Continuous Improvement Program (CIP)

Approved by Curriculum Committee 5/22/14
Approved by the EE Faculty 5/29/14
Approved by Curriculum Committee 3/6/17
Approved by Curriculum Committee 12/5/18
Approved by the ECE Faculty 12/6/18

Introduction

This document sets forth the procedures to be followed to periodically assess and improve the important aspects of our BSEE degree program. Implicit in this process are the department's desires to provide the best possible undergraduate education to our students while serving the department's mission and objectives, and to maintain our high standing as one of our nation's elite programs of undergraduate education in electrical engineering. This document contains a description of our current program as well as procedures for the periodic review and improvement of

- our BSEE program educational objectives
- what we expect our students to learn (student outcomes)
- methods used to assess student learning
- the overall BSEE educational strategy of the department
- the sequence of courses in major undergraduate concentration areas
- individual BSEE course offerings
- the manner in which we assess and evaluate our effectiveness in reaching our BSEE program educational objectives
- this program of continuous improvement

Figure 1 describes, in schematic form, the flow of information surrounding the delivery of our BSEE program to our students and the controls that operate to ensure continuous improvement of the program. In brief, the chart divides the processes into daily, quarterly, yearly, and periodic (2-3 year) activities:

Daily Activities
On a daily basis, the members of the faculty create course materials and teach the students. The course materials are developed through the research activities of the faculty and the continuous infusion of new ideas and information about new technologies. Minor changes in the presented materials are not documented. Larger changes may be documented in end-of-course reports and Master Course Descriptions. The advising office provides an ongoing resource to our students, checking that their course choices and grades comport with program and university graduation requirements.

