COMPUTER ENGINEERING
Student Outcomes Assessment Program (SOAP)

(Last updated May 11)

Department of Electrical and Computer Engineering
Lyles College of Engineering

I. Mission

The mission of the Department of Electrical and Computer Engineering is to fulfill the needs of the region and state by providing an undergraduate technical education in Electrical Engineering and Computer Engineering to a diverse group of students. The department strives to continually update its strong program of study in order to qualify its graduates for positions in industry located in the region and beyond, while providing sufficient breadth and depth in its program to assure its graduates a successful practice in the profession. At the same time, students are grounded in the rigorous scientific and theoretical foundations of the discipline in order to enable graduates to enter and be successful in any advanced level educational program of their choosing, and to allow them to build upon this strong foundation and extend it to new depths.

II. Program Objectives

The program awards degrees to students who within three to five years of graduation, through work experience and/or graduate education in the engineering field will be expected to,

a) Have grown technically and be productive in their respective workplaces.
b) Be capable of addressing technical problems of increasing complexity.
c) Communicate and function effectively in a team environment.
d) Demonstrate ability for independent learning and continued professional as well as ethical development.

As such, students in the Computer Engineering Program will

1. Be given the opportunity to learn a wide spectrum of topics in Computer Engineering;

2. Be well prepared to enter the engineering profession or further advanced study;

3. Obtain an engineering education which will be necessary for them to understand the impact of computer engineering-based solutions on issues in the complex domain of global society;

4. Be exposed to humanitarian issues concerning society in general, and the engineering profession in particular;

5. Be motivated to further develop their knowledge and skills as engineers;

6. Be exposed to contemporary tools and methodologies consistent with those used in

industry.

III. Student Learning Outcomes

The Computer Engineering program seeks to produce graduates with

Outcome 1 - Knowledge of applied differential and integral calculus and discrete mathematics.

Outcome 2 - Knowledge of probability and statistics, and the impact of these principles in engineering analysis.

Outcome 3 - Knowledge of core computer engineering, computer science and electrical engineering topics, and some depth in at least one area of computer engineering.

Outcome 4 - A broad education and knowledge of contemporary issues, necessary to reason about the impact of computer engineering-based solutions on situations arising in society.

Outcome 5 - The ability to use mathematical and computer based tools for analysis and design.

Outcome 6 - The ability to identify and synthesize solutions for computer engineering problems by making use of their knowledge and experience with basic science, mathematics, and engineering.

Outcome 7 - The ability to design, conduct, and evaluate the results of experiments.

Outcome 8 - The ability to analyze, design, and test systems that include both hardware and software.

Outcome 9 - The ability to document experimental processes and to write satisfactory technical reports/papers.

Outcome 10 - The ability to make technical oral presentations and interact with an audience.

Outcome 11 - The recognition for and the motivation to further develop their knowledge and skills as engineers.

Outcome 12 - The ability to work both independently and in multi-person teams.

Outcome 13 - An understanding of professional and ethical responsibility.

IV. Relevance of Outcomes to Program Objectives

The learning outcomes contribute to the program objectives as follows:

Objective 1 - ***The students will be given the opportunity to learn a wide spectrum of topics in Computer Engineering.***

This objective is accomplished via **Outcomes 3** and **4** where a broad knowledge in computer engineering, computer science and electrical engineering, is ensured (**Outcome 3**). A broad knowledge of contemporary issues (**Outcome 4**) is also emphasized.

Objective 2 - ***The students will be well-prepared to enter the engineering profession or further advanced study.***

All outcomes contribute to this objective. Knowledge of mathematics and statistical analysis (**Outcomes 1** and **2**), breadth and depth in engineering (**Outcomes 3** and **4**), engineering analysis and design (**Outcome 5** and **6**), and hands-on experience (**Outcome 7**) are essential technical attributes needed for practice. **Outcomes 9 - 13** monitor important soft skills of communication and teamwork which are important to a successful practice.

Objective 3 - ***The students will obtain an engineering education that is necessary for them to understand the impact of computer engineering based solutions on issues in the complex domain of global society.***

This objective is accomplished via **Outcomes 4**, **6**, and **13** where broad engineering education (**Outcome 4**), problem identification and synthesis (**Outcome 6**), and ethical conduct (**Outcome 13**), are direct contributors. Also, the general education component of the program contributes directly to this objective.

