ISE 4320</td>
</tr>
<tr>
<td>g</td>
<td>BME</td>
<td>ISE 4910</td>
<td>BME/ISE 4920</td>
<td></td>
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<tr>
<td>h</td>
<td>BME</td>
<td>4410</td>
<td>BME/ISE 4920</td>
<td></td>
</tr>
<tr>
<td>i*</td>
<td>BME</td>
<td>ISE 4910</td>
<td>BME 3530*</td>
<td>ISE 4810</td>
</tr>
<tr>
<td>j</td>
<td>BME</td>
<td>4550</td>
<td>BME/ISE 4910</td>
<td>ISE 1110</td>
</tr>
<tr>
<td>k</td>
<td>BME</td>
<td>ISE 3540</td>
<td>BME/ISE 3212</td>
<td></td>
</tr>
</tbody>
</table>

*Outcome I can be placed in any course (draft suggestions are BME 3530 and ISE 4810 because they are not scheduled for any other assessment)

|          |          |          |          |          |          |          |          |          |          |          |

BME and ISE kept separate assessment schedules during Years 1 and 2, and so are listed separately, even if course was crosslisted.

**Bold BLACK** = data collected

**Red strikethrough** = data on 30-day response schedule, but not necessary because not on new optimized schedule
## Data collection schedule based on optimized map

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>F13</td>
<td>F14</td>
<td>F15</td>
<td>F16</td>
</tr>
<tr>
<td>B/I 3511 (DK)</td>
<td>ISE 2211 (DK)</td>
<td>Analyze</td>
<td>Implement necessary changes</td>
</tr>
<tr>
<td>B/I 3511 (DK)</td>
<td>ISE 2212 (DK?)</td>
<td>ISE 4300 (CC)</td>
<td>Analyze</td>
</tr>
<tr>
<td>B/I 3511 (DK)</td>
<td>B/I 3512 (DK)</td>
<td>Implement necessary changes</td>
<td></td>
</tr>
<tr>
<td>B/I 4910 (CP)</td>
<td>B/I 4920 (TH)</td>
<td>Implement necessary changes</td>
<td></td>
</tr>
<tr>
<td>B/I 4910 (CP)</td>
<td>B/I 4920 (TH)</td>
<td>Analyze</td>
<td>Implement necessary changes</td>
</tr>
<tr>
<td>B/I 4910 (CP)</td>
<td>B/I 4920 (TH)</td>
<td>B/I 3211 (TG)</td>
<td>BME 4421 (DR)</td>
</tr>
<tr>
<td>B/I 4910 (CP)</td>
<td>B/I 4920 (TH)</td>
<td>ISE 4310 (GB)</td>
<td>Analyze</td>
</tr>
<tr>
<td>B/I 4910 (CP)</td>
<td>B/I 4920 (TH)</td>
<td>Analyze</td>
<td>Implement necessary changes</td>
</tr>
<tr>
<td>B/I 4910 (CP)</td>
<td>B/I 4920 (TH)</td>
<td>B/I 3211 (TG)</td>
<td>BME 4421 (DR)</td>
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<tr>
<td>B/I 3540 (NK)</td>
<td>B/I 3212 (TG)</td>
<td>Analyze</td>
<td>Implement necessary changes</td>
</tr>
</tbody>
</table>