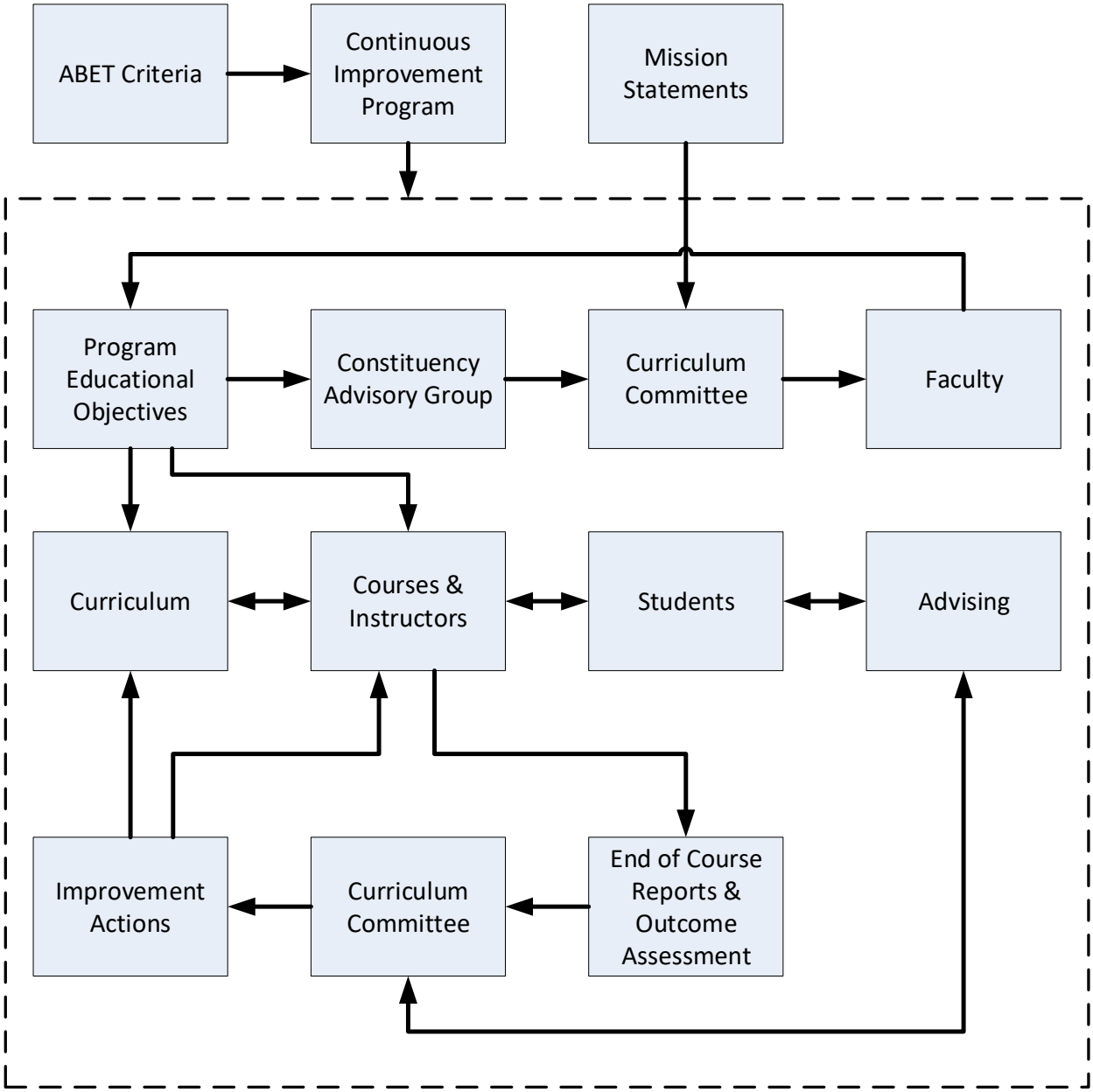

Figure 1. Overview of the Continuous Improvement Program for the BSEE degree.

Quarterly Activities

Each undergraduate course instructor generates an end-of-course (EOC) report which is submitted through an automated, on-line system. The report data are filed into an ABET database. In addition, instructors of selected undergraduate courses will include any assigned student outcome assessments as part of their end-of-course report. Instructors are expected to suggest course improvements if any student outcomes are not meeting the levels of competent or exemplary.

Yearly Activities

During Fall Quarter, the ABET Coordinator briefs the Curriculum Committee on assessment results for student outcomes assessed in the previous academic year. The Curriculum Committee considers student outcome achievement against desired achievement, and determines if course improvements at the instructor level have been adequate or whether

there is a need for changes at the syllabus or curriculum level to address identified deficiencies in student outcomes. If changes are needed at the syllabus level, the course coordinator will be requested to formulate a new course syllabus and Master Course Description (MCD) and present this to the Curriculum Committee for approval. If changes are needed at the overall curriculum level (i.e. issues involving multiple courses), the Curriculum Committee will assign the appropriate faculty to develop and present a solution within one year.

The ABET Coordinator consults the ABET website to determine if any changes have been made in the ABET process that require actions by the program. The ABET Coordinator determines which student outcomes are to be assessed in the current academic year and makes assessment assignments to instructors of specific courses. New or changes to capstone design courses are also reviewed for compliance with the capstone design course principles within the Curriculum Committee.

In Spring Quarter, Seniors are surveyed either by experienced interviewers from the university's Center for Teaching and Learning (CTL) using a small group instructional diagnostic techniques, or by on-line questionnaires administered by the ABET Coordinator. The ABET Coordinator compiles all of these survey results into the annual report to the Curriculum Committee. Also during Spring Quarter, each of the undergraduate concentrations (tracks) are reviewed and presented to the Curriculum Committee by the group chairs.

Activities every 2 – 3 years
Following the strategic plan of the department, several new professors may join the faculty, bringing new expertise and enthusiasm. The department mission statement is reviewed. Membership in the constituency advisory group is reviewed. The constituency advisory group (selected from regional employers, alumni, students, and department faculty) reviews the program educational objectives. The Curriculum Committee reviews student outcomes for consistency with these program educational objectives. Biennial surveys of alumni are conducted by the *Office of Educational Assessment* and results are distributed.

