

Electrical Engineering - BSE 2016 - 2017 Assessment Plan

Currently status is: Accepted
Change Plan Status

I. ANNUAL REPORT FOR YEARS 2015 - 2016

Mission Statement

The mission of the BSE Program in Electrical Engineering is to produce graduates who will:

- contribute to the economic development of this state and the nation by the competent and ethical practice of electrical engineering.
- be sought after by leading industrial, governmental, and academic organizations.
- exhibit leadership qualities in their organizations by virtue of their excellent technical abilities, communication skills, and comprehensive vision.
- use their technical competence in electrical engineering to creatively solve problems for the betterment of society.
- ceaselessly improve their technical competence

Overview

The BSE program in Electrical Engineering is accredited by the Accreditation Board for Engineering and Technology. ABET requires each program to define Program Educational Objectives (which are used above to describe the program Mission) and to produce eleven Student Outcomes, colloquially known as “the A through K outcomes”. These eleven outcomes have been grouped into three larger “Goals” in order to align with USC’s own assessment processes, as shown in Table 1.

Table 1: Mapping of ABET Student Outcomes into USC Program Goals and Program Outcomes

USC Program Goals	ABET Student Outcomes = USC Program Outcomes
Goal 1: Broad education	ABET H: the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context ABET A: an ability to apply knowledge of mathematics, science, and engineering ABET B: an ability to design and conduct experiments, as well as to analyze and interpret data
Goal 2: Engineering skills - broad and deep	ABET C: 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 ABET E: an ability to identify, formulate, and solve engineering problems ABET J: a knowledge of contemporary issues (relevant to electrical engineering) ABET K: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
Goal 3: Professional skills	ABET D: an ability to function on multidisciplinary teams ABET F: an understanding of professional and ethical responsibility ABET G: an ability to communicate effectively ABET I: a recognition of the need for, and an ability to engage in life-long learning

Goal 1.

The first goal of the academic program is to imbue in the graduate a broad education that establishes competencies in the arts, humanities, foreign languages, sciences, and mathematics and that fosters an appreciation of the role of the engineer in society and the world-awareness that is necessary to the practice of engineering in a global economy. This goal contributes to the achievement of the ABET Outcome H.

Curriculum

The Carolina Core is largely responsible for producing this outcome. Carolina Core Learning Outcomes to be met at foundational level of mastery are as follows:

- Aesthetic and Interpretive Understanding: Create or interpret literary, visual or performing arts
- Analytical Reasoning and Problem Solving: Apply the methods of mathematical, statistical, or analytical reasoning to critically evaluate data, solve problems, and effectively communicate findings verbally and graphically.
- Effective, Engaged, and Persuasive Communication: Identify and analyze issues, develop logical and persuasive arguments, and communicate ideas clearly for a variety of audiences and purposes through writing and speaking.
- Global Citizenship and Multicultural Understanding:
 - Use the principles of the social sciences to explore diverse cultural identities and to analyze political and environmental issues.

- o Use the principles of historical thinking to assess the relationships between modern societies and their historical roots.
- o Communicate effectively in more than one language.
- o Scientific Literacy: Apply the principles and language of the natural sciences and associated technologies to historical and contemporary issues.
- o Information Literacy: Collect, manage and evaluate information using technology, and communicate findings.
- o Values, Ethics, and Social Responsibility: Examine different kinds of social and personal values, analyzing the ways in which these are manifested in communities as well as individual lives

Learning Outcome 1.

ABET Outcome H – Students will demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Measures and Criteria

Measures are defined as “internal” or “external” depending on whether the raw data is produced and owned by the program faculty or by another campus entity.

1. The external measure is the fraction of students in the immediate past graduating class who earned at least a C in every one of their Carolina Core courses. Success: More than 90% of students had no grade less than C in any Carolina Core course.
2. The internal measure is the fraction of students who demonstrated competent or better performance when given an assignment to evaluate the impact of a modern electrical engineering technology on humanity, in a junior-level electrical engineering class. Success: More than 70% of students score competent or better.

Methods

1. Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.
2. We will examine the transcripts of the most-recent spring-semester graduating class and count the number of students who made any grade less than C in any course that produced credit for a Carolina Core outcome and compute using the attached formula.
3. A student assignment in ELCT 361 requires a written assessment of the impact of a relevant technology on humanity. The assignment is evaluated by the course instructor according to Rubric H, student performance is recorded in Blackboard, and the Rubric Report is generated by an administrative staff member.

Carolina Core Formula

Rubric H

Results

The result of Goal 1, Learning Outcome 1 (ABET Outcome H) came from two measurements: "external" and "internal".

1. The external measure is the fraction of students in the immediate past graduating class who earned at least a C in every one of their Carolina Core courses and we consider the Outcome to be achieved if more than 90% of students had no grade less than C in any Carolina Core course. Please see attached formula. The most recent measurement, for the Spring 2016 graduating class showed that **100%** of the students earned C or better in every one of their CC courses, thus the success criterion was met.
2. The internal measure is the fraction of students who demonstrated competent or better performance when given an assignment to evaluate the impact of a modern electrical engineering technology on humanity, in a junior-level electrical engineering class. Success is defined as more than 70% of students scoring competent or better. **83%** of students scored competent or better in the latest measurement, thus the success criterion was met.

Detailed result is shown in the attached report.

Outcome H Report

Use of Results

No action required.

Goal 2.

The second goal of the academic program is to imbue in the graduate engineering skills that are both broad in the basics and deep within a specific field so as to support a declared career plan. This goal contributes to the achievement of ABET Outcomes A, B, C, E, J, and K.

Curriculum

Breadth of EE skills are taught in the introductory courses – ELCT 102 (Electrical Science), ELCT 221 (Circuits), ELCT 222 (Signals and Systems), and in the core courses – ELCT 321 (Digital Signal Processing), ELCT 331 (Control Systems), ELCT 361 (Electromagnetics), ELCT 363 (Microelectronics), ELCT 371 (Electronics), ELCT 350 (Computer Modeling of Electrical Systems), that cover the wide scope of EE topics.

Laboratory courses: ELCT 201 (Introductory EE Laboratory), 301 (Electronics Laboratory), 302 (Real Time System Laboratory)
Support knowledge integration across these core courses in a hands-on mode.

The Curriculum Map 1 (attached) shows the extent to which each of these courses contributes to achievement of Goal 2 and its associated Outcomes.

