Assessment Plan

for
Electrical and Electronic Engineering

Approved by the EEE Faculty
on 4/3/2013

Processes Used by the EEE Department Faculty to Monitor and Assess the Achievement of Student Outcomes and Educational Objectives

Introduction

This report describes the processes now used by the EEE Department faculty to monitor and assess Student Outcomes (SO), and Educational Objectives (EO) – both of which have been established according to due process and the guidelines of ABET, the accrediting agency for our undergraduate programs. Student Outcomes are defined as that knowledge and those abilities that students should be able to demonstrate at the time of their graduation with the B.S. degree, and Educational Objectives are those professional characteristics that students should be able to demonstrate approximately 5 years after graduation. The processes are graphically summarized in Figure 1 (Student Outcomes) and Figure 2 (Educational Objectives) below.

Student Outcomes (SO)

Excerpted from ABET General Criteria 3 for Accreditation of Engineering Programs, 2013-2014

"The program must have documented student outcomes that prepare graduates to attain the program educational objectives. Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(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 multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice."

Educational Objectives

The EEE Department Educational Objectives are:

I. Core Knowledge: Our graduates will have careers in electrical engineering, or be engaged in a related career path.
II. Application of Knowledge: Our graduates will apply their knowledge and skills to solve practical engineering problems.
III. Life-long Learning: Our graduates will continue to develop their skills and seek knowledge after graduation in order to adapt to advancing technology and the needs of society. This may be indicated by the graduate's pursuit of an advanced degree or other formal instruction, and/or that the graduate has developed a professional specialty.
IV. Professionalism: Our graduates will have the necessary professional skills, such as high ethical standards, effective oral and written communications, and teamwork, to be productive engineers and to advance in their careers.

Course Level Assessment

We have established a quantitative Course Embedded Assessment (CEA) process that encompasses all of our classes, required as well as elective, graduate as well as undergraduate, which are included in the degree programs of our major students. Each University approved course in our curricula has specific course outcomes listed on the official ABET outline for the course. On an annual basis, the designated faculty Course Coordinators each present a report to the department faculty reflecting on student achievement with regard to the specific course outcomes of the courses for which they are responsible, and suggest changes, if any, that they feel need to be made in order to improve the achievement of those outcomes.

This process is very useful because it enables faculty who may not be directly involved in specific courses to get a better understanding of those courses, and learn about best-practice adjustments that they may make. It allows new faculty and part-time faculty to acquire a better understanding of the curriculum and become familiar with the challenges that it faces. Also, the process ensures that faculty teaching related courses in each area of the curriculum will interact with each other on a regular basis when preparing the CEA report for a particular course. Equally important, the CEA reports provide the documentation necessary to illustrate how the faculty are using quantitative assessment results for continuous program improvement.

The CEA process also includes indirect (qualitative) measures of student satisfaction with the quality of instruction and their achievement of the course outcomes through Student Evaluations of Teaching (SET) surveys. These surveys are conducted for each course in each semester that the course is offered.

Program Level Assessment

Outcome and objective assessment at the program level is carried out by using a variety of assessment tools:

1. Direct measurement via course embedded assessment, with course outcomes mapped to student outcomes
2. Student and alumni surveys reflecting on ABET specific program outcomes
3. Site visits to industry reflecting on the ABET program educational objectives
4. Qualitative feedback on the achievement of program outcomes and educational objectives from the department-level Industry Liaison Council (ILC)
5. Qualitative feedback from College's Industry Advisory Board (IAB)
6. Faculty surveys

In general, both direct (quantitative) and indirect (qualitative) assessment methods are used to monitor student outcomes. However, in some instances it is appropriate to rely on qualitative indicators, rather than or in preference to quantitative ones, to assess the achievement of a particular outcome (e.g. qualitative feedback and specific action items resulting from discussions by the Department's Industry Liaison Council or the College's Industry Advisory Board). The assessment of objectives is done entirely using indirect (qualitative) methods.

Assessment Instruments

In order to meet current ABET Engineering Criteria for accreditation with respect to assessment, we use the following assessment instruments in our programs:

Focused Assignments and Examinations: Assignments and examinations including midterm and final exams are required in all courses. In addition, projects, computer aided design (CAD) and term papers are required in several classes as appropriate. These form the basis for quantitative evaluation of course outcomes. An example rubric for the evaluation of course outcomes from assignments and examinations is shown below. Each course outcome is then mapped into a relevant ABET educational outcome and becomes part of the quantitative base for the assessment of that SO.

