Bachelor of Science in Engineering Accreditation Information

The Bachelor of Science in Engineering Degree (BSE) is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET), http://www/abet/org. Motivated from a Mission Statement, the degree strives to achieve specific Program Educational Objectives (PEOs) and Student Outcomes (SOs), determined in consultation with constituents. A Continuous Improvement Process guides program management. Below we detail the mission, objectives, outcomes, and improvement process. Note that PEOs and SOs were revised during the 2011-2012 academic year to the ones shown here. The PEOs and SOs in place from prior to 2006 until 2012 are included at the end of this document.

Bachelor of Science in Engineering Degree Program Mission Statement

The BSE Program enables students to obtain an ABET/EAC accredited, interdisciplinary Bachelor of Science degree with specializations in civil, electrical, environmental or mechanical engineering. We emphasize fundamental engineering science and design principles to provide a viable basis for life-long learning and expose our students to the cutting edge of engineering research and practice. The education that we offer provides breadth and disciplinary focus relevant to the CSM Mission in energy, earth, and materials. Most importantly, our graduates acquire the technical and social tools, ethical foundation, vision and sense of inquiry that allows them to be team players in the formulation and realization of solutions to society's most significant problems.

Program Educational Objectives

Within three years of attaining the BS degree:

1. Graduates will be situated in growing careers in their chosen engineering fields or will be successfully pursuing a graduate degree. (As measured by the career center)
2. Graduates will be advancing in their professional standing, generating new knowledge and/or exercising leadership in their field. (As measured by reported promotions, project responsibilities, post-graduate education, etc.)
3. Graduates will be contributing to the needs of society through professional practice, research, and/or service. (As measured by membership in professional societies, research position, and reported service work)

Student Outcomes (ABET (a)-(k))

Upon graduation students will have

(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.

Continuous Improvement Process

The assessment process for the Engineering program is shown in Figure 1. The process has two loops, or cycles. The innermost cycle performs the assessment of individual courses and is done semiannually
(i.e., twice a year), or each time the course is given. The outermost cycle is the overall program assessment process, which incorporates the course assessment cycle as a key element. This cycle is done on a biennial basis (i.e., every two years).

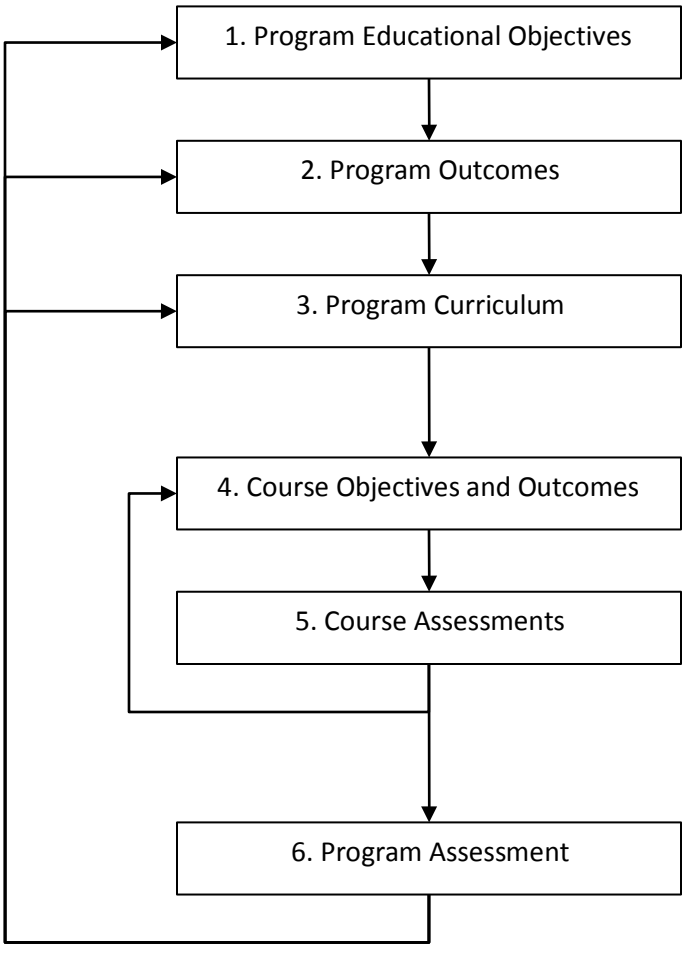

Figure 1 The Engineering program assessment process is comprised of an inner course assessment cycle (done semiannually) and an outer program assessment cycle (done biennially).

1 Overview of Process

1. The process begins by developing a mission statement and program educational objectives for the Engineering undergraduate program. The mission statement and educational objectives are developed in concert with our core constituents of students, faculty, industry representatives, and alumni.

2. Next, we develop student outcomes that are consistent with the achievement of our objectives and the fulfillment of our mission. These educational outcomes are equivalent to the ABET (a)-(k) Student Outcomes of Criterion 3 of Engineering Criteria 2000 from the Accreditation Board for Engineering and Technology (ABET).