Depth is achieved via the 15 hours of Career Plan courses that support the specific career objective that a student has stated on their Career Plan form.

The EE Capstone design sequence, ELCT 403 and 404, requires students to further develop the depth of their skills in the specific technologies associated with their team project. Compared to the other core course, the capstone design sequence especially emphasizes Outcomes C and J as shown in the Curriculum Map 2 (attached).

Learning Outcome 1.

ABET Outcome A – Students will demonstrate an ability to apply knowledge of mathematics, science, and engineering.

Measures and Criteria

This is a very broad outcome and we necessarily employ a multi-point method to assess it. Student performance is assessed in each EE course according to rubrics appropriate to the topic. This broad multi-point measurement is being incrementally implemented.

The measure is percentage of students scoring “Meets Expectations” or better. For any criteria, success is defined as more than 70% of students scoring “Meets Basic Expectations” or better.

An example of Rubric A is attached.

Example of Rubric A

Methods

Multipoint measurements will be made in all courses as shown in the Curriculum Map 1 evaluated by several rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Curriculum Map 1

Results

Assessment results for Goal 2, Learning Outcome 1 (ABET Outcome A) were produced in at least 7 courses and spanned 27 topics in electrical engineering.

Generally student accomplishments of this outcome increased as students progressed to the upper level courses. In lower-level courses, two areas of concern were identified:

- In ELCT 221 a student weakness was identified in solving problems for AC circuits.
- In ELCT 222 a student weakness was identified in application of Fourier and Laplace methods.
- In ELCT 363 a student weakness was identified in fundamental properties of semiconductor material and devices.

Detailed result is shown in the attached report.

Outcome A Report

Use of Results

The Undergraduate Program Committee will work with the instructors to develop a plan to improve student's competence related to the following topics:

- ELCT 221 -- impedance, power, and Thevenin analysis of AC circuits
- ELCT 222 -- Fourier and Laplace topics
- ELCT 363 -- fundamental concept of semiconductor material and devices

Learning Outcome 2.

Learning Outcome B.

ABET Outcome B -- Students will demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.

Measures and Criteria

This is also a very broad outcome and we again employ a multi-point method to assess it. Student performance is assessed in three EE lab classes – ELCT 201, 301, 403 according to rubrics appropriate to the project. This broad multi-point measurement is being incrementally implemented.

The measure is percentage of students scoring “Meets Expectations” or better. For any criteria, success is defined as more than 70% of students scoring “Meets Basic Expectations” or better.

An example of Rubric B is attached.

Example of Rubric B

Methods

Multipoint measurements will be made in all courses as shown in the Curriculum Map 2 evaluated by several rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Curriculum Map 2

Results

The result of Goal 2, Learning Outcome 2 (ABET Outcome B) came from multiple laboratory courses: ELCT 201, 301, 403/404.

1. ELCT 201 – the measurement was made based on the project, "Butterworth Filter". In spring 2016, **83%** of students in ELCT 201 scored "meets basic expectations" or better, thus the success criterion was met.

2. ELCT 301 -- the measure was made in two areas in fall 2015.

- Criterion #1: functionally test and debug electronic circuits – **100%** of the students scored "meets basic expectations" or better
- Criterion #2: use SPICE to simulate electronic circuits – **100%** of the students scored "meets basic expectations" or better

Based on the results, both success criteria were met.

3. ELCT 403/404, Capstone Design Projects, more than **80%** of students scored meets expectations or better on all five of the evaluation criteria for the ability to "design appropriate tests to measure and evaluate the performance of prototypes subsystems to determine whether they meet performance and interface requirements and recommend changes where they do not. Based on the number, the success criterion was met.

Detailed results are shown in the attached report.

Outcome B Report

Use of Results

The Undergraduate program committee will work with the instructors to implement the following actions:

1. ELCT 201 – recommendation was made to revise the definition of the measurement because "design and present the project" is not strictly equivalent to "design an experiment"
2. ELCT 301 no action required
3. ELCT 403/404 instructor recommended changes to ELCT 302 to better prepare students to define requirements and set testable tolerances on requirements. This will improve the ability of students to design tests to characterize subsystem performance.

Learning Outcome 3.

ABET Outcome C -- Students will demonstrate 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.

Measures and Criteria

1. **The first measure** of this important outcome is assessed in the Capstone Design lab sequence ELCT 403-404. The measure of performance is the extent to which the design goals and constraints are satisfied when a team completes their project. Project success is evaluated by Rubric C. The measure is the percentage of students who score "Meets Expectations" or better on the criteria in that rubric. For any criteria, success is defined as more than 80% of students scoring "Meets Basic Expectations" or better.
2. **The second measure** of this outcome is the distribution of rankings of the team projects by members of the Department of Electrical Engineering Industrial Advisory Board during the project presentations. The outcome is considered to be successful if 80% of the projects are ranked, according to the evaluation rubric, as "meets expectations" and no project is receives more than 25% of IAB member rankings below "meets expectations".

An example of Rubric C and the IAB evaluation rubric are attached.

Example of IAB evaluation rubric

[Rubric C-404-FinalPresentation](#)

[Rubric C-403-TechManual](#)

[Rubric C-403-Proposal](#)

[Rubric C-403-UtilityAssessment](#)

[Rubric 403-C-TechnicalCompetence](#)

Methods

1. Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.
2. The first measurement will be made in ELCT404 final presentation evaluated by Rubric C.
3. The second measurement will be made in the Spring meeting of the department of Electrical Engineering Industrial Advisory Board. The IAB members evaluate each final presentaiton using a rubric defined by the

course instructor (A sample rubric is attached). The data is stored in Blackboard, and the assessment report is administratively generated.

Results

The result of Goal 2, Learning Outcome 3 (ABET Outcome C) came from two measurements.

1. ELCT 404, Capstone Design Project II, the measure of performance was made using final demonstration.

- Criterion 1: Meets functional requirements: 29% of the students scored meets basic expectations or better
- Criterion 2: Meets performance requirements: 29% of the students scored meets basic expectations or better
- Criterion 3: Respects constraints: 57% of students scored meets basic expectations or better
- Criterion 4: Exhibits high engineering competency: 57% of students scored meets basic expectations or better
- Criterion 5: Completeness: 36% of students scored meets basic expectations or better

2. IAB evaluation – During the Spring 2016 meeting IAB members were asked to rate each project using an interactive online survey using slightly different ranking scale than was defined last year. (Experienced revealed that the original measurement was too detailed to be applied within the available time.) On a scale of 1 to 5 (5 being most impressive), our objective was for 80% of projects being rated above 3. But results showed that only 43% of groups were rated above 3, and only 1 out of 7 groups was rated above 4.

