COMPUTER ENGINEERING
Student Outcomes Assessment Program (SOAP)

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 an 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;

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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.

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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. Other outcomes, like 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. technical graduate programs.

Objective 6 - ***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.

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Objectives/Outcomes Summary Matrix

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

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., science, and engr.
out. 7 - hands-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 has on-going data collection and reflection processes that include the following:

- The department holds a general departmental students/faculty meeting every semester. All ECE students are invited to attend this meeting. The purpose of the meeting is twofold: first, to strengthen the face-to-face, out-of-class communication channel with students and to listen to their views of the program and the department in general; and second, to share with students updates regarding upcoming curriculum changes, department news, and to receive their opinion on the changes that have taken place. Comments from students at these and other meetings have highlighted issues as perceived by them – e.g., the state of laboratories, the need for additional hands on experience in courses, scheduling and timing of course offerings, etc. In most of these cases, the faculty has been able to institute changes in order to accommodate student needs.

- Graduating students are invited individually or in small groups for an exit interview with the chairman of the department. Personal reflections and comments are encouraged, and are usually much more informational and useful than numeric scores on a survey sheet. At the end of the interview, students are handed out a survey form to fill out. These meetings are very telling, and graduating students are very forthcoming with their comments and suggestions.

- Faculty make personal observations during their numerous casual visits with students, prospective students, and their parents.

- The department collects input from alumni.

The department collects input from industry representatives who come to campus to recruit students for co-op and permanent employment, and from members of the advisory board.

VII. How The Program Demonstrates that the Graduates Achieve Outcomes

The department ensures that graduates achieve outcomes in two ways: first, by offering a coherent program of study that provides an opportunity for learning, and second, by developing and applying an assessment program to determine the success of students in fulfilling learning outcomes.

1. *Student Transcripts* demonstrate the breadth and depth of topics attempted by individual students. They also moderately demonstrate student exposure to basic science, mathematics, engineering subjects, contemporary issues, and the sequence in which students take their courses. The faculty believe that transcripts provide a possible indicator to students' success in achieving the remainder of the outcomes. The relevance of courses to outcomes and the grades earned by the student demonstrate, to some extent, achievement of these outcomes. Mandatory advising has provided an opportunity for continuous monitoring of student transcripts and the students' academic progress reports (DARS reports).

2. Since Capstone Design is a culminating experience, *Capstone Design Reports* provide a strong indicator for many of the outcomes indicated in Table B.3.2. 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.

3. *Student Homework and Exams* provide a moderate indicator for breadth and depth in electrical engineering subjects. Knowledge in basic science and the ability to work independently are moderately indicated through student coursework and exams. There is also sufficient evidence of computer skills in student work, and students' open-ended problem solving skills are moderately monitored through their coursework. *Lab Reports* are strong monitoring instruments for hands-on experiences, use of modern engineering tools, following technical instructions, written communication, and teamwork skills.

5. *Video Recordings of Student Presentations* strongly demonstrate the student's oral communications skills. These recordings also show examples of hands-on experiences, engineering design, use of modern engineering tools, and teamwork skills (for group projects). Sample videos will be available to the visiting team during the site visit.

6. *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.

7. The *Student Survey* 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, and teamwork.

8. *Graduates' 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. ECE faculty spend time discussing these comments while placing them in context of other assessment data before considering any changes or adjustments.

9. *Employer Input* is obtained in an informal manner via meetings with advisory board members from industry, potential employers of students that come to campus for on-campus interviews, and also from feedback provided by the VIP Co-Op employers..

Table B.3.2. Assessment Summary Table									
	Trans.	*Capstone design reports*	*Home-works & exams*	*Lab reports*	*Video tapes*	*Course Assessment*	*Student survey*	*Graduates survey (exit)*	*Alumni survey*
Out. 1	2		3	2		3		2	2
Out. 2	1					3			2
Out. 3	3		3		3	3	2	2	2
Out. 4	1	2			2		1	1	1
Out. 5	1	3	2	2	3		3	3	3
Out. 6	2	3	3		2	3	2	2	2
Out. 7	1	2		3		3	2	2	2
Out. 8	1	3	3	2	3	3	2	2	
Out. 9	1	3	2	3		2	3	1	1
Out. 10	1		2		3	2	3		1
Out. 11		2		1	1		2	1	1
Out. 12		3	2	3	3	2	3	2	3
Out. 13	1	1			3		3	1	1

3=Strong, 2=Moderate, 1=Possible

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. 8 – design
out. 9 - written communication
out. 10 - oral communication
out. 11 - life-long learning
out. 12 - work independently and in teams
out6- apply math, sci, engr
out7 – hands on experience
out 13 - ethics

VIII. Assessment Process

The department established a comprehensive process to assess students' learning according to the aforementioned 14 program outcomes. The current assessment processes have been in place for the last six years. These processes (listed below) have proven to be extremely useful to the faculty and have resulted in several changes to improve the curriculum – in essence; they have helped the faculty to collectively make informed decisions and to "close the loop". They include the following:

1. Assessment survey instruments were designed and were themselves assessed for continued appropriateness.

2. Data is collected. The faculty work together in department meetings to review available assessment material. Students in their respective courses also fill out course evaluation forms. The quantitative and qualitative data gathered using the evaluation forms provide:

   a) faculty perspective through transcripts, student course work, lab reports, Capstone Design reports, and video presentation evaluation forms,

   b) students' perspectives through course objectives assessment forms, and student/faculty forums,

   c) the graduating class perspective through graduate (exit) interviews and surveys,

   d) the alumni perspective through the alumni surveys/alumni focus groups,

   e) the industry perspective through the employer survey.

   An important source of input to the assessment process is provided via educational conferences and workshops, industry contacts, advisory board, alumni meetings, and informal visits with students.

3. The compiled data collected in Step 2 was analyzed to assess achievement of outcomes and to establish a point of reference for future evaluations. Action items for program improvements were then determined.

The general philosophy in analyzing the available data is to examine the faculty perspective in light of the students' and graduating class' perspective to determine an opportunity for curriculum improvement. Repeated concerns of students supported by faculty are considered a high priority item for program modification and improvement. The alumni and industry perspective is then considered to support longer-term changes.

IX. Data Analysis and Outcomes Satisfaction

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

1. Annually

    a) Exit Surveys (Spring and Fall Graduates)
    b) Student/Faculty Forums
    c) Alumni/Advisory Meeting
    d) Course Evaluations
    e) Student Records (Transcripts, DARS Report)

2. Every other year

    a) Capstone Design Reports
    b) Video Tapes

3. Every third year

    a) Alumni Survey/Alumni Focus Group Meeting
    b) Employer Survey (Currently using Co-op Employer Surveys)

4. Every sixth year

    a) Student Coursework Assessment (assembly of course binders)

On a scale of 1 (poor) to 5 (excellent), the faculty consider a rating of 3.0 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 3.0 requires further observation as a "carry over item" in the next evaluation cycle.