ANNUAL PROGRAM REPORT

College	College of Science
Department	Engineering
Program	Computer Engineering
Reporting for Academic Year	2017-18
Last 5-Year Review	2015-16
Next 5-Year Review	2022-23
Department Chair	Saeid Motavalli
Date Submitted	10-12-2018

I. SELF-STUDY

Five-Year Review Planning Goals

5-Year Plan:

1. Summary of program changes: The main change is the transfer to a semester-based program. The Computer Engineering curriculum has been transformed in such a way that it satisfies the accreditation requirements, and will produce technically stronger graduates. This has been accomplished by fundamental changes to courses, teaching methods and course requirements.
2. Faculty: We are in the process of hiring a tenure-track faculty member to join the program in the Fall of 2019. This is a replacement position for Howard Lei who left in 2017. We will be requesting an additional faculty member to join the program before our next accreditation visit in 2021.
3. Research: The Computer Engineering faculty are active in research and have been successful in securing funds for their research. Growth in research is a goal that the engineering faculty are aggressively pursuing.
4. Laboratory Development: Engineering is being allocated space for faculty research and teaching in ScS 215. The space is going to be utilized for the development of an electronics laboratory and other computer engineering research space requirement. Two computer engineering faculty and one construction management faculty will be using this lab to conduct research and support their classes.
5. Equipment: Through A2E2 annual funding and other College of Science resources, we will purchase lab equipment that will partially be used to equip this space.
6. Growth: The Computer Engineering program is the fastest growing undergraduate program in Engineering. We anticipate that the growth will continue and make it viable to start offering a graduate program in Computer Engineering.

A. Progress Toward Five-Year Review Planning Goals

We are in the search process for a tenure-track faculty to join the program in 2019.

B. Program Changes and Needs

Overview: The Computer Engineering program was established in 2007 as an option under engineering. The program is now a standalone accredited major. The enrollment in the program has been increasing consistently. Two tenure-track faculty, Roger Doering and James Tandon, support this program. Howard lei resigned in 2018.

Curriculum: We have transformed the curriculum in transition to semester offerings. The transformed curriculum satisfies accreditation requirements and is in line with the needs of its constituents.

Students: The number of students has increased from 19 in 2012 to 151 in 2017.

Faculty: Two tenure-track faculty serve the Computer Engineering program

Staff: We have two full time staff for the School of Engineering, Mrs. Lisa Holmstrom and a laboratory technician, Mr. Praveen Apparsamy**.**

Resources: As part of the College of Science renovation plan a large lab space (SSC 125) has been dedicated as research facility for electronics and computer engineering.

Assessment: Computer engineering is an accredited program. As part of the accreditation process, a systematic assessment and evaluation plan has been in place for four years. The details of assessment activities are given below.

II. SUMMARY OF ASSESSMENT

A. Program Learning Outcomes (PLO)

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (ILO 1)
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (ILO 1 & 5)
3. An ability to communicate effectively with a range of audiences. (ILO 2)
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. (ILO 3, 4 & 5)
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. (ILO 3 & 4)
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (ILO 1 & 2)
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (ILO 1, 2, & 4)

B. **Program Learning Outcome(S) Assessed**

List the PLO(s) assessed. Provide a brief background on your program's history of assessing the PLO(s) (e.g., annually, first time, part of other assessments, etc.)

The program learning outcomes assessed for 2018-2019 are PLOs 2 and 6. The PLOs were assessed by using results from final exam questions across three classes. Since the BS in Computer Engineering is a new program that officially began in 2013, this is the first 5-year assessment. The three classes were ENGR 230 (Circuits 1), CS 321 (Computer Architecture 1), and CMPE 480 (VLSI). While our 5-year assessment plan has eleven program learning outcomes, we elected to change them with the conversion to the semester system. The old learning outcomes with the new learning outcomes (in red) that they map to are listed here:

Explanation of PLOs:

PLO 1: Ability to apply knowledge of mathematics, science, and engineering. PLO1

PLO 2: Ability to design and conduct experiments, as well as to analyze and interpret data. PLO6

PLO 3: 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. PLO2

PLO 4: Ability to function on multidisciplinary teams. PLO5

PLO 5: Ability to identify, formulate, and solve engineering problems. PLO1

PLO 6: Understanding of professional and ethical responsibility. PLO4

PLO 7: Ability to communicate effectively. PLO3

PLO 8: Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. PLO4

PLO 9: Recognition of the need for, and an ability to engage in, life-long learning. PLO7

PLO 10: Knowledge of contemporary issues. PLO2

PLO 11: Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. PLO6

C. **Summary of Assessment Process**

Summarize your assessment process briefly using the following sub-headings.

Instrument(s): *(Include if new or old instrument, how developed, description of content)*

The instruments used to assess PLO's were the midterm and final exam questions. Since professors used different grading scales, each question normalized to a rating scale 1-4 with 1 being the lowest score and 4 being the highest score. Questions focused on engineering data analysis and system design and synthesis.

Sampling Procedure:

Students in different classes were assessed based on specific course materials in the computer engineering discipline. The knowledge to be successful in these courses is cumulative where ENGR 230 material is introductory level, CS 321 material is practice level, and CMPE 480 is mastery level. Problems were chosen by the proctoring professor to be exemplary of the material in each course.