Based on the result, the criteria were not met.

Detailed results are show in the attached report.

Outcome C Report

Rubric C

Use of Results

This assessment showed that the capstone design course encountered some considerable challenges this year that at least gave the appearance of impaired student abilities. (It is unlikely that student capabilities themselves dropped suddenly this year, whereas the nature of projects in the class did change somewhat substantially this year.) The Undergraduate program committee, the course instructor, and related instructors across the college are working to implement several changes that are expected to improve the implementation details of the class and student performance on projects:

1. Many of the projects this year required the establishment of cross-disciplinary teams composed of students from both EE and MechE. But insufficient coordination between Electrical and Mechanical Engineering classes (assignments, due dates, rates of progress) compromised students' ability to satisfy the design objectives. Additional discussions are underway to standardize capstone design project schedules across the college to improve the ability to function on teams.
2. The college lacks consistency in processes for accepting projects from external clients so that some projects were ill-defined at the start of the semester. Thus some project teams were not able to start on their projects in a timely way. Corrective action requires more rigorous enforcement of schedule and technical expectations when clients define projects, and this will require a better method for interfacing with clients. (The scope of activity required for successful client interactions and team supervision exceeds the time available from the course instructor.) The department expects that a college-level initiative to coordinate capstone design projects will resolve this problem. If not, the short-term solution will be to avoid accepting client projects that require cross-departmental coordination.
3. Some teams used project ambiguity as a reason to delay work on their project even though substantial progress could have been achieved despite the ambiguity. Since ambiguity is common in engineering design, skills to deal with it must be developed. Additional classroom emphasis will be placed on the importance of satisfying project objectives and methods to deal with ambiguity.

Learning Outcome 4.

ABET Outcome E – Students will demonstrate an ability to identify, formulate, and solve engineering problems.

Measures and Criteria

This is also a very broad outcome and we again employ a multi-point method to assess it. Student performance is assessed in all core classes according to rubrics appropriate to the problem (homework or exam). All specific rubrics are based on the generic Rubric E. This broad multi-point measurement is being incrementally implemented. Eventually all course outcomes will be mapped to program outcomes by associating course outcomes with program outcomes using Blackboard Goal and Assessment Tool.

The measure is percentage of students scoring “Meets Expectations” or better. For any criteria, success is defined as more than 70% of students scoring “Meets Basic Expectations” or better.

An example of Rubric for Outcome E is attached.

Example of Rubric E

Methods

Multipoint measurements will be made in all courses as shown in the Curriculum Map 1 evaluated by several rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Curriculum Map 1

Results

The result of Goal 2, Learning Outcome 4 (ABET Outcome E) came from five courses.

Generally students performed well and the success criteria were met in all but in the following outcomes:

- ELCT 221 – Find the impedance of and power in R,L,C network components – 62% of students scored meet basic expectations or better
- ELCT 363 – Fundamental properties of semiconductor material and devices – 48% of students scored meet basic expectations or better

Detailed results is show in the attached report.

Outcome E Report

Use of Results

The Undergraduate program committee will work with the instructors to implement the following actions:

- ELCT 221: more time and assignments will be allocated to improve student competence in impedance, power, and Thevenin analysis, already started in Spring 2016.
- ELCT 363 –more coverage of semiconductor devices will be provided starting in Fall 2016.

Learning Outcome 5.

ABET Outcome J – Students will demonstrate knowledge of contemporary issues.

Measures and Criteria

This is a broad outcome as it relates to contemporary issues in the various subdisciplines of electrical engineering, so we employ a multi-point method to assess it. This broad multi-point measurement is being incrementally implemented in all 500-level Career Plan courses according to rubrics appropriate to the assignment (homework or exam). Eventually all course outcomes will be mapped to program outcomes by associating course outcomes with program outcomes using Blackboard Goal and Assessment Tool.

The measure is percentage of students scoring "Meets Expectations" or better on the criterion. For any criterion, success is defined as more than 70% of students scoring "Meets Basic Expectations" or better.

An example of Rubric J is attached.

Example of Rubric J

Methods

The measurement will be made in no less than 50% of the 500-level Career Plan courses each semester evaluated by the appropriate rubric. A sample of rubric is attached.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Results

The department's goal to implement this measurement in all 500-level classes has not yet been achieved. Therefore, the only available measurement is the one from ELCT 404, the Capstone Design Project.

- Criterion #1: Patentability -- 100% of students scored "meet basic expectations" or better
- Criterion #2: Prototype to Product -- 86% of students scored "meet expectations" or better
- Criterion #3: Business Plan -- 100% of students scored "meet basic expectations" or better

Based on the number, the success criteria were met.

Detailed result is shown in the attached report.

Outcome J Report

Use of Results

During the Spring 2016 curriculum review held on May 13, 2016, the faculty identified at least seven contemporary issues in Electrical Engineering that will be included in 500-level classes. The Undergraduate program committee will work with all 500 level course instructors to implement this action.

Learning Outcome 6.

ABET Outcome K – Students will demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Measures and Criteria

This is a very broad outcome as it relates to a multiplicity of analytic methods, computer-based engineering design tools, and laboratory hardware. We will employ a multi-point method to assess it. Student performance will be assessed in many classes, with emphasis on analytic methods and software tools in theory classes and emphasis on hardware

tools in the laboratory classes. Rubrics are customized to each tool and each problem (homework or exam). This broad multi-point measurement is being incrementally implemented.

The measure is percentage of students scoring "Meets Expectations" or better on the criterion. For any criteria, success is defined as more than 70% of students scoring "Meets Expectations" or better.

Example of Rubric K

Methods

Multipoint measurements will be made in all courses as shown in the Curriculum Map 1 evaluated by the appropriate rubrics. A sample of Rubric K is attached.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Curriculum Map 1

Results

The result of Goal 2, Learning Outcome 6 (ABET Outcome K) came from five courses.

