2012-2013 Assessment Report  
Program: Electrical Engineering, BEE

Samuel Ginn College of Engineering  
Electrical & Computer Engineering  
Electrical Engineering, BEE

Expected Outcome 1: Breadth  
By the time of graduation from the program, graduates of the Electrical Engineering (ELEC) Program will have achieved and demonstrated an ability to apply knowledge of mathematics, basic science, and engineering to solve problems encompassing the seven fundamental areas of electrical engineering (circuits and systems, electronics, digital systems, electromagnetics, communications and signal processing, control systems, and power engineering.)

Assessment Method 1: Course Data Collection  
Assessment Method Description  
Data is collected typically from final exam questions in junior and senior level courses taught in fall semesters. Particular courses are assessed every other year. A rubric is employed that features three performance indicators to determine how well the student understands the problem (“PI1: Understands Problem”), if the correct solution approach is chosen (“PI2: approach”), and if student is able to implement the solution approach (“PI3: execution”). A 4 point scale is used for each performance indicator on the rubric where scores of 1, 2, 3, 4 correspond to unsatisfactory, developing, meets expectations, and exceeds expectations, respectively. The preliminary assessment is carried out by the course instructor. The data is evaluated by the department’s Curriculum and Assessment Committee.  
Primary success metric: at least 70% of students rate scores of at least a 3 on each PI.  
Secondary success metric: no more than 10% of students rate below a 2 on each PI.  
The Fall 2012 assessment for the breadth outcome was carried out for ELEC students in the following courses: ELEC 3320, ELEC 3400, and ELEC 3700.
Findings
The primary success metric was met on all performance indicators for ELEC students in courses ELEC 3320 and ELEC 3400. In ELEC 3700, the primary success metric for PI1 was achieved by 89% of the students, but PI2 and PI3 had 69% and 61%, below the 70% target. As expected, most students had a good understanding of the problem but sometimes used the wrong solution approach or had difficulty executing the approach.

How did you use findings for improvement?
Most of the problems students had involved choosing the proper approach to solve the problem and then successfully carrying out the solution approach. Mostly these problems are course specific, and instructors are informed of the results so they can improve how the material is taught. It has been noted, however, that a better grasp of material in one of the earlier courses, ELEC 2120 Linear Signals and Systems, would enhance our students’ ability to solve problems. The department’s Curriculum and Assessment Committee is recommending that a one-hour lab be added to the ELEC 2120 course.

Additional Comments
The department’s Curriculum and Assessment Committee is revising how the assessment results are reported in an effort to provide more meaningful information and improve consistency across all courses and academic majors. The secondary success metric is seen to be of little use and will be discontinued. A better form for collecting performance indicator data for each assessed student in each assessed class has been prepared for future assessments so that data can be compared across courses and compared year by year.

Assessment Method 2: Senior Exit Survey
Assessment Method Description
Survey of graduating seniors; Provides quantifiable data with respect to student satisfaction with their preparation to attain outcomes. Students were asked how well they believed they achieved the Breadth Outcome, stated above. The rating scale was 5 (excellent), 4 (very good), 3 (good), 2 (fair), and 1 (poor).

Findings
Combining the Fall 2012, Spring 2013, and Summer 2013 surveys, there were responses from a total of 47 graduating seniors. Of these 47, 31 were in the Electrical Engineering program, 9 were in the
Electrical Engineering (with Computer Option) program, 3 were in the Wireless program, and 4 were in dual major or degree programs. The aggregate scores for the Breadth Outcome question from these 47 students are as follows:
5 (excellent): 17 students (36%)
4 (very good): 21 students (45%)
3 (good): 8 students (17%)
2 (fair): 1 student (2%)
1 (poor): 0 students (0%)
The overwhelming majority of our graduates believe they have achieved the breadth outcome.

How did you use findings for improvement?
The department’s Curriculum and Assessment Committee reviewed the survey results for the Breadth outcome and determined that the outcome has been successfully met.

Additional Comments
Presently, the survey instrument combines results for the various undergraduate programs in the Department of Electrical & Computer Engineering. The committee believes that the survey is most effective as a “flag” for poor performance and that the present aggregate data from our closely related programs is both useful and adequate. However, we will modify the survey instrument to allow breaking out results by program.

Expected Outcome 2: Communication
By the time of graduation from the program, graduates of the Electrical Engineering (ELEC) Program will have achieved and demonstrated proficiency in communicating ideas and information orally and in writing.