EEE (course number) Rubric for the Direct Assessment of Course Outcomes

Course Outcome	Exceeds Expectations	Meets Expectations	Below Expectations
1) Enter the first Course Outcome here	Enter how a student will perform if they exceed expectations for this outcome	Enter how a student will perform if they meet expectations for this outcome	Enter how a student will perform if they are below expectations for this outcome
2) Enter the second Course Outcome here	Enter how a student will perform if they exceed expectations for this outcome	Enter how a student will perform if they meet expectations for this outcome	Enter how a student will perform if they are below expectations for this objective
3) Enter the third Course Outcome here	Enter how a student will perform if they exceed expectations for this outcome	Enter how a student will perform if they meet expectations for this outcome	Enter how a student will perform if they are below expectations for this outcome
4) Enter the fourth Course Outcome here	Enter how a student will perform if they exceed expectations for this outcome	Enter how a student will perform if they meet expectations for this outcome	Enter how a student will perform if they are below expectations for this outcome
5) Enter the fifth Course Outcome here **(It is advisable to limit the number of course outcomes to 5 or less to ease data collection)**	Enter how a student will perform if they exceed expectations for this outcome	Enter how a student will perform if they meet expectations for this outcome	Enter how a student will perform if they are below expectations for this outcome

Surveys of Graduating Students: Graduating students are surveyed at the time of graduation for their perceptions about the how well they have achieved the program's educational outcomes, our relative success in delivering those outcomes, and suggestions for program improvement.

Alumni Surveys: the Office of Institutional Research (OIR) surveys Alumni from our program every three years. The survey questions include several that are directly related to the achievement of our Educational Objectives.

Site Visits: At the end of each semester, faculty teams visit a company that employs several graduates from our program in order to meet directly with a group of our alumni and their managers. Typically the alumni include recent graduates (1-5 years out), as well as experienced engineers and managers (6-10 years out, 11 years and over). A set of open-ended questions is distributed to the site prior to the visit to provide a foundation for discussion with the participants. Specific questions related to the achievement of educational objectives are also given to the alumni. The interviews are recorded during the visit and placed on the Web for subsequent faculty review. A written transcript is also produced and shared with all faculty members. The Assessment and Accreditation Committee (AAC) of the department analyzes these results, and action items with appropriate timelines are developed for implementation.

Employer Surveys: The College's Career Planning and Placement Office periodically surveys regional employers and provides us with salary data and relevant information concerning the professional growth trends and employment opportunities in our disciplines.

Industry Liaison Council: This is a department level council made up of engineers from industry representing all major areas of emphasis in the EEE program. The ILC meets biannually and provides the faculty with independent feedback on its efforts to achieve the program Educational Objectives.

Industry Advisory Board: At the college level, the IAB receives reports from each program on a biannual basis and evaluates each program's success in implementing the strategic plan of the college. The IAB meets in executive session following the presentations and reports back to the Program Coordinators, Department Chairs and the Dean with specific recommendations for follow up and action.

Our ultimate goal is to utilize these various assessment instruments to make continuous improvements to our programs.

Course Embedded Assessment represents the "bricks and mortar" of our assessment program. Our experience shows that assignments and exams in individual courses provide immediate and valuable feedback to both the student and the faculty. Problems specifically designed to assess the achievement of particular course outcomes allow the faculty to identify potential problems the students may be having in achieving those outcomes. If the performance of a significant number of students on a targeted exam problem or assignment indicates that they have not achieved a desired course outcome, it immediately triggers discussion among the faculty in the area of how to improve students' achievement of that particular course outcome. If the problem is seen to require broader interaction among the faculty of the department, the findings and recommendations of the area faculty are summarized by the Course Coordinator and then presented to the entire department faculty for action.

Indirect program level assessment in general provides us with a supplemental view of our educational outcomes and objectives, and of how well they are being achieved, from several different perspectives – that of our graduating students, our alumni, our advisory boards, the managers in industries that employ our graduates, and the faculty. The survey data from these constituencies are collected by the AAC, which then provides a periodic report and recommendations for improvement to the entire department faculty.

Graduate Level Assessment

Although ABET does not accredit our graduate programs, we follow similar ABET guidelines in their assessment. The student outcomes of the graduate program, however, have been redefined to be appropriate for graduate-level education. Both student outcomes and educational objectives are evaluated at the graduate-level using the same types of instruments as described above for our undergraduate assessment.