Generally, students performed well using tools and techniques including MATLAB, SPICE, lab measurement equipment, etc and the success criteria were met. However in ELCT 201 in fall 2015, only **58%** of students scored meets basic expectations for circuit prototyping.

Detailed results are shown in the attached report.

Outcome K Report

Use of Results

The Undergraduate program committee will work with ELCT 201 instructor to implement a plan to allocate additional time to improve student competence in building and troubleshooting of circuit prototypes.

Goal 3.

The third goal of the academic program is to imbue in the graduate professional skills that include the abilities to communicate effectively, to work productively as a team member, to understand professional ethical responsibility, and to engage in career-long professional development. This goal contributes to the achievement of ABET Outcome D, F, G and I.

Curriculum

Significant parts of these outcomes are taught and produced in the Carolina Core courses, particularly those that produce the skills EEP and VSR. The core skills are built on in several EE classes, particularly the laboratory sequence that includes ELCT 201 (Introductory EE Laboratory), 301 (Electronics Laboratory), 302 (Real Time Systems Laboratory) ELCT 403 (Capstone Design I) and 404 (Capstone Design II).

Each of these labs requires oral presentations and extensive written works such as laboratory reports, design proposals, etc.

Team work is employed throughout, and is taught in incremental fashion in ELCT 302 (Real Time Systems Laboratory) and in more detail in Capstone design sequence, ELCT 403 (Capstone Design I) and 404 (Capstone Design II).

The understanding of professional and ethical responsibility is taught in ELCT 331 (Control Systems) and ELCT 363 (Microelectronics), based on the understanding previously developed in the Carolina Core VSR.

An appreciation for and understanding of the need for career-long professional development is mentioned throughout the curriculum, beginning in ELCT 101 and ending in ELCT 404 where extensive self-learning is required in order to complete a challenging engineering design project that requires knowledge beyond that learned in formal coursework.

The Curriculum Map 3 (attached) shows the extent to which each of these courses contributes to achievement of Goal 3 and its associated Outcomes.

Learning Outcome 1.

ABET Outcome D – Students will demonstrate an ability to function on a multidisciplinary team.

Measures and Criteria

This important outcome is assessed in several of the EE laboratory courses, but more extensively in the Capstone Design lab sequence ELCT 403-404.

The measure of performance is evaluated by several rubrics as linked below. The measure is percentage of students scoring "Meets Expectations" or better on each criterion.

For any criteria, success is defined as more than 70% of students scoring "Meets Expectations" or better.

[Rubric D-403-Teamwork](#)

[Rubric D-403-StatusReport](#)

[Rubric D-403-Notebook](#)

[Rubric D-403-PeerEvaluationLetter](#)

Methods

The measurement will be made in all lab courses each academic year (two courses per semester) as shown in the Curriculum Map 3, and evaluated by the appropriate rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Curriculum Map 3

Results

The result of Goal 3, Learning Outcome 1 (ABET Outcome D) came from several lab courses (Sophomore to Seniors). Students performed well and the success criteria were met in all areas.

Detailed result is shown in the attached report.

Outcome D Report

Use of Results

No actions required

Learning Outcome 2.

ABET Outcome F – Students will demonstrate an understanding of professional and ethical responsibility.

Measures and Criteria

1. This outcome is assessed using both external and internal measurements. Two external measurements are made: 1) The fraction of the students in the most recent graduating class who took PHIL 325, Engineering Ethics, and 2) the fraction of those students who earned a C or better in that course. (Students can satisfy their curricular requirements with other courses, but we think that this is the best to achieve this outcome, which is why we measure the fraction who actually did take it.) The measure is percentage of students who earned C or better in the course. For any criteria, success is defined as more than 70% of students who earned C or better.
2. The internal measure is made using teaching modules on ethics in the courses ELCT 363 Introduction to Microelectronics and 331 Control Systems. Student performance is assessed according to Rubric F. The measure is percentage of students scoring “Meets Expectations” or better. For any criteria, success is defined as more than 70% of students scoring “Meets Basic Expectations” or better.

Example of Rubric F

Methods

1. Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.
2. Examine the transcripts of the most-recent spring-semester graduating class and count the number of students who made any grade less than C in any course that produced credit for a Carolina Core outcome and compute using the attached formula.
3. A student assignment in both ELCT 331 and ELCT 363 requires a written assessment. The assignment is evaluated by the course instructor according to Rubric F, student performance is recorded in Blackboard, and the Rubric Report is generated by an administrative staff member.

PHIL325 Formula

Results

The result of Goal 3, Learning Outcome 2 (ABET Outcome F) came from two measurements.

1. The external measure came from PHIL 325 Engineering Ethics (an approved VRS CC course) – 24 out of 27 graduating in Sp 16 completed PHIL 325 and **100%** earned C or better grades. Three students took a different VSR elective. Therefore the success criterion was met.
2. The internal measure came from ELCT 363 assignment on the topic of Engineering Ethics. **100%** of students scored competent (meet basic expectations). Therefore this success criterion was met.

Use of Results

The Undergraduate program committee will re-evaluate which courses are most appropriate to assess this outcome as an internal measure.

Learning Outcome 3.

ABET Outcome G – Students will demonstrate an ability to communicate effectively (in written and oral forms).

Measures and Criteria

This important outcome is assessed in several of the EE laboratory courses, but more extensively in the Capstone Design lab sequence ELCT 403-404. Performance is evaluated by separate rubrics for different aspect of Oral and

Written communication.

The measure is percentage of students scoring "Meets Basic Expectations" or better on the criteria. For any criterion, success is defined as more than 70% of students scoring "Meets Basic Expectations" or better.

Rubric G-403-Oral
Rubric G-403-Written

Methods

The measurement will be made in ELCT 301 and ELCT 404 evaluated by several rubrics appropriate for each course. A Sample rubric is attached.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Results

The result of Goal 3, Learning Outcome 3 (ABET Outcome G) came from several laboratory courses including ELCT 301 and ELCT 403/404.

- Writing skills:
 - ELCT 403 – 4 success criteria were set to assess student's competence. More than 80% of students scored meet basic expectations in all criteria.
 - Structure: 88%
 - Coherence: 100%
 - Grammar: 100%
 - Technical terminology: 100%
 - ELCT 301 – 76% met basic expectations.
- Oral presentation skills:
 - Capstone Design projects
 - Describe organizational and technical plans and process in oral presentation – 100% of students scored meet basic expectations.
 - Oral presentation at final project demonstration – 100% of student scored meet basic expectations.