1. Mission and Constituencies

The current mission and objectives statement of the department was adopted in 2016. It speaks to our role as a department in an institution active in undergraduate and graduate education, research and service:

We educate and develop tomorrow's leaders to solve the world's biggest problems. We are committed to broadening participation in STEM. We provide our students with a strong technical foundation, refined communication skills and group project work. We hire and retain exceptional faculty to develop an innovation ecosystem. We provide electrical and computer hardware fundamentals and promote an entrepreneurial mindset. We foster an innovation hub by partnering with industry, government and regional sponsors.

We recognize that our students have very diverse interests and talents, and although the majority may find employment in one of the many specialties or interdisciplinary activities in industry or academe to which electrical & computer engineers traditionally gravitate, we

also expect some of our alumni to build careers in business, law, health care, government or other professions. Regardless of the intended career, our educational objective is to have them use the analytical discipline problem-solving experience and collaborative skills of their undergraduate education in creative endeavors as professionals and to avail themselves of opportunities to learn new skills and advance their careers through continuing education.

The Department of Electrical Engineering, in its role as a provider of a highly technical undergraduate education, sees the citizens of the State of Washington as one of its primary constituencies. The part of this broad constituency that best understands our role and benefits most directly from our efforts, and therefore has been chosen to represent the community at large, is the group of regional industries that employ our graduates. Generally, representatives of three or four such industries are invited to join our constituency advisory group. Our constituencies also include our students, our alumni, and our faculty, generally represented by the department chair and the ABET Coordinator.

2. Program Educational Objectives

The current program educational objectives, revised and (to be) adopted in Autumn 2018, read as follows:

The educational objectives of the University of Washington, Seattle, Bachelor of Science in Electrical Engineering (BSEE) degree program are to serve the needs of our students, faculty, and regional industry by producing graduates who have acquired foundational knowledge and skills through a comprehensive curriculum and immersive educational and developmental experience. Our graduates are expected to have achieved all of the ABET Criterion 3 student outcomes:

(1) **Problems** An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(2) **Design** An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

(3) **Communication** An ability to communicate effectively with a range of audiences

(4) **Responsibility** An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

(5) **Teams** An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

(6) **Experiment** An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

(7) **Learning** An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Our curriculum is expected to be compliant with ABET Criterion 5 and to provide a rich, balanced, and contemporary educational pathway for our students to optimally develop the skills and habits which will carry them through their life and career. We expect our graduates to be well prepared for entering the workforce, to be able to rapidly grow and adapt to their fast changing world, and to rise to levels of leadership and impact in their chosen specialties. We expect our graduates to embrace change, challenge, innovation, and diversity while applying their creative talents toward the benefit of themselves, their communities, their region, and the world at large.

3. Student Outcomes

The student outcomes to be achieved by our students by the time of graduation include all student outcomes mandated by ABET for programs in electrical engineering and augmented by the faculty, as desired, to reflect our program educational objectives. Implications of changes in the wording of student outcomes mandated by ABET from year to year shall be discussed by the faculty and implemented through the mechanisms described below for improvements to courses and concentration areas. Review of student outcomes shall occur after review of program educational objectives, if necessary, every third year, or sooner if there are changes in ABET Criterion 3.

The student outcomes are those stated in the current ABET Criterion 3, and listed in the program educational objectives above.

4. Assessment of Student Learning in EE Undergraduate Courses

Direct Assessment Methods

Direct assessments of student learning will be made *for the purposes of this Continuous Improvement Program only* through the use of rubrics, or as otherwise determined by the Curriculum Committee.

When rubric assessment is used, a generic rubric is used to assess each student outcome. Generic rubrics are prepared by the ABET Coordinator which categorize student achievement into four levels: novice, developing, competent, and exemplary. Competent and exemplary levels are considered to be meeting our achievement expectations, whereas novice and developing are not.

