# ACADEMIC SENATE
## Committee on Academic Planning and Review

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**ANNUAL PROGRAM REPORT**

**I.**

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| College | College of Science |
| Department | Engineering |
| Program | Computer Engineering |
| Reporting for Academic Year | 2018-19 |
| Last 5-Year Review | 2015-16 |
| Next 5-Year Review | 2022-23 |
| Department Chair | Saeid Motavalli |
| Date Submitted | 10-01-2019 |

**SELF-STUDY**

Five-Year Review Planning Goals

5-Year Plan:

1. Summary of program changes: The First year of implementation of semester based curriculum was successful. Extensive advising main change is the transfer to a semester-based program. The aim of advising was not to delay any student's graduation.
2. Faculty: We hired a tenure-track faculty to substitute for Howard Lei who left the year before. Dr. Alex Sumarono started this Fall 2019. He comes to us with years of experience with INTEL and CISCO corporations.
3. Research: The Computer Engineering faculty are active in research and have been successful in publishing their work. 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 being utilized for the development of an electronics laboratory and other computer engineering research space requirement. Two computer engineering faculty and faculty from computer science work in this laboratory.
5. Equipment: Through A2E2 annual funding and IT department resources we are planning to upgrade the computer engineering laboratory ScN 237.
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**

A new tenure-track has joined the program in the Fall of 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. As of the fall quarter of 2018, the enrolment is 159

students. Three tenure-track faculty, Roger Doering, James Tandon, and Alex Sumarsono support this program.

**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 159 in the fall of 2018.
**Faculty:** Three tenure-track faculty serve the Computer Engineering program.

**Staff:** We have two full time staff for the School of Engineering, Mrs. Lisa Holmstrom, Engineering Advisor and a laboratory technician, Mr. Linh Nguyen**.** We also have a part time ASC who is with engineering for 8 hours a week.

**Resources:** The ScS 125 research laboratory is functional and equipped with drones and other research equipment. Dr. James Tandon and Alex Sumarsono conduct research in that lab.

**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 3 and 5. The PLOs were assessed by using results from group projects or presentations across three classes. Since the BS in Computer Engineering is a new program that officially began in 2013, this year is part of the second 5-year cycle of assessment. The three classes were CS 321 (Computer Architecture 1), CMPE 492 (Senior Design), and CMPE 493 (Senior Capstone). 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 public presentations and group projects. 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 CS 321 material is practice level, while CMPE 492 and CMPE 493 are mastery level. Problems were chosen by the proctoring professor to be exemplary of the material in each course.

**Sample Characteristics:**

The courses 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:**

CS 321 (taught by CMPE faculty)
Item: Implement an arithmetic logic unit with your partner.
Average score (out of 4): 2.97 (31 submissions)
Score of 1: 2 Score of 2: 9 Score of 3: 8 Score of 4: 12
Score of 3 or higher: 64.5%

CMPE 492
Item: Project presentation—graded by content, organization, and delivery.
Average score (out of 4): 3.6 (15 submissions)
Score of 1: 1 Score of 2: 0 Score of 3: 3 Score of 4: 11
Score of 3 or higher: 93.3%

CMPE 493
Item: Final group project—graded on integration of member designed components.
Average score (out of 4): 3.3 (14 submissions)
Score of 1: 0 Score of 2: 1 Score of 3: 8 Score of 4: 5
Score of 3 or higher: 92.9%

Rubric for PLO3 (492):
(1) Presentation gives vague specification of project, length too short, imbalanced delivery
(2) Presentation content missing a major component, length is short, organization issues
(3) Presentation organization has minor discontinuities, content misses only minor points, need to practice delivery
(4) Presentation organization is coherent, content is completely specified, good delivery

Rubric for PLO5 (321 and 493):
(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 PLO5: Students in CS 321 and CMPE 493 worked together to complete a group project. While students in CS 321 were left to themselves with respect to breaking down group responsibilities, students in CMPE 493 were guided to specialize and graded based on the quality of their individual components. As students moved from practice level to mastery level, the level of understanding increased significantly with an average project score of 2.97 to 3.3. The bi-model distribution of understanding/not-understanding which was a problem when reviewing PLO2 last year did not appear with respect to PLO5. Pedagogy did not change.

With respect to PLO3: Students did an exceptional job presenting their material for the most part in CMPE 492. While the class has effective communication as a learning outcome, students are forced by their project assignments to write, re-write, and refine their project specifications at least four times before they build the project. This forces the students to think very hard about their topic and become specialists in their work.

**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 1, PLO 4, and PLO 7. All PLOs will be assessed by either midterm or final exam questions.

## 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 data as of Fall of 2018 stands at 159. The current faculty of Computer Engineering are; Roger Doering James Tandon and Alex Sumarsono . The program is accredited by ABET until the Fall of 2022.

| 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 |

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| **Fall Quarter 2016** | **Total** | **Engineering** | **140** | **119** | **89** | **342** | **0** |
| **Fall Quarter 2017** | **Total** | **Engineering** | **151** | **121** | **76** | **348** | **0** |
| **Fall Quarter 2018** | **Total** | **Engineering** | **159** | **102** | **46** | **496** | |

**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:**

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

1. **Request for Tenure-Track Hires**, We have hired Alex Sumarsono as tenure-track assistant professor fall of 2019.

2. Request for Other Resources