Based on the number, all criteria were met.

Detailed result is shown in the attached report.

Outcome G Report

Use of Results

No action required.

Learning Outcome 4.

ABET Outcome I – Students will demonstrate recognition of the need for, and an ability to engage in life-long learning.

Measures and Criteria

This important outcome is assessed once at the beginning of the program, in ELCT 102, and once at the end of the program in the Capstone Design lab sequence ELCT 403-404. The measure of performance is evaluated by Rubric I.

The measure is percentage of students scoring "Meets Basic Expectations" or better on the criteria. For any criteria, success is defined as more than 70% of students "Meets Basic Expectations" or better.

Example of Rubric I

Methods

The measurement will be made in ELCT 102 and ELCT 403-404 evaluated by the appropriate rubrics for each course. A sample rubric is attached.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee will meet once per year during the spring semester to review the results and recommend changes as needed.

Results

The result of Goal 3, Learning Outcome 4 (ABET Outcome I) came from ELCT 102 and ELCT 403/404 course.

- ELCT 403/404 -- 100% of students scored meet basic expectations or better, thus the success criterion was met.
- ELCT 102 didn't have result to report at this time.

Detailed result is shown in the attached report.

Outcome I Report

Use of Results

In retrospect, measurement of lifelong learning in ELCT 102 is premature. It is heavily mentioned throughout the curriculum and is ultimately assessed in ELCT 403/404.

Goal 4.

The fourth goal of the academic program is to use a holistic approach to maintain the quality of the program to satisfy various program's constituents, including employers, students, and faculty.

Curriculum

This goal guides formulation of the overall curriculum to ensure that the program meets the needs of constituents.

Learning Outcome 1.

Industrial Advisory Board -- This outcome is to assess the program to satisfy our Industrial Advisory Board by reviewing their recommendations to ensure we are producing the qualified Electrical Engineers.

Measures and Criteria

Positive feedback from the IAB members will indicate that the outcome is met.

Methods

The IAB meeting is held every semester. Their recommendations or feedbacks will be compiled and preserved in Blackboard.

The Undergraduate Program Committee will meet once per year during the spring semester to review the feedbacks and recommend changes as needed.

Results

The result of Goal 4, Learning Outcome 1, came from the feedbacks given by the IAB members in the last meetings. The overall feedback is positive. The members particularly are encouraged to learn that the department has made changes in the following areas as a part of our continuous improvements:

- Updated ELCT 101 to emphasize hands on experience by using the Digilent USB scope device for homework labs and community engagement project
- Developed new Career Plan webpages to encourage students to select appropriate elective courses that help achieve their career goals.
- The five-lab sequence is good; it serves as integrating experience for concepts learned from all courses.
- Addition of EMCH 201 and PHYS 306 as elective alternatives to CSCE 146 (Java).
- Development of improved assessment processes, especially using Blackboard to collect data.
- Opportunity to rate/evaluate capstone design project.

Based on the comments, the success criterion was met.

Use of Results

The IAB agreed with positive changes already made and encouraged the program to continue introducing new ideas and methods as opportunities arise.

Learning Outcome 2.

Undergraduate Students -- This outcome is to assess students in all levels of their satisfaction in the quality of the education they receive from the program.

Measures and Criteria

Student course evaluations, senior exit interviews, and feedback from the Student Advisory Board (SAB) will be used to collect student input regarding the program. The measure is the fraction of students who rate the program as "Acceptable" or better. More importantly, these evaluations collect information that is valuable but ad hoc and often qualitative and thus does not lend itself to specific measures and criteria.

Methods

Course evaluations are done in every course at the end of every semester. Senior Exit interviews are performed in the ELCT 404 class near the end of each term. The Student Advisory Board meets once each semester with faculty representatives and once each year with the Industry Advisory Board.

Data from each of these will be compiled and reviewed by the Undergraduate Program Committee once per year during the spring semester, from which any recommendations for improvement will issue.

Results

The result of Goal 4, Learning Outcome 2, came from feedbacks collected from the following sources.

- Senior Exit Interview –
 - Generally students felt adequately prepared in all areas of their education, with the highest ranking being that 96% expressed that they are confident that their oral and written communication skills have developed sufficiently to perform capably in a job environment and 88% expressed that they feel adequately prepared to independently design and conduct experiments. At the opposite extreme, only 68% expressed that their teamwork experiences were positive and only 60% expressed that their education at USC has contributed significantly to their understanding of the global issues relating to engineering and the societal context of engineering as a profession.
- Student Advisory Board
 - The SAB identified five concerns about the program including mentoring by upper class students, availability of graders and teaching assistants, effect of internships on on-time graduation, need to develop career plan earlier in order to be sure that course prerequisites are satisfied by the time electives are taken.
- Course Evaluation
 - Overall rating of EE instructors is 4.3. The most important concerns were lack of understanding of the objectives and organization of 101 and 102.

Based on the comments, the success criteria were met.

Use of Results

- Use of criterion 1 result:
 - The undergraduate committee will work with the instructor with a goal to introduce more incremental team building skills into ELCT 302.

- o Spring 2016 curriculum review identified at least seven contemporary issues in EE that will be included in 500-level classes.
- Use of criterion 2 result: Undergrad Program committee introduced several actions to address these concerns:
 - o 101-403 mentoring plan
 - o Revise TA assignments to reduce schedule conflicts
 - o Added ELCT 331 and 302 in summer which will permit 20 students to graduate on time in spring 2017
- Use of criterion 3 result:
 - o Highly experienced senior professor was assigned for 101 starting fall 2016
 - o Peer review of 102 will be conducted to understand the issues and recommend changes.

Learning Outcome 3.

Faculty -- This Outcome is to assess faculty satisfaction with the program.

Measures and Criteria

There is no Criteria listed for this assessment.

Methods

Faculty input and recommendations are collected through a variety of methods including annual curriculum review, undergraduate program committee, and monthly faculty meetings.

Data from each of these will be compiled and reviewed by the Undergraduate Program Committee once per year during the spring semester, from which any recommendations for improvement will issue.