Each year, the ABET Coordinator will determine which student outcomes are to be assessed. For each student outcome to be assessed, the ABET Coordinator will determine the course offerings in which the student outcome is assessed. Selected course offerings will span the major concentration areas (tracks). Course offerings later in the curriculum (senior year where possible) are preferred. Selected course offerings will have content permitting rubric assessment of the assigned student outcome. The ABET Coordinator will determine the total number of evaluations of each rubric to be performed (not less than 25), and allot the evaluations to specific course offerings in proportion to enrollment. Course instructors will perform the rubric evaluations assigned to their course offering using a suitable ABET problem (which will necessarily differ from course to course) and randomly selected student work. The completed student outcome assessment and a copy of the ABET problem will be submitted as part of the end-of-course (EOC) report, which will be due within four weeks after the end of the quarter in which the course is offered. The ABET Coordinator will review the EOC reports and the student outcome assessments from the different courses and present these findings to the Curriculum Committee as described in the yearly activities above.

Indirect Assessment Methods

Students in every undergraduate class are given the opportunity to evaluate the quality of instruction through the use of instructional assessment surveys distributed by the *Office of Educational Assessment*. These instructional assessment surveys focus on course quality issues, availability of extra help, homework grading and textbook issues, and consequently are useful as a tool to triangulate with data developed by the senior surveys.

Every Spring, the *Center for Teaching and Learning (CTL)* will conduct group interviews with seniors registered in the several electrical engineering capstone design classes being offered that quarter. These interviews will direct discussion away from aspects of the particular capstone class toward more general discussions of the electrical engineering program as a whole. Topics will include (a) program strengths identified by the students, (b) changes recommended by students, (c) educational outcomes strongly supported by the program, and (d) educational outcomes least supported by the program. Actual student comments will be documented and grouped by topic. For those capstone courses which do not support the group discussion format, online survey questionnaires will be administered by the ABET Coordinator.

The ABET Coordinator will review the results of the CTL and online surveys and transmit the assessment results to the curriculum committee in the annual report.

Compliance and Process Improvement

The Advising Office will maintain records of submission of CIP materials, and report problems to the ABET Coordinator to promote compliance. The ABET Coordinator will report continuing non-compliance to the Department Chair. Faculty compliance with CIP procedures shall be addressed in all yearly faculty merit reviews conducted by the department chair.

Alternative student learning assessment methods will be recommended by the ABET Coordinator and discussed and approved by the Curriculum Committee. As faculty sophistication with assessment methods increases, the methods will be reviewed and improved from time to time. The ABET Coordinator will monitor overall departmental compliance with established assessment procedures and make suggestions for revisions as appropriate.

5. Undergraduate Educational Strategy

The educational strategy of the department is designed to reflect departmental objectives while meeting all the graduation requirements of the University and specific program requirements of ABET. Within that framework, a great deal of innovation is possible. Continuing discussions of curricular structure is the hallmark of an active and committed faculty. Major revisions of overall curricular structure shall be undertaken with great care, overseen by the curriculum committee, following discussions with the department's constituencies and motivated by a conviction that improvement in the department's ability to achieve our objectives will result.

6. Review of Undergraduate Courses and Concentration Areas

Instructors shall submit an end-of-course (EOC) report within four weeks of the end of the quarter. An on-line form is available for this purpose at

https://vannevar.ece.uw.edu/cgi-bin/operations/advising/course_db/eoq_main.pl

The end-of-course report will address all significant educational and/or administrative issues that arose during the teaching of the class the previous quarter. Instructors will also comment on the educational outcome achievements of the class. If problems are noted, solutions should be proposed. The Associate Chair for Education will act as group chair for core courses and for courses not presently associated with a particular group (orphan courses). The ABET Coordinator will monitor faculty compliance with this process. Non-compliance will be reported to the group chair to promote compliance. The group chair shall report continuing non-compliance to the department chair.

Group chairs will consult with instructors and/or course coordinators if a problem is detected with any course under their purview. The Associate Chair for Education will represent core courses and orphan courses, if necessary.

Once each year, group chairs shall prepare a review document analyzing the ability of each major concentration area (track) within the group to meet student outcome expectations and shall present these results at a curriculum committee meeting. The curriculum committee will seek to improve those tracks for which problems are detected, documenting recommendations, and revisiting the issues as new data becomes available.