Assessment Method 1: Course Data Collection
Assessment Method Description
Communication exercises have been integrated into a number of key ELEC courses in the curriculum. All core laboratory courses have technical writing components, leading up to the final lab course, ELEC 3040, and the senior design course ELEC 4000, in which written and oral communications are significant components of the design experience. Students receive feedback and recommendations for
improvements from the faculty at all stages of these activities. Many upper level courses also have term projects that require written and/or oral reports.

A writing rubric is employed which features 6 performance indicators (PI): PI1 - Content, PI2 - Organization, PI3 - Style, PI4 - Grammar, PI5 - Figures/Tables, PI6 - Use of sources. An oral presentation rubric is employed which features 5 performance indicators: PI1 - elocution, PI2 - enthusiasm, PI3 - eye contact, PI4 - visual aids, PI5 - content. A 4 point scale is used for each performance indicator on the rubric where scores of 1, 2, 3, 4 correspond to unsatisfactory, developing, meets expectations, and exceeds expectations, respectively. The preliminary assessment is carried out by the course instructor. The data is evaluated by the department’s Curriculum and Assessment Committee.

Primary success metric: at least 70% of students rate scores of at least a 3 on each PI.
Secondary success metric: no more than 10% of students rate below a 2 on each PI.

The Fall 2012 assessment of communication ability was assessed in two sections of ELEC 4000, with 21 ELEC students.

**Findings**

**Writing Rubric Data Summary: 21 Students**

<table>
<thead>
<tr>
<th>PI</th>
<th>≥ 3</th>
<th>&lt; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI1: Content</td>
<td>86%</td>
<td>0</td>
</tr>
<tr>
<td>PI2: Organization</td>
<td>86%</td>
<td>0</td>
</tr>
<tr>
<td>PI3: Style</td>
<td>86%</td>
<td>0</td>
</tr>
<tr>
<td>PI4: Grammar</td>
<td>100%</td>
<td>0</td>
</tr>
<tr>
<td>PI5: Figures/Tables</td>
<td>77%</td>
<td>5%</td>
</tr>
<tr>
<td>PI6: Use of sources.</td>
<td>14%</td>
<td>45%</td>
</tr>
</tbody>
</table>

The primary and secondary success metrics for written communication were met for all performance indicators except for PI6: Use of sources. The worst offenders left out references entirely or failed to refer to references in the report.

**Oral Rubric Data Summary: 21 Students**

<table>
<thead>
<tr>
<th>PI</th>
<th>≥ 3</th>
<th>&lt; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI1: Elocution</td>
<td>86%</td>
<td>0</td>
</tr>
<tr>
<td>PI2: Enthusiasm</td>
<td>91%</td>
<td>0</td>
</tr>
</tbody>
</table>
PI3: Eye Contact 86% 0
PI4: Visual Aids 100% 0
PI5: Content 100% 0

All primary and secondary success metrics were met for oral presentations.

**How did you use findings for improvement?**
The department’s Curriculum and Assessment Committee has reviewed the assessment and notes the following:

The amount of writing our students do is significant, and the quality is generally quite good. The relatively poor performance on use of references is being fed back to all electrical & computer engineering instructors who require written reports.

Presentation skills are generally very good, perhaps owing to the experience our students gained in making presentations in the junior level labs. No action is recommended.

**Additional Comments**
The department’s Curriculum and Assessment Committee is revising how the assessment results are reported in an effort to provide more meaningful information and improve consistency across all courses and academic majors. The secondary success metric is seen to be of little use and will be discontinued. A better form for collecting performance indicator data for each assessed student in each assessed class has been prepared for future assessments so that data can be compared across courses and compared year by year.

**Assessment Method 2: Senior Exit Survey**

**Assessment Method Description**
Survey of graduating seniors; Provides quantifiable data with respect to student satisfaction with their preparation to attain outcomes. Students were asked how well they believed they achieved the Communications Outcome, stated above. The rating scale was 5 (excellent), 4 (very good), 3 (good), 2 (fair), and 1 (poor).

**Findings**
Communication exercises have been integrated into a number of key ELEC courses in the curriculum. All core laboratory courses have technical writing components, leading up to the final lab course, ELEC 3040, and the senior design course ELEC 4000, in which written and
oral communications are significant components of the design experience. Students receive feedback and recommendations for improvements from the faculty at all stages of these activities. Many upper level courses also have term projects that require written and/or oral reports.

Combining the Fall 2012, Spring 2013, and Summer 2013 surveys, there were responses from a total of 46 graduating seniors. Of these 46, 30 were in the Electrical Engineering program, 9 were in the Electrical Engineering (with Computer Option) program, 3 were in the Wireless program, and 4 were in dual major or degree programs. The aggregate scores for the Communications Outcome question from these 46 students are as follows:

- 5 (excellent): 15 students (33%)
- 4 (very good): 20 students (43%)
- 3 (good): 10 students (22%)
- 2 (fair): 1 students (2%)
- 1 (poor): 0 students (0%)

**How did you use findings for improvement?**
The department provides its students with many opportunities to practice their oral and written communications skills. Almost all (98%) of the students believe they have been taught good or better skills. At this time the department’s Curriculum and Assessment Committee feels no action need be taken.