Results

At the May 13, 2016 curriculum retreat, EE faculty identified issues and opportunities:

- compared current topics in EE to current course offerings and identified some shortcomings
- need to add hands-on experiences in 200 and 300-level classes
- Need to develop a process to ensure continuity of continuous course improvements even when instructor changes semester by semester

Use of Results

The Undergraduate program committee will work with instructors to implement the following actions:

- add new topics for 500-level classes
- use the Analog Discovery portable instrumentation
- CQI form adoption for all classes Developed sandbox classes in BB to preserve the latest improvements regardless of instructor

II. FUTURE ASSESSMENT PLAN FOR YEARS 2016 - 2017

Mission Statement

The mission of the BSE Program in Electrical Engineering is to produce graduates who will:

- contribute to the economic development of this state and the nation by the competent and ethical practice of electrical engineering.
- be sought after by leading industrial, governmental, and academic organizations.
- exhibit leadership qualities in their organizations by virtue of their excellent technical abilities, communication skills, and comprehensive vision.
- use their technical competence in electrical engineering to creatively solve problems for the betterment of society.
- ceaselessly improve their technical competence

Overview

The BSE program in Electrical Engineering is accredited by the Accreditation Board for Engineering and Technology. ABET requires each program to define Program Educational Objectives (which are used above to describe the program Mission) and to produce eleven Student Outcomes, colloquially known as “the A through K outcomes”. These eleven outcomes have been grouped into three larger “Goals” in order to align with USC’s own assessment processes, as shown in Table 1.

Table 1: Mapping of ABET Student Outcomes into USC Program Goals and Program Outcomes

USC Program Goals	ABET Student Outcomes = USC Program Outcomes
Goal 1: Broad education	<p>ABET H: the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context</p> <p>ABET A: an ability to apply knowledge of mathematics, science, and engineering</p> <p>ABET B: an ability to design and conduct experiments, as well as to analyze and interpret data</p> <p>ABET C: 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</p>
Goal 2: Engineering skills -	

broad and deep

safety, manufacturability, and sustainability

ABET E: an ability to identify, formulate, and solve engineering problems

ABET J: a knowledge of contemporary issues (relevant to electrical engineering)

ABET K: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

ABET D: an ability to function on multidisciplinary teams

ABET F: an understanding of professional and ethical responsibility

Goal 3: Professional skills

ABET G: an ability to communicate effectively

ABET I: a recognition of the need for, and an ability to engage in life-long learning

Goal 1.

The first goal of the academic program is to imbue in the graduate a broad education that establishes competencies in the arts, humanities, foreign languages, sciences, and mathematics and that fosters an appreciation of the role of the engineer in society and the world-awareness that is necessary to the practice of engineering in a global economy. This goal contributes to the achievement of the ABET Outcome H.

Curriculum Map Outcome H

Curriculum

The Carolina Core is largely responsible for producing this outcome. Carolina Core Learning Outcomes to be met at foundational level of mastery are as follows:

- Aesthetic and Interpretive Understanding: Create or interpret literary, visual or performing arts
- Analytical Reasoning and Problem Solving: Apply the methods of mathematical, statistical, or analytical reasoning to critically evaluate data, solve problems, and effectively communicate findings verbally and graphically.
- Effective, Engaged, and Persuasive Communication: Identify and analyze issues, develop logical and persuasive arguments, and communicate ideas clearly for a variety of audiences and purposes through writing and speaking.
- Global Citizenship and Multicultural Understanding:
 - Use the principles of the social sciences to explore diverse cultural identities and to analyze political and environmental issues.
 - Use the principles of historical thinking to assess the relationships between modern societies and their historical roots.
 - Communicate effectively in more than one language.
 - Scientific Literacy: Apply the principles and language of the natural sciences and associated technologies to historical and contemporary issues.
 - Information Literacy: Collect, manage and evaluate information using technology, and communicate findings.
 - Values, Ethics, and Social Responsibility: Examine different kinds of social and personal values, analyzing the ways in which these are manifested in communities as well as individual lives

Learning Outcome 1.

ABET Outcome H – Students will demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Measures and Criteria

Measures are defined as “internal” or “external” depending on whether the raw data is produced and owned by the program faculty or by another campus entity.

1. The external measure is the fraction of students in the immediate past graduating class who earned at least a C in every one of their Carolina Core courses. Success: More than 90% of students had no grade less than C in any Carolina Core course.
2. The internal measure is the fraction of students who demonstrated competent or better performance when given an assignment to evaluate the impact of a modern electrical engineering technology on humanity, in a junior-level electrical engineering class. Success: More than 70% of students score competent or better.

Methods

1. Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.
2. Examine the transcripts of the most-recent spring-semester graduating class and count the number of students who made any grade less than C in any course that produced credit for a Carolina Core outcome and compute using the attached formula.
3. A student assignment in ELCT 361 requires a written assessment of the impact of a relevant technology on humanity. The assignment will be evaluated by the course instructor according to Rubric H, student performance will be recorded in Blackboard, and the Rubric Report will be generated by an administrative staff member.

Goal 2.

The second goal of the academic program is to imbue in the graduate engineering skills that are both broad in the basics and deep within a specific field so as to support a declared career plan. This goal contributes to the achievement of ABET Outcomes A, B, C, E, J, and K.

Curriculum Map 1
Curriculum Map 2

Curriculum

Breadth of EE skills are taught in the introductory courses – ELCT 102 (Electrical Science), ELCT 221 (Circuits), ELCT 222 (Signals and Systems), and in the core courses – ELCT 321 (Digital Signal Processing), ELCT 331 (Control Systems), ELCT 361 (Electromagnetics), ELCT 363 (Microelectronics), ELCT 371 (Electronics), ELCT 350 (Computer Modeling of Electrical Systems), that cover the wide scope of EE topics.

Laboratory courses: ELCT 201 (Introductory EE Laboratory), 301 (Electronics Laboratory), 302 (Real Time System Laboratory) Support knowledge integration across these core courses in a hands-on mode.

The Curriculum Map 1 (attached) shows the extent to which each of these courses contributes to achievement of Goal 2 and its associated Outcomes.

Depth is achieved via the 15 hours of Career Plan courses that support the specific career objective that a student has stated on their Career Plan form.

The EE Capstone design sequence, ELCT 403 and 404, requires students to further develop the depth of their skills in the specific technologies associated with their team project. Compared to the other core course, the capstone design sequence especially emphasizes Outcomes C and J as shown in the Curriculum Map 2 (attached).