3. Faculty from each specialty (electrical, mechanical, civil, and environmental engineering) work together to design an overall curriculum to achieve program outcomes. The curriculum plan specifies the required courses for each specialty, as well as their descriptions and normal schedule of offerings. The curriculum for the Engineering program can be found in the CSM Bulletin.

4. Student outcomes flow down into course outcomes. Course coordinators (the faculty responsible for each course) define objectives and outcomes for each individual course. Course outcomes are mapped to overall student outcomes to ensure that the curriculum covers the desired outcomes.

5. Next, metrics and processes are devised for measuring individual course outcomes. Course instructors collect and analyze quantitative assessment data relating to the metrics. Based on the assessment data, modifications to the courses are designed and implemented.

6. Finally, the program as a whole is assessed on a biennial basis (i.e., every two years). The Undergraduate Curriculum Committee writes a report on the strengths and weaknesses of the program – including curriculum, processes, metrics, objectives, and outcomes. Recommendations are formulated and presented to the faculty, and an implementation plan is devised. If the curriculum needs to be changed, the process starts again at step 3. Or, if the fundamental program educational objectives or student outcomes need to be changed, the process starts again at steps 1 or 2, respectively.

2 Process Entities and Constituencies

The principal entities and constituencies in the program assessment process are shown in Figure 2. The Undergraduate Curriculum committee has the central role in the assessment process. It is composed of a faculty member from each of the specialties in the Engineering program. The committee reports to the EG Dean. The chair of the curriculum committee ensures that information is flowing along the lines defined by the chart.

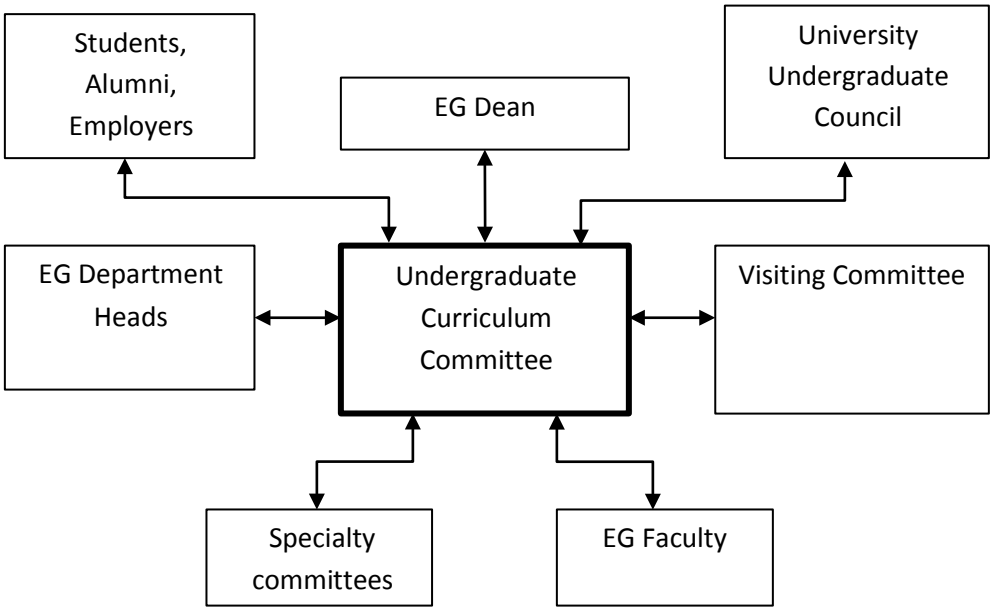

Figure 2 Entities and constituencies in program assessment process.

The Undergraduate Curriculum Committee is responsible for making sure that the curriculum as a whole is designed to meet and measure the goals stated above.
The committee collects assessment material from a variety of sources, including:

- Individual course assessment reports
- Student, alumni, and employer contacts and surveys
- The university undergraduate council representative
- Meetings of the Visiting Committee
- Feedback from EG faculty

The committee meets regularly to evaluate this material. Problem areas are identified and, if needed, more data is gathered. This data is shared with the faculty, the Department Heads, and the Dean. Periodically, the faculty (and external constituencies such as the EG Visiting Committee) will be asked to review the mission statement and educational objectives for the program. The Undergraduate Curriculum Committee collects feedback from these sources and writes a biennial report detailing its findings and recommendation of courses of action.

The Undergraduate Curriculum Committee works closely with subcommittees in each of the specialties (electrical, mechanical, and civil engineering). These specialty committees meet regularly to deal with detailed curriculum issues within each specialty. The specialty committee consists of all faculty within that specialty. It is the responsibility of the specialty committees to ensure that each course in their area has a syllabus that reflects the required content and that instructors do indeed cover that material.

3 Detailed Process Steps

The course assessment process and the program assessment process both follow the same overall steps. Specifically, these are:

- *Measure* – determine quantitative metrics to measure outcomes and collect data
- *Analyze* – focus on key points and summarize
- *Decide* – devise recommendations for modifications and improvements, in consultation with constituents as needed
- *Implement* – create an action plan, delegate as necessary, and implement the improvements

Each of the steps is documented in the form of memos, meeting minutes, and tabular and/or graphical data showing analysis. The purpose is to show how decisions and actions taken affect the development of the program.