**Additional Comments**
Presently, the survey instrument combines results for the various undergraduate programs in the Department of Electrical & Computer Engineering. The committee believes that the survey is most effective as a "flag" for poor performance and that the present aggregate data from our closely related programs is both useful and adequate. However, we will modify the survey instrument to allow breaking out results by program.

**Expected Outcome 3: Design**
By the time of graduation from the program, graduates of the Electrical Engineering (ELEC) Program will have achieved and demonstrated an ability to design and analyze a component or system to meet desired needs within the field of electrical engineering.
Assessment Method 1: Course Data Collection

Assessment Method Description

We assessed design on the final project report for the Fall 2012 offering of ELEC 3040 lab. A rubric is employed that features five performance indicators (PI): PI1 - Use knowledge, methods, processes and tools to create a design that meets stated requirements. PI2 - Evaluate if a design meets desired needs. PI3 - Consider realistic constraints in the design. PI4 - Testing of the final design. PI5 - Constructing a prototype of the design. A 4 point scale is used for each performance indicator on the rubric where scores of 1, 2, 3, 4 correspond to unsatisfactory, developing, meets expectations, and exceeds expectations, respectively. The preliminary assessment is carried out by the course instructor. The data is evaluated by the department’s Curriculum and Assessment Committee.

Primary success metric: at least 70% of students rate scores of at least a 3.
Secondary success metric: no more than 10% of students rate below a 2.

Findings

Summary of data: \[ \begin{array}{ccc} \text{PI1: Use knowledge} & 75\% & 0\% \\ \text{PI2: Desired needs} & 72\% & 0\% \\ \text{PI3: realistic constraints} & 94\% & 0\% \\ \text{PI4: test final design} & 75\% & 0\% \\ \text{PI5: prototype} & 94\% & 0\% \\ \end{array} \]

How did you use findings for improvement?

Although the students met the success metrics on all performance indicators, the department’s Curriculum and Assessment Committee would like to see better performance on indicators 1, 2, and 4. The assessment results are fed back to the course instructors for use in improving course content and addressing shortcomings.

Presently, students in electrical and computer engineering practice design in the labs ELEC 3040 (for ELEC students), ELEC 3050 (for ECPE students) and ELEC 3060 (for WIRE students). These labs serve as the prerequisite for a more rigorous design experience in ELEC 4000 Senior Design Project. At present, the department’s Curriculum and Assessment Committee assesses the labs 3040/3050/3060 in the fall of even numbered years, and assesses ELEC 4000 in the fall of odd numbered years.
Additional Comments
The department’s Curriculum and Assessment Committee is revising how the assessment results are reported in an effort to provide more meaningful information and improve consistency across all courses and academic majors. The secondary success metric is seen to be of little use and will be discontinued. A better form for collecting performance indicator data for each assessed student in each assessed class has been prepared for future assessments so that data can be compared across courses and compared year by year.

Assessment Method 2: Senior Exit Survey
Assessment Method Description
Survey of graduating seniors; Provides quantifiable data with respect to student satisfaction with their preparation to attain outcomes. Students were asked how well they believed they achieved the Design Outcome, stated above. The rating scale was 5 (excellent), 4 (very good), 3 (good), 2 (fair), and 1 (poor).

Findings
Combining the Fall 2012, Spring 2013, and Summer 2013 surveys, there were responses from a total of 47 graduating seniors. Of these 47, 31 were in the Electrical Engineering program, 9 were in the Electrical Engineering (with Computer Option) program, 3 were in the Wireless program, and 4 were in dual major or degree programs. The aggregate scores for the Design Outcome question from these 47 students are as follows:
5 (excellent): 14 students (30%)
4 (very good): 17 students (36%)
3 (good): 11 students (23.4%)
2 (fair): 2 students (4.3%)
1 (poor): 2 students (4.3%)

How did you use findings for improvement?
Students tend to rate their abilities fairly high. However, for this Design Outcome assessment the scoring is lower relative to some of the other items assessed. This indicates a degree of unease in the students’ perceived ability to perform design tasks.

The department’s Curriculum and Assessment Committee provides these assessment results to the faculty and encourages them to craft better design opportunities for our students wherever possible.
Additional Comments
Presently, the survey instrument combines results for the various undergraduate programs in the Department of Electrical & Computer Engineering. The committee believes that the survey is most effective as a “flag” for poor performance and that the present aggregate data from our closely related programs is both useful and adequate. However, we will modify the survey instrument to allow breaking out results by program.