Learning Outcome 1.

ABET Outcome A – Students will demonstrate an ability to apply knowledge of mathematics, science, and engineering.

Measures and Criteria

This is a very broad outcome and we necessarily employ a multi-point method to assess it. Student performance is assessed in each EE course according to rubrics appropriate to the topic. This broad multi-point measurement is being incrementally implemented.

The measure is percentage of students scoring “Meets Expectations” or better. For any criteria, success is defined as more than 70% of students scoring “Meets Basic Expectations” or better.

An example of Rubric A is attached.

Methods

Multipoint measurements are made in all courses as shown in the Curriculum Map 1 evaluated by several rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric A

Learning Outcome 2.

Learning Outcome B.

ABET Outcome B – Students will demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.

Measures and Criteria

This is also a very broad outcome and we again employ a multi-point method to assess it. Student performance is assessed in three EE lab classes – ELCT 201, 301, 403/404 according to rubrics appropriate to the project. This broad multi-point measurement is being incrementally implemented.

The measure is percentage of students scoring “Meets Expectations” or better. For any criteria, success is defined as more than 70% of students scoring “Meets Basic Expectations” or better.

An example of Rubric B is attached.

Methods

Multipoint measurements are made in all courses as shown in the Curriculum Map 2 evaluated by several rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program

Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric B

Learning Outcome 3.

ABET Outcome C – Students will demonstrate 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.

Measures and Criteria

1. **The first measure** of this important outcome is assessed in the Capstone Design lab sequence ELCT 403-404. The measure of performance is the extent to which the design goals and constraints are satisfied when a team completes their project. Project success is evaluated by Rubric C. The measure is the percentage of students who score “Meets Expectations” or better on the criteria in that rubric. For any criteria, success is defined as more than 80% of students scoring “Meets Basic Expectations” or better.
2. **The second measure** of this outcome is the distribution of rankings of the team projects by members of the Department of Electrical Engineering Industrial Advisory Board during the project presentations. The outcome is considered to be successful if 80% of the projects are rated over 4.00 and above.

An example of Rubric C and the IAB evaluation rubric are attached.

Methods

1. Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.
2. The first measurement is made in ELCT404 final presentation evaluated by Rubric C.
3. The second measurement is made in the Spring meeting of the department of Electrical Engineering Industrial Advisory Board. The IAB members evaluate each final presentation using a rubric defined by the course instructor (A sample rubric is attached). The data is stored in Blackboard, and the assessment report will administratively generated.

Rubric C

IAB Evaluation Rubric

Learning Outcome 4.

ABET Outcome E – Students will demonstrate an ability to identify, formulate, and solve engineering problems.

Measures and Criteria

This is also a very broad outcome and we again employ a multi-point method to assess it. Student performance is assessed in all core classes according to rubrics appropriate to the problem (homework or exam). All specific rubrics are based on the generic Rubric E. This broad multi-point measurement is being incrementally implemented. Eventually all course outcomes will be mapped to program outcomes by associating course outcomes with program outcomes using Blackboard Goal and Assessment Tool.

Currently 12 measurement criteria are formulated for 6 classes. Minimum expectations are defined for each criterion and success for each criterion was defined as at least 70% of students scoring “meets basic expectations” or better.

An example of Rubric for Outcome E is attached.

Methods

Multipoint measurements are made in all courses as shown in the Curriculum Map 1 evaluated by several rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric E

Learning Outcome 5.

ABET Outcome J – Students will demonstrate knowledge of contemporary issues.

Measures and Criteria

This is a broad outcome as it relates to contemporary issues in the various subdisciplines of electrical engineering, so we employ a multi-point method to assess it.

This broad multi-point measurement is being incrementally implemented in all 500-level Career Plan courses according to rubrics appropriate to the assignment (homework or exam) and the assignment of "Patent Review" in ELCT 404.

The measure is percentage of students scoring “Meets Expectations” or better on the criterion. For all 500 level courses, the success is defined as more than 70% of students scoring “Meets Basic Expectations” or better. For ELCT

404, the success is defined as more than 70% of teams scoring "Meet Basic Expectations" or better.

An example of Rubric J is attached.

Methods

Two measurements will be made for this learning outcome.

1. The first measurement is made in ELCT 404 assignment, Patent review, evaluated by Rubric J.
2. The second measurement is made in no less than 50% of the 500-level Career Plan courses each semester evaluated by the appropriate rubric.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric J

Learning Outcome 6.

ABET Outcome K – Students will demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Measures and Criteria

This is a very broad outcome as it relates to a multiplicity of analytic methods, computer-based engineering design tools, and laboratory hardware. We will employ a multi-point method to assess it. Student performance will be assessed in many classes, with emphasis on analytic methods and software tools in theory classes and emphasis on hardware tools in the laboratory classes. Rubrics are customized to each tool and each problem (homework or exam). This broad multi-point measurement is being incrementally implemented.

The measure is percentage of students scoring "Meets Expectations" or better on the criterion. For any criteria, success is defined as more than 70% of students scoring "Meets Expectations" or better.

Methods

Multipoint measurements are made in all courses as shown in the Curriculum Map 1 evaluated by the appropriate rubrics. A sample of Rubric K is attached.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric K

Goal 3.

The third goal of the academic program is to imbue in the graduate professional skills that include the abilities to communicate effectively, to work productively as a team member, to understand professional ethical responsibility, and to engage in career-long professional development. This goal contributes to the achievement of ABET Outcome D, F, G and I.

Curriculum Map 3

Curriculum

Significant parts of these outcomes are taught and produced in the Carolina Core courses, particularly those that produce the skills EEP and VSR. The core skills are built on in several EE classes, particularly the laboratory sequence that includes ELCT 201 (Introductory EE Laboratory), 301 (Electronics Laboratory), 302 (Real Time Systems Laboratory) ELCT 403 (Capstone Design I) and 404 (Capstone Design II).

Each of these labs requires oral presentations and extensive written works such as laboratory reports, design proposals, etc.

Team work is employed throughout, and is taught in incremental fashion in ELCT 302 (Real Time Systems Laboratory) and in more detail in Capstone design sequence, ELCT 403 (Capstone Design I) and 404 (Capstone Design II).

The understanding of professional and ethical responsibility is taught in ELCT 331 (Control Systems) and ELCT 363 (Microelectronics), based on the understanding previously developed in the Carolina Core VSR.

