Continuous Improvement Program (CIP)

Approved by Curriculum Committee 5/22/14
Approved by the EE Faculty 5/29/14

Introduction

This document-sets forth the procedures to be followed to periodically assess and improve the important aspects of our undergraduate education 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 undergraduate program educational objectives
- what we expect our students to learn (student outcomes)
- methods used to assess student learning
- the overall undergraduate educational strategy of the department
- the sequence of courses in major undergraduate concentration areas
- individual undergraduate course offerings
- the manner in which we collect, analyze and evaluate evidence of our effectiveness in reaching our undergraduate program educational objectives
- this program of continuous improvement

Figure 1 describes, in schematic form, the flow of information surrounding the delivery of our undergraduate program to our students and the controls that operate to ensure continuous improvement of the program. In brief, the chart divides the processes into continuous (24/7), quarterly, yearly, periodic (2-3 year) and periodic (5-10 year) activities:

24/7 Activities
On a daily basis, the members of the faculty create course materials and teach the students. The course materials are informed by the research activities of the faculty and the continuous infusion of new ideas and information about new technologies. Minor changes in materials presented are not documented. Larger changes may be documented in end-of-quarter reports and catalog 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.

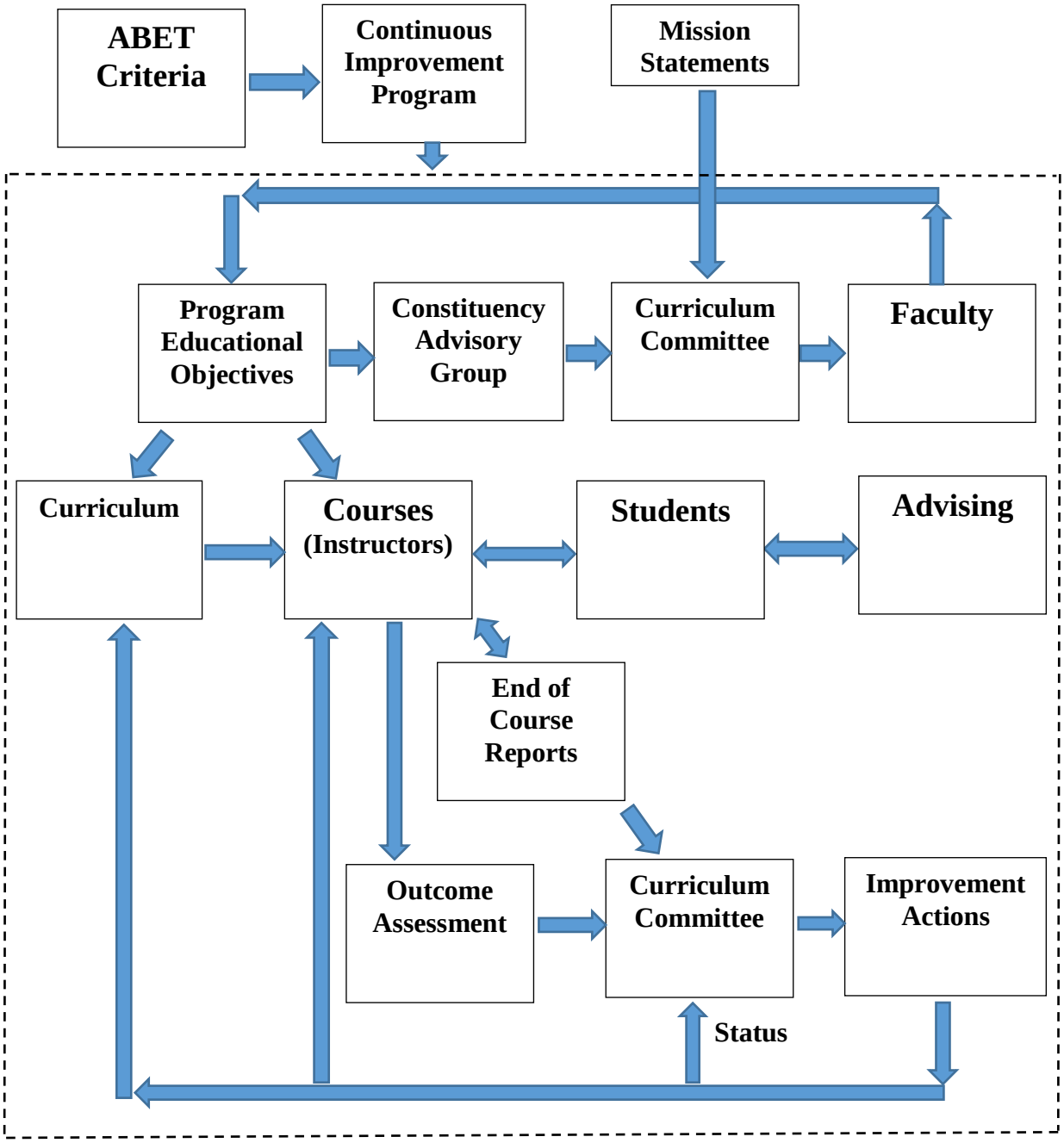

Figure 1 – Overview of the Continuous Improvement Program in Electrical Engineering

Quarterly Activities
Undergraduate instructors conduct assessment of selected student outcomes in selected undergraduate classes. Each undergraduate course instructor generates an end-of-quarter report.