The EEE Department has developed a detailed and clear assessment plan for the B.S. program. Our M.S. program assessment plan is modeled on our undergraduate assessment plan. The Department has the following student outcomes at the program level:

1) A knowledge of advanced mathematics
2) A knowledge of applied engineering
3) The ability to apply knowledge of mathematics, science and engineering to solve problems in E&EE
4) A knowledge of core and advanced E&EE topics
5) Depth in at least one area of E&EE out of Analog/Digital Electronics, Control Systems, Communications and Power
6) The ability to use contemporary engineering techniques and tools for analysis and design
7) The ability to work with modern instrumentation, software and hardware, design and perform experiments, and analyze and interpret the results
8) The ability to communicate effectively

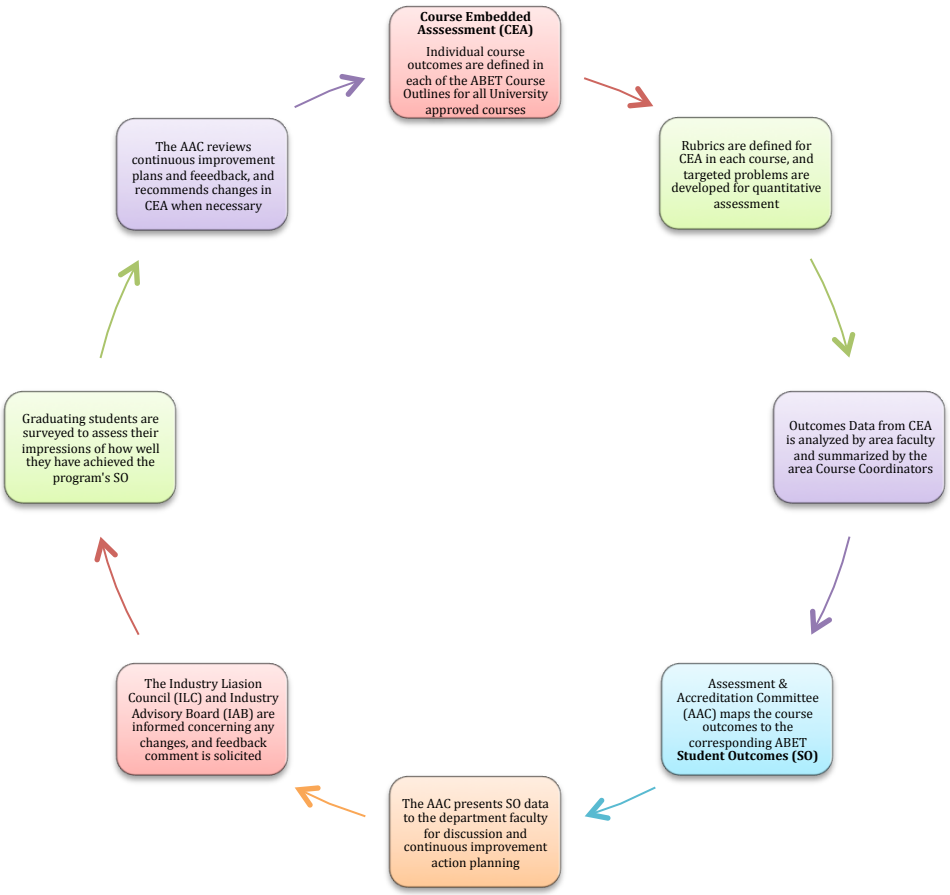

Figure 1: Flowchart of Student Outcomes assessment in Electrical & Electronic Engineering

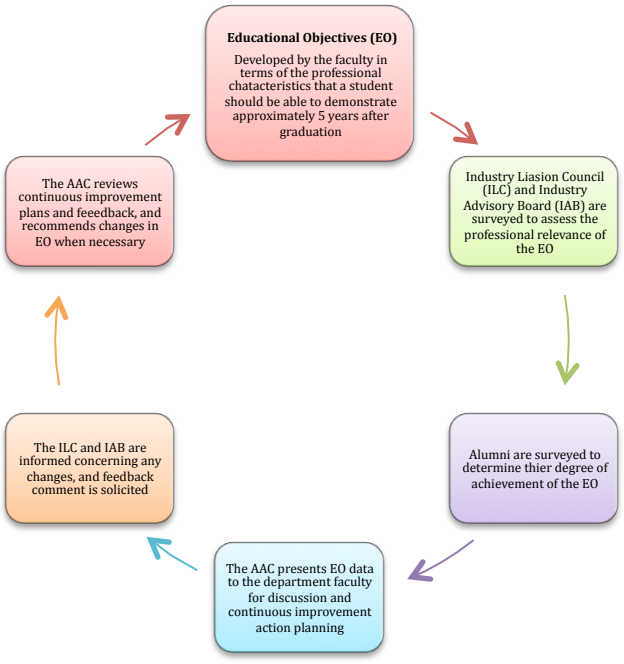

Figure 2: Flowchart of Educational Objectives assessment in Electrical & Electronic Engineering

CSU 120/180 Units Curriculum Map

Campus: Sacramento

Degree (BA, BS…): BS

Major: Electrical and Electronic Engineering

Concentration:

Total units: 122

GE Area requirements double counted with major or other requirement: 12 A3, E, C,D

Please attach sheet detailing exceptions requested.