An appreciation for and understanding of the need for career-long professional development is mentioned throughout the curriculum, beginning in ELCT 101 and ending in ELCT 404 where extensive self-learning is required in order to complete a challenging engineering design project that requires knowledge beyond that learned in formal coursework.

The Curriculum Map 3 (attached) shows the extent to which each of these courses contributes to achievement of Goal 3 and its associated Outcomes.

Learning Outcome 1.

ABET Outcome D – Students will demonstrate an ability to function on a multidisciplinary team.

Measures and Criteria

This important outcome is assessed in several of the EE laboratory courses, but more extensively in the Capstone

This important outcome is assessed in several of the EE laboratory courses, but more extensively in the Capstone Design lab sequence ELCT 403-404.

The measure of performance is evaluated by several rubrics as linked below. The measure is percentage of students scoring "Meets Expectations" or better on each criterion.

For any criteria, success is defined as more than 70% of students scoring "Meets Expectations" or better.

Methods

The measurement is made in all lab courses each academic year (two courses per semester) as shown in the Curriculum Map 3, and evaluated by the appropriate rubrics.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric D

Learning Outcome 2.

ABET Outcome F – Students will demonstrate an understanding of professional and ethical responsibility.

Measures and Criteria

1. This outcome is assessed using both external and internal measurements. Two external measurements are made: 1) The fraction of the students in the most recent graduating class who took PHIL 325, Engineering Ethics, and 2) the fraction of those students who earned a C or better in that course. (Students can satisfy their curricular requirements with other courses, but we think that this is the best to achieve this outcome, which is why we measure the fraction who actually did take it.) The measure is percentage of students who earned C or better in the course. For any criteria, success is defined as more than 70% of students who earned C or better.
2. The internal measure is made using teaching modules on engineering ethics in a junior level course. Student performance is assessed according to Rubric F. The measure is percentage of students scoring "Meets Expectations" or better. For any criteria, success is defined as more than 70% of students scoring "Meets Basic Expectations" or better.

Methods

1. Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.
2. Examine the transcripts of the most-recent spring-semester graduating class and count the number of students who made any grade less than C in any course that produced credit for a Carolina Core outcome and compute using the attached formula.
3. The Undergraduate program committee identifies an appropriate junior level course to evaluate this learning outcome. The selected course requires a written assessment. The assignment is evaluated by the course instructor, student performance is recorded in Blackboard, and the Rubric Report is generated by an administrative staff member.

PHIL325 Formula

Learning Outcome 3.

ABET Outcome G – Students will demonstrate an ability to communicate effectively (in written and oral forms).

Measures and Criteria

This important outcome is assessed in all EE laboratory courses in either oral and/or written forms. Performance is evaluated by separate rubrics for different aspect of Oral and Written communication.

The measure is percentage of students scoring "Meets Basic Expectations" or better on the criteria. For any criterion, success is defined as more than 70% of students scoring "Meets Basic Expectations" or better.

Methods

The measurements are made in ELCT 301 and ELCT 404 evaluated by several rubrics appropriate for each course. A Sample rubric is attached.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric G Oral

Rubric G Written

Learning Outcome 4.

ABET Outcome I – Students will demonstrate recognition of the need for and an ability to engage in life-long learning.

Learning Outcome 1 – Students will demonstrate recognition of the need for, and an ability to engage in, life-long learning.

Measures and Criteria

This important outcome is assessed at the end of the program in the Capstone Design lab sequence ELCT 403-404. The measure of performance is evaluated by Rubric I.

The measure is percentage of students scoring “Meets Basic Expectations” or better on the criteria. For any criteria, success is defined as more than 70% of students “Meets Basic Expectations” or better.

Methods

The measurement is made in ELCT 403/404 evaluated by the appropriate rubrics for each course. A sample rubric is attached.

Student performance is scored in Blackboard, using BB Rubrics, the data is stored in Blackboard, and the assessment report is administratively generated. The results are reported to the course instructor and to the Undergraduate Program Committee. The Undergraduate Program Committee meets once per year during the spring semester to review the results and recommend changes as needed.

Rubric I

Goal 4.

The fourth goal of the academic program is to use a holistic approach to maintain the quality of the program to satisfy various program's constituents, including employers, students, and faculty.

Curriculum

This goal guides formulation of the overall curriculum to ensure that the program meets the needs of constituents.

Learning Outcome 1.

Industrial Advisory Board -- This outcome is to assess the program to satisfy our Industrial Advisory Board by reviewing their recommendations to ensure we are producing the qualified Electrical Engineers.

Measures and Criteria

Positive feedback from the IAB members will indicate that the outcome is met.

Methods

The IAB meeting is held every semester. Their recommendations or feedbacks are compiled and preserved in Blackboard.

The Undergraduate Program Committee meets once per year during the spring semester to review the feedbacks and recommend changes as needed.

Learning Outcome 2.

Undergraduate Students -- This outcome is to assess students in all levels of their satisfaction in the quality of the education they receive from the program.

Measures and Criteria

Student course evaluations, senior exit interviews, and feedback from the Student Advisory Board (SAB) will be used to collect student input regarding the program. The measure is the fraction of students who rate the program as "Acceptable" or better. More importantly, these evaluations collect information that is valuable but ad hoc and often qualitative and thus does not lend itself to specific measures and criteria.

Methods

Course evaluations are done in every course at the end of every semester. Senior Exit interviews are performed in the ELCT 404 class near the end of each term. The Student Advisory Board meets once each semester with faculty representatives and once each year with the Industry Advisory Board.

Data from each of these is compiled and reviewed by the Undergraduate Program Committee once per year during the spring semester, from which any recommendations for improvement will issue.

Learning Outcome 3.

Faculty -- This Outcome is to assess faculty satisfaction with the program.

Measures and Criteria

Feedbacks and comments made by the faculty during the annual curriculum review, the undergraduate program committee meetings, and the monthly faculty meetings will be used to collect inputs regarding the program. Positive feedbacks from faculty will indicate that the outcome is met.

Methods

Faculty input and recommendations are collected through a variety of methods including annual curriculum review, undergraduate program committee, and monthly faculty meetings.

Data from each of these is compiled and reviewed by the Undergraduate Program Committee once per year during the spring semester, from which any recommendations for improvement will issue.