Expected Outcome 4: Teamwork
By the time of graduation from the program, graduates of the Electrical Engineering (ELEC) Program will have achieved and demonstrated an ability to function as a member of a multidisciplinary team in the solution of engineering problems.

Assessment Method 1: Course Data Collection
Assessment Method Description
Teamwork is introduced in the freshman year, and then emphasized throughout the curriculum by requiring team projects in several courses, building up to a significant multidisciplinary teamwork experience in the senior projects course. Thus, the primary collection of assessment data for teamwork comes from senior design projects. A teamwork rubric is employed which features 8 performance indicators (PI): PI1 - Research and gather information, PI2 - Fulfill team role’s duties, PI3 - Share in the work of the team, PI4 - Listen to other teammates, PI5 - Cooperate with teammates, PI6 - Make fair decisions, PI7 - Receptive to feedback, PI8 - Express alternate points of view. A 4 point scales is used for each performance indicator on the rubric where scores of 1, 2, 3, 4 correspond to unsatisfactory, developing, meets expectations, and exceeds expectations, respectively. The preliminary assessment is carried out by the course instructor. The data is evaluated by the department’s Curriculum and Assessment Committee.
Primary success metric: at least 70% of students rate scores of at least a 3 on each PI.
Secondary success metric: no more than 10% of students rate below a 2 on each PI.
The Fall 2012 assessment for the teamwork outcome was carried out for 12 students in the Senior Design Projects course, ELEC 4000. Assessment results were not broken out by major, since it was clear
that the primary success metric was met by all majors, with very few low scores. Students for each program were 5 ELEC, 3 ECPE, 3 WIRE and 1 dual major (ELEC/WIRE).

**Findings**
93% of the scores were 3’s and 4’s, with more 4’s than 3’s, and only a few isolated cases of 1 and 2 scores. Overall, there were only 7 instances of 1 scores, with most of these between two students, indicating a possible personality conflict. There were only 18 total instances of 2 scores (less than 5% of all scores), mostly for PI8 (expresses alternate viewpoints), and PI7 (receptive to feedback.) All success metrics were met for all performance indicators.

In general, good teamwork was observed for these three teams this semester, more so than for some teams observed in previous semesters. It appeared that all team members made significant contributions to each project.

**How did you use findings for improvement?**
The department makes a strong effort to develop teamwork skills for our students. Based on this and other assessment activities, the department’s Curriculum and Assessment Committee sees no need for action on this outcome at this time.

**Additional Comments**
The department’s Curriculum and Assessment Committee is revising how the assessment results are reported in an effort to provide more meaningful information and improve consistency across all courses and academic majors. The secondary success metric is seen to be of little use and will be discontinued. A better form for collecting performance indicator data for each assessed student in each assessed class has been prepared for future assessments so that data can be compared across courses and compared year by year.

**Assessment Method 2: Senior Exit Survey**

**Assessment Method Description**
Survey of graduating seniors; Provides quantifiable data with respect to student satisfaction with their preparation to attain outcomes. Students were asked how well they believed they achieved the Teamwork Outcome, stated above. The rating scale was 5 (excellent), 4 (very good), 3 (good), 2 (fair), and 1 (poor).
Findings
Teamwork is introduced in the freshman year, and then emphasized throughout the curriculum by requiring team projects in several courses, building up to a significant multidisciplinary teamwork experience in the senior projects course.

Combining the Fall 2012, Spring 2013, and Summer 2013 surveys, there were responses from a total of 46 graduating seniors. Of these 46, 30 were in the Electrical Engineering program, 9 were in the Electrical Engineering (with Computer Option) program, 3 were in the Wireless program, and 4 were in dual major or degree programs. The aggregate scores for the Teamwork Outcome question from these 46 students are as follows:
5 (excellent): 24 students (52%)
4 (very good): 16 students (35%)
3 (good): 3 students (6.4%)
2 (fair): 2 students (4.3%)
1 (poor): 2 students (4.3%)

How did you use findings for improvement?
The department’s Curriculum and Assessment Committee believes the department provides many teaming opportunities for its students. The students appear to agree, with 87% ranking their abilities as good or excellent. At this time the committee feels no action need be taken.

Additional Comments
Presently, the survey instrument combines results for the various undergraduate programs in the Department of Electrical & Computer Engineering. The committee believes that the survey is most effective as a “flag” for poor performance and that the present aggregate data from our closely related programs is both useful and adequate. However, we will modify the survey instrument to allow breaking out results by program.