			ENGR1 - Introduction to engineering	Math 30 - Calculus I	Chem 1E Chemistry for Engineers	Engr 50 - Comp methods and App	Math 31 - Calculus II	Phys 11A - Gen Phys - Mechanics	EEE64 - Intro to Logic Design	Math 32 - Calculus III	Phys 11C - Gen Phys - Elec & Mag	Engr 17 - Circuit Analysis	Math 45 - Differntial Equations	EEE117 - Network Analysis (Circuits II)	EEE130 - Electromechanical Conversion	EEE161 - Applied Electromagnetics	EEE 180 - Signals and Systems	EEE108 - Electronics I	EEE174 - Introduction to Microprocessors	EEE184 -Introduction to Feedback Systems	EEE109 - Electronics II OR EEE141 +EEE143	EEE185 - Modern communication systems	Engr120 - Probability and Random Signals	ENGR140 - Engineering Economics	EEE192A&B OR EEE193A&B Senior Design	Electives
		All courses required for graduation →																								
		Number of Units →	1	4	4	3	4	4	4	4	4	3	3	4	3	4	3	4	4	4	3	4	3	3	2	4	13
Student Learning Outcomes (identify all required for accreditation, certification, or licensure)	**Accreditation Student Outcome A** Apply math, sci and engineering knowledge	Content Level → (Introduced, developed, mastered)		I	I		I	D	I	D	D	D	D	D	D	D	D	D	D	M	M	M	M		M	
	Accreditation Student Outcome B Experiments, analyze and interpret data				I			I	I		D			D		D		D	D		M		D		M	
	Accreditation Student Outcome C Design to meet needs within constraints								I			D				D		D	D	M	M	M	D	D	M	
	Accreditation Student Outcome D Work in multidisciplinary teams			I	I		D	D		D	D	D	D	D					D		M				M	
	Accreditation Student Outcome E Identify, formulate, solve engineering problems		I					I				I		D	D	D	D	D	D	M	M	M	D		M	
	Accreditation Student Outcome F Professional ethics		I																						M	
	Accreditation Student Outcome G Communicate effectively		I	I	I			I	I					D		D		D	D		M				M	
	Accreditation Student Outcome H Breadth for understanding engineering in many contexts		I												D	D		D	D	M					M	
	Accreditation Student Outcome I Life long learning		I																					D	M	
	Accreditation Student Outcome J Use modern engineering skills & tools for practice								I			D		D		D	D	D	D	M	M		M		M	
Program Outcomes	**Program Outcome 1** Enter professional employment or graduate study in electrical and electronic engineering											I		D	D	D	D	D	D	M	M	M	M	D	M	
	Program Outcome 2 Ause principles of science, math, and engineering to identify, formulate and solve electrical and electronic engineering problems			I	I		I	I	I		I	D	I	D	D	D		D	D	M	M	M	M		M	
	Program Outcome 3 Apply creativity in design of systmens, components, processes, and/or experiments working in multidiscplinary teams								I			I							D	M	M				M	
	Program Outcome 4 Communicate effectively through speaking, writing, and graphics using appropriate technology			I	I		I	I	I		D	D								D	M				M	

	Program Outcome **5** Apply knowledge of professional, ethical, social responsibilities, diverse cultures and life long learning in professional career			**I**	**I**																			**D**	**M**	
CSU GE Area A	**GE Area A1--Oral Communication** 3 units																									
	GE Area A2--Written Communication 3 units																									
	GE Area A3--Critical Thinking 3units			**I**	**I**		**I**	**D**			**D**	D				D		**D**		**M**	**M**	**M**				
CSU GE Area B	**GE Area B1--Physical Science** 3units																									
	GE Area B2 --Life Science 3units																									
	GE Area B3--Laboratory Science (with B1 or B2 course) 3units																									
	GE Area B4--Math/Quantitative Reasoning 3units																									
CSU GE Area C	**GE Area C1--Arts, Cinema, Dance, Music, Theater** 3units																									
	GE Area C2--Lit, Phil, Language (not English) 3units																									
	GE Area C 3units																									
	GE Area C 3units																									
CSU GE Area D	**GE Area D** (Must be taken in more than one area) 3units																									
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	GE Area D (Must be taken in more than one area) 3units																									
	GE Area D (Must be taken in more than one area) 3units																									
CSU GE Area E	**GE Area E** 3units																									
American Institutions	**American Institutions: US History Constitution** Varying units																									
	American Institutions: California and local gov. Varying units																									