3.1 Course Assessment Process

The detailed process steps for course assessment are explained below.

- *Measure*. The instructor for each course (or the course coordinator, in the case of large multi-section courses) devises metrics to measure the course objectives and outcomes. These typically take the form of tests, homework, and surveys. Appropriate rubrics are devised to help quantitatively measure projects. The instructor collects this data during the delivery of the course. Additional data can take the form of feedback from alumni, employers, other faculty, the specialty committees, or the Undergraduate Curriculum committee.

- *Analyze*. The instructor (or the team, in the case of a large multi-section course) analyzes the data and documents the results in the form of memos that go into the Course Assessment File. Also recorded are observations on how improvements from previous years have affected the course this time.

- *Decide*. After the course is over, the instructor (or team) decides on recommendations for improvements. Substantial changes (such as changes to objectives and outcomes), and changes that affect other courses, are presented, discussed, and approved at a specialty committee meeting. The recommendations of the specialty committee are then reviewed and approved by the Undergraduate Curriculum Committee, and ultimately by the entire EG faculty.

- *Implement*. The instructor devises a course of action to implement the improvements. In most cases, these will be minor changes to the way the course is taught. Finally, the instructor fills out a form, called the “End of Term Assessment”, which is filed in the Course Assessment File.

3.2 Program Assessment Process

The detailed process steps for program assessment are explained below.

- *Measure*. The Undergraduate Curriculum Committee devises metrics to measure the overall program objectives and outcomes. These include the individual course assessment forms, exit surveys from graduating seniors (data provided by the Dean), alumni and employer surveys (data provided by the EG Publicity committee). Additional data can take the form of feedback from faculty, the specialty committees, or the University Undergraduate Council. The committee collects this data on an ongoing basis.

- *Analyze*. The Undergraduate Curriculum Committee meets regularly to analyze the data. The committee will task the specialty committees, or ad-hoc committees, as necessary to help with the analysis. Problem areas will be identified and, if needed, more data will be gathered. This data will be shared with the Dean and the faculty. Results in the form of memos are documented in the Program Assessment File. Also recorded are observations on how improvements from previous years have affected the program.

- *Decide*. The Undergraduate Curriculum Committee assembles recommendations from subcommittees and the faculty, and decides on overall recommendations. These recommendations are presented, discussed, and approved at a faculty staff meeting. An biennial report is written at the end of the academic year and filed in the Program Assessment File. This report, called the Engineering Program Assessment Report, includes the following sections: (1) Review of course assessments and other internal program metrics, (2) review of external assessments, (3) review of the assessment process, and (5) recommendations for change.

- *Implement*. The Undergraduate Curriculum Committee lists action items to be delegated to faculty and/or specialty subcommittees. The committee is responsible for seeing that the recommendations are communicated to course instructors. The committee may recommend the formation of an ad-hoc committee to address specific issues.

Program Educational Objectives and Student Outcomes, pre-2006 to 2012

(former) Engineering Division Objectives (ABET Criteria 2)

EG1 Graduates will understand the design and analysis of engineering systems and the interdisciplinary nature of engineering.

EG2 Graduates will incorporate an appreciation for issues involving earth, energy, materials, and environment in their professional practice.

EG3 Graduates will incorporate non-technical considerations (e.g., aesthetic, social, ethical, economic, etc.) in their professional practice.

EG4 Graduates will contribute to the needs of society through engineering and professional practice, research, or service.

(former) Engineering Division Outcomes (ABET Criteria 3)

EG1 Graduates will understand the design and analysis of engineering systems and the interdisciplinary nature of engineering.

a. Students will understand the broad fundamentals of mathematics, science, and

engineering (maps to ABET Criteria 3a)

b. Students will be able to specify, analyze, design, prototype (when appropriate), and test electrical, mechanical, civil, or environmental engineering sub-systems (maps to ABET Criteria 3b,c,e,k).

c. Students will be able to work in teams to specify, analyze, design, and integrate interdisciplinary engineering systems (maps to ABET Criteria 3d,e).

EG2 Graduates will incorporate an appreciation for issues involving earth, energy, materials, and environment in their professional practice.

a. Students will understand sustainability issues in the context of engineering systems development, deployment, and retirement (maps to ABET Criteria 3f,h,j).

EG3 Graduates will incorporate non-technical considerations (e.g., aesthetic, social, ethical, economic, etc.) in their professional practice.

a. Students will have an appreciation for the impact of engineering in global and societal contexts (maps to ABET Criteria 3f,h,j).

b. Students will understand their professional and ethical responsibilities as engineers (maps to ABET Criteria 3f).

EG4 Graduates will contribute to the needs of society through engineering and professional practice, research, or service.

a. Students will be able to find new information and use it effectively (maps to ABET Criteria 3g,k).

b. Students will be able to effectively share information with a diverse audience, through written and verbal communications (maps to ABET Criteria 3g,k).

c. Students will have a mastery of the fundamental knowledge necessary for continual learning (maps to ABET Criteria 3i).

d. Graduates will be prepared to assume positions of responsibility in industry or to enter graduate school.

e. Graduates will be active in professional and service organizations.