Objective 4 - ***The students will be exposed to humanitarian issues concerning society, in general, and the engineering profession, in particular.***

This objective is intertwined with **Objective 3** and it is accomplished via the general education component of the curriculum and **Outcomes 4** and **13**.

Objective 5 - ***The students will be motivated to further develop their knowledge and skills as engineers***

Outcome 11 contributes directly to monitoring this objective. **Outcomes 1**, **2**, **5**, **6**, and **12**, provide the demonstration of the necessary competencies needed to succeed in higher education, where knowledge of fundamentals is most needed.

<u>Objective 6</u> - ***The students will be exposed to contemporary tools and methodologies consistent with those used in industry***

Outcomes 5, **7**, and **8** ensure sufficient exposure to modern engineering tools to solve problems. Use of tools to perform computations (**Outcome 5**), conduct experiments (**Outcome 7**), and combine hardware and software (**Outcome 8**) are all directly relevant to accomplishing this objective.

Table 1. Objectives/Outcomes Summary Matrix

Objectives	Outcomes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1. Broad education in CompE			●	●									
2. Prepare students for practice	●	●	●	●	●	●	●	●	●	●	●	●	●
3. Understand the impact of engineering on society				●		●							●
4. Understanding of societal issues				●									●
5. Further their knowledge	●	●			●	●					●		
6. Contemporary tools and methodologies					●		●	●					

out. 1 – apply math.
out. 2 – knowledge of probability and stats.
out. 3 – breadth and depth in comp. Engr.
out. 4 – contemporary issues
out. 5 – modern engr. tools
out. 6 – apply math, sci, engr.
out. 7 – hand on experience
out. 8 – design
out. 9 – written communication
out. 10 – oral communication
out. 11 – life-long learning
out. 12 – work independently and in teams
out. 13 – ethics

V. Constituencies

Faculty, students, alumni, and industrial employers are the program's primary constituencies who provide both informal and formal input to the educational process. Students' parents and individuals from the community and state provide informal input to the process on matters affecting the program.

VI. Assessment Tools

The department ensures that graduates achieve learning outcomes in two ways: first, by offering a coherent program of study that provides an opportunity for learning, and second, by developing and applying ***direct*** and ***indirect*** assessment techniques to determine the success of students in fulfilling learning outcomes. Table 2 maps the developed assessment tools to each of the learning outcomes. Furthermore, scoring rubrics for **Outcomes 1, 3**, **5-9** are developed by faculty members to facilitate in the assessment process.

Direct Student Assessment Tools:

1. *Culminating Experience* is assessed through *Capstone Design Reports*. *Capstone Design Reports* provide a strong indicator for many of the outcomes indicated in Table 2. Applying engineering science, open-ended problem solving, use of modern engineering tools, computation competence, problem solving, written communication, and team skills for group projects are elements that can be assessed through oral progress reports and written final reports. Sample reports will be made available during the site visit. (*Scoring rubrics applied*.)

2. *Embedded Questions* provide a moderate indicator for breadth and depth in electrical engineering subjects. Table 3 ties the learning outcomes to the current curriculum. The learning outcomes are ***introduced*** in lower division courses and continue to be ***reinforced*** throughout the sequence of courses toward the culminating experience. (*Scoring rubrics applied*.)

3. *Lab Reports* are strong monitoring instruments for hands-on experiences, use of modern engineering tools, following technical instructions, written communication, and teamwork skills. *(Scoring rubrics applied.)*

4. *Poster Sessions/Oral Presentations* strongly demonstrate the student's written and oral communication skills. These sessions also show examples of hands-on experiences, engineering design, use of modern engineering tools, and teamwork skills (for group projects). Sample posters will be available to the visiting team during the site visit. (*Scoring rubric applied*.)

5. *Employer Survey* helps assess program objectives and learning outcomes for practicing engineers and VIP students.

Indirect Student Assessment Tools:

1. *Student Transcripts* demonstrate the breadth and depth of topics attempted by individual students.

2. *Course Assessment* demonstrates the accomplishment of course objectives as related to learning outcomes in individual courses. The level of student satisfaction is an indicator of relevant knowledge gained. Survey forms are administered in individual courses in which students appraise the contribution of the course to each educational outcome.

3. *Student/Faculty Forum* is administered in an open forum where students from all levels are present. Most of the outcomes can be monitored by such student input. In these meetings students typically tend to discuss issues like laboratory facilities, curriculum, internships and job opportunities, hands-on experience, available modern tools, lab upgrades, communication skills, ethics, and teamwork.