All documents reflecting track analysis and recommendations of the Curriculum Committee will be forwarded to the ABET Coordinator and archived by the Advising Office.

7. Review of the Continuous Improvement Program

The department shall maintain the position of ABET Coordinator. An ABET Committee consisting of members of the faculty and representatives of the advising office may from time to time be appointed to assist the ABET Coordinator. The ABET Coordinator will assure the smooth running of the Continuous Improvement Program described herein.

The ABET Coordinator will review materials on the official ABET website on a yearly basis to maintain familiarity with changes in ABET requirements for programs in electrical engineering and, if necessary, recommend modifications to the CIP to accommodate such changes.

The ABET Coordinator will be the principal interface between the department and the College of Engineering and between the department and ABET on all accreditation matters.

In all years except those in which an ABET Self Study Report is written, the ABET Coordinator shall provide an annual report of the state of the Continuous Improvement Program to the department chair noting the educational assessment results, valuable comments and suggestions gleaned from student surveys, the improvements in the

undergraduate educational program that occurred since the previous report, the problems that were discovered during the course of the academic year and referred to the ABET Coordinator, as well as an analysis of all major changes instituted in courses, curricula and assessment methods. The report will also include updated schedules for review of program educational objectives by the department and its constituencies. The report will be in a format consistent with the structure of a Self Study Report. It is intended that these reports will provide a complete snapshot of the state of the Continuous Improvement Process in the department, and a resource for writing the next departmental self study report for accreditation purposes.

Approximately every third year, the ABET Coordinator will institute a comprehensive review of the Continuous Improvement Program and recommend changes to the faculty if deemed advisable.

The following table highlights the activities described above, showing their frequency and the party responsible for initiating the activity.

Activity	**Frequency**	**Responsible Party**
Distribute assessment evaluations to selected classes	Quarterly	ABET Coord
Conduct assessment of selected student outcomes in selected class	Quarterly	Instructor
Submit end-of-quarter report	Quarterly	Instructor
Note changes in ABET requirements for EE programs	Yearly	ABET Coord
Review student outcome data, performance criteria, assessment practices Report to Curriculum Committee for prior academic year student outcomes	Yearly	ABET Coord
Senior survey	Yearly	CTL
Professional group meetings to discuss course improvements; Report on student outcome coverage of concentration areas	Yearly	Group Chairs
Report on the state of the CIP	Yearly	ABET Coord
Review alumni surveys	2 years	ABET Coord
Review department mission	2-3 years	Faculty
Review constituency advisory group (CAG) membership	2-3 years	ABET Coord
Review program educational objectives	2-3 years	CAG
Review student outcomes	2-3 years	Curr Comm

Change History

April 12, 2007	Originally approved by vote of the EE faculty.
October 28, 2008	Modified by addition of outcome n.
June 15, 2013	Modified with revised Mission Statement.
December 5, 2013	Change History Section created. Figure 1 incorporated. Outcomes L, M and N removed, no longer required by ABET. Assessment of Program Educational Objectives removed, no longer required by ABET.

	Revised Program Educational Objectives incorporated. Minor process changes to reflect current practice.
May 28, 2014	Major modification of assessment process to focus on program assessment. Minor textual revisions.
March 6, 2017	Revised end-of-course (EOC) reports to include assigned student outcome assessments. Revised student outcome evaluation strategy into three levels: instructor, syllabus, and curriculum. Elimination of non-functioning task forces. Approved development of automated on-line EOC reporting system and ABET database.
December 6, 2018	Revised to reflect the 2016 department mission and objectives statement. Revised to reflect the new ABET Criterion 3 student outcomes. Revised to reflect the new program educational objectives (PEOs). Revised to include both CTL group discussion and online capstone student surveys. Revised the assessment cycle from a three-year rotation to cover all outcomes each year. Language adjustments to properly distinguish the program from the department and evaluation from assessment.