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 whether there is a need for improvement activity for each presented student outcome. If a need is identified, the Associate Chair for Education will appoint a task force to conduct improvement activities for a specific student outcome. The Task Force may conduct further assessment, consult with relevant course coordinators and instructors, and obtain agreement on actions to improve the subject student outcome. The Task Force reports its work to the Curriculum Committee. Improvements are discussed by the Curriculum Committee and syllabus modifications, if any, are approved by the faculty.

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. A three year rotation of outcomes is used. The ABET Coordinator makes assessment assignments to specific courses. In Spring Quarter, Seniors are questioned by experienced interviewers from the university's Center for Teaching and Learning (CTL) using a small group instructional diagnostic technique. Results are transmitted to the ABET Coordinator.

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 employers, alumni, students, external graduate faculty and department faculty) reviews our educational objectives in light of the department's mission. The Curriculum Committee reviews student outcomes for consistency with the program educational objectives. After completing all program and university degree requirements, the typical student graduates. Biannual surveys of alumni are conducted by the *Office of Educational Assessment* and results are distributed.

Activities every 5 – 10 years
A new strategic plan is written. Our alumni develop their careers and feed their experiences as professionals back to our department through alumni surveys and membership in our constituency advisory group.

1. Mission and Constituencies

The current statement of the mission of the department was adopted in academic year 2011-12. It speaks to our role as a department in an institution active in undergraduate and graduate education, research and service:

> *The mission of the Electrical Engineering Department at the University of Washington is:*
>
> *To nurture and develop tomorrow's engineering leaders in an environment of excellence in discovery with visionary researchers, by*

- *Providing world-class undergraduate and graduate education in Electrical Engineering*
- *Conducting high-impact research of technical influence and recognized excellence*
- *Addressing and formulating engineering solutions to aspects of the largest challenges facing humanity in health, energy, the environment, and in people-centric systems*

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 companies that employ our graduates. Generally, representatives of three or four such companies are invited to join our constituency advisory group. Our constituencies also include our students, our alumni, faculty at top-ranked graduate schools to which our graduates go for advanced degrees and faculty of our own department, generally represented by the department chair and the ABET Coordinator. Representatives of the various components of our constituency advisory group shall be reviewed at least as often as once every third year.

2. Program Educational Objectives

The undergraduate program educational objectives of the department must reflect our mission, and are formulated in consultation with the department's constituencies and discussed and approved by the faculty.

The current statement of the undergraduate program educational objectives of our department, adopted by the faculty in December 2013, is as follows:

> *"The objective of the Department of Electrical Engineering at the University of Washington is to produce alumni who contribute to our society and to the economic base of our region, our nation and the world to the best of their abilities. 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 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."*

Review of the undergraduate program educational objectives of the department shall occur approximately every third year.

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.

The current list of student outcomes is as follows:

- *a: An ability to apply knowledge of mathematics, science and engineering*
- *b: An ability to design and conduct experiments, as well as to analyze and interpret data*
- *c: An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability*
- *d: An ability to function on multi-disciplinary teams*
- *e: An ability to identify, formulate and solve engineering problems*
- *f: An understanding of professional and ethical responsibilities*
- *g: An ability to communicate effectively*
- *h: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context*
- *i: A recognition of the need for, and an ability to engage in life-long learning*
- *j: Knowledge of contemporary issues*
- *k: An ability to use the techniques, skills and modern engineering tools necessary for engineering practice*

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 single generic rubric is used to assess each student outcome. Generic rubrics are prepared by the ABET Coordinator, usually with help from a Task Force, and archived with other ABET materials.

Yearly, the ABET Coordinator will determine which student outcomes are to be assessed, such that all are assessed in a three year cycle. 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) will be 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, and return the completed evaluations, with a copy of the ABET problem, to the ABET Coordinator within two weeks of the end of the quarter in which the course is offered. The ABET Coordinator will combine the rubric evaluations from different courses to obtain an assessment result for each student outcome being assessed. These results are reported 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, etc., 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 an extensive series of 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.

The ABET Coordinator will review the results of the CTL survey and transmit the analysis to the curriculum committee, the electrical engineering faculty as a whole, or the department chair, as appropriate.

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-quarter report to the advising office within four weeks of the end of the quarter. An on-line form is available for this purpose at

www.ee.washington.edu/ABET/end_of_quarter_report.html.

The end-of-quarter 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. Upon receipt of the end-of-quarter reports, the Advising Office will archive the reports for the benefit of future instructors and to provide copies to the group chairs upon request. 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	Yearly	ABET Coord

outcomes		
Senior survey	Yearly	CIDR
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
Write a new strategic plan	5-10 years	Faculty

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.