Sample Characteristics:

The course used for assessment are all required courses in the computer engineering discipline. Correct completion of each question requires essential knowledge for completion of the degree program. The selection was done in consultation between the individual proctoring professors, the assessment coordinator, and the department chair for computer engineering.

Data Collection: *(include when, who, and how collected)*

Problems were collected by the responsible data assessment coordinator. Raw data scores were normalized across all sample problems to the 1-4 scale for correctness. Next, the scores were utilized to facilitate comparisons between Introductory, Practice, and Mastery levels.

Data Analysis:

ENGR 230
Item: Nodal/mesh analysis circuit problem
Average score (out of 4): 2.67 (13 submissions)
Score of 1: 4 Score of 2: 1 Score of 3: 2 Score of 4: 6
Score of 3 or higher: 61.5%

CS 321 (taught by CMPE faculty)
Item: Implement a finite state machine that solves a problem
Average score (out of 4): 2 (11 submissions)
Score of 1: 1 Score of 2: 3 Score of 3: 2 Score of 4: 5
Score of 3 or higher: 63.6%

CMPE 480
Item: Midterm, VLSI transistor circuit layout problem
Average score (out of 4): 2 (10 submissions)
Score of 1: 3 Score of 2: 4 Score of 3: 3 Score of 4: 0
Score of 3 or higher: 30.0%

Rubric:
(1) Correctly specified less than 25% of all components and connections in circuit designs
(2) Correctly specified 25% or more of all components and connections in circuit designs

(3) Correctly specified 50% or more of all components and connections in circuit designs
(4) Correctly specified 75% or more of all components and connections in circuit designs

D. **Summary of Assessment Results**

Summarize your assessment results briefly using the following sub-headings.

Main Findings:

With respect to PLO2: Students in ENGR 230, and to a lesser extent CS 321 tend to either understand the material, or not understand it as reflected in the bimodal distribution of scores. While some people successfully completed the introductory training in ENGR 230, some people are unable to understand and use knowledge taught. This is less of a problem in CS 321.

With respect to PO3: Less than half of the students were able to satisfy this learning outcome when measured by the learning outcome in CMPE 480. This may be due to a particular set of exam question relative to the questions used in PLO2.

Recommendations for Program Improvement: *(Changes in course content, course sequence, student advising)*

Consistent syllabi and sample questions should be developed by the department for each course to uniformly measure the PLO's across courses that may be run by multiple professors. While this may encourage professors to "teach to the test" to some degree, if the assessment covers only the core material, then professors will have wider latitude to teach the material as they see fit.

Next Step(s) for Closing the Loop: *(Recommendations to address findings, how & when)*

Professors in computer engineering should convene to prepare the assessment questions for each class. Additionally, creating questions that test introductory, practice, and mastery levels, should be considered. However, the assessment questions should be balanced in that they can be solved at the end of a final exam.

Other Reflections:

The syllabi and assessment questions used for CAPR assessment and ABET assessment should be co-created to minimize the impact of program assessment to the student learning experience.

E. **Assessment Plans for Next Year**

Summarize your assessment plans for the next year, including the PLO(s) you plan to assess, any revisions to the program assessment plan presented in your last five-year plan self-study, and any other relevant information.

We plan to continue assessment with midterm exam questions and final exam questions where feasible for individual work for PLOS 1,2,4,6, and 7. PLOs 3 and 5 require assessment of group work and an ability to communicate respectively. For PLO 3, group project grades and peer review questionnaires will be used for assessment. For PLO 5, written and oral assignments will be used for assessment. The next set of PLOs to assess (on the new set) are PLO 3 and 6. PLO 3 will be assessed by with a written assignment in ENGR 200 and with an oral presentation in CMPE 344.

III. DISCUSSION OF PROGRAM DATA & RESOURCE REQUESTS

Discussion of Trends & Reflections

The following table is enrollment data extracted from Pioneer Data Warehouse. This data indicates that the Computer Engineering enrollment is increasing at a constant rate. The current enrollment is 140 undergraduate students. The current faculty of Computer Engineering are; Roger Doering and James Tandon. The program is accredited by ABET until the Fall of 2022. We are in the process of hiring a tenure-track faculty to replace the position vacated by Howard Lei. If the search is successful, the new faculty will join the program in the Fall semester of 2019.

Term	College	School	Computer Engineering	Industrial Engineering	Engineering Management	Total	Minor
Fall Quarter 2012	Total	Engineering	24	18	36	78	0
Fall Quarter 2013	Total	Engineering	64	54	49	167	0
Fall Quarter 2014	Total	Engineering	103	78	98	279	0
Fall Quarter 2015	Total	Engineering	130	109	103	212	0
Fall Quarter 2016	Total	Engineering	140	119	89	342	0
Fall Quarter 2017	Total	Engineering	151	121	76	348	0

Notable Trends:

1. Growth in enrollment

2. Strong industry demand for the graduates

3. Active Advisory Board Council

4. Maintaining accreditation

Reflections on Trends and Program Statistics:

We have a proposal to add an undergraduate Civil Engineering program pending the faculty senate approval. The addition of this program will improve the School of Engineering enrollement and lower per FTES costs.

Request for Resources *(Suggested length of 1 page)*

1. **Request for Tenure-Track Hires**, We are in the process of hiring a tenure-track faculty to replace the position vacated by Dr. Howard Lei. We will ask for an additional faculty member before of next accreditation visit in 2021.

2. Request for Other Resources