4. *Exit Interviews/Surveys* address most of the outcomes and document students' level of satisfaction with the learning attributes at the time of graduation. Graduating seniors typically spend between 2-4 years in the department. Therefore, their experiences, usually in the form of oral comments expressed during exit interviews are much more telling and useful than numeric scores on survey sheets. Electrical and Computer Engineering faculty members spend time discussing these comments while placing them in context of other assessment data before considering any changes or adjustments.

6. *Alumni Survey* helps assess program objectives and learning outcomes.

Table 2. Assessment Summary Table

		Culminating Experience*	Embedded Questions*	Lab Reports*	Poster sessions/ Oral presentations*	Course Assessment	Student/ Faculty Forum	Exit survey/ interview	Alumni Survey ‡	Employer Survey*‡
Out. 1**			●	●		●		●	●	●
Out. 2						●			●	●
Out. 3**			●		●	●	●	●	●	●
Out. 4		●			●		●	●	●	●
Out. 5**		●	●	●	●		●	●	●	●
Out. 6**		●	●		●	●	●	●	●	●
Out. 7**		●		●		●	●	●	●	●
Out. 8**		●	●	●	●	●	●	●	●	●
Out. 9**		●	●	●		●	●	●	●	●
Out. 10			●		●	●	●			●
Out. 11		●		●	●		●	●	●	●
Out. 12		●	●	●	●	●	●	●	●	●
Out. 13		●			●		●	●	●	●

* ***Direct assessment tools***
** ***Scoring rubrics applied***
‡ ***Provides feedback relative to program objectives***

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out. 12 – work independently and in teams
out. 13 – ethics

Table 3. Curriculum map showing the target courses for each learning outcome.

	ECE 1	ECE 2	ECE 85	ECE 85L	ECE 90	ECE 90L	ECE 106	ECE 107	ECE 115	ECE 118	ECE 120L	ECE 124	ECE 125	ECE 128	ECE 128L	ECE 174	ECE 176	ECE 178	ECE 186
Out.1			•		•			•				•		•					
Out.2													•						
Out.3							•	•	•			•	•			•			•
Out.4	•																		•
Out.5		•			•					•	•	•		•			•	•	
Out.6					•				•			•	•						•
Out.7				•		•					•				•			•	
Out.8			•				•				•						•	•	•
Out.9	•					•					•				•				•
Out.10	•										•								•
Out.11	•										•								•
Out.12	•		•	•						•	•							•	
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VIII. Assessment Process

The department established the following comprehensive process to assess students' learning according to the aforementioned 13 program outcomes. The current assessment process has been in place since the year 2000.

1. Reevaluation of the mission statement, program objectives, and learning outcomes. (This is done with the input from the advisory council, faculty, and survey response from the alumni and the employers.)

2. Reevaluation of surveys and scoring rubrics will be done by faculty during the scheduled faculty retreat sessions.

3. Data is collected using the assessment tools and according to the established time schedule.

4. Data is analyzed according to the established time schedule. (This is done by faculty and advisory council members.)

5. The action items are determined to close the loop of the assessment.

6. Progress is monitored based on the action items.

On a scale of 1 (poor) to 5 (excellent), the faculty members consider a rating of 3.5 or higher to be satisfactory. An overall rating below 2.0 for any of the outcomes requires immediate attention, and a rating between 2.0 and 3.5 requires further observation as a "carry over item" in the next evaluation cycle.

Rubrics for assessing learning outcomes were developed and utilized since 2009.

IX. Assessment Activities Timeline

The department collects and analyzes data according to the following schedule:

1. Every semester (starting Spring 09)

    (a) Exit Surveys (Spring and Fall Graduates)
    (b) Embedded questions
    (c) Alumni/Advisory Meeting
    (d) Faculty retreat

2. Annually (starting Spring 09)

    (a) Culminating Experience
    (b) Poster Sessions/Oral Presentations
    (c) Student/Faculty Forums
    (d) Course Evaluations

3. Every third year (starting 2009)

    (a) Alumni Survey/Alumni Focus Group Meeting
    (b) Employer Survey (Currently using Co-op Employer Surveys)
    (c) Review of a mission statement, program objectives, and learning outcomes.

5. Every sixth year (starting 2000)

    (a) Assembly of course binders and assessment of the overall success.