**California State University, Fresno**

**Department of Electrical and Computer Engineering (ECE)**

**Graduate Program Assessment**

**Master of Science in Engineering (MSE) – EE Option and CE Option Academic Year 2018-2019**

**Assessment Coordinator:**

**Dr. Nagy Bengiamin, Graduate Program Coordinator September 2019**

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**General Information**

1) The Master of Science in Engineering (MSE) has the following three options: ∙ Electrical Engineering (EE) option, which is offered by the Electrical and Computer Engineering (ECE) Department

∙ Computer Engineering (CE) option, which is offered by the Electrical and Computer Engineering (ECE) Department

∙ Mechanical Engineering (ME) option, which is offered by the Mechanical Engineering Department.

2) This assessment report has been prepared by the ECE for the **EE and CE options only**.

3) It is worth mentioning that the MSE program underwent an external review and the review cycle was completed in March 2019 with the attached memo from the University Graduate Committee. The external review panel report, of March 2018, highlighted the viability of the ECE MS program in general and it emphasized the positive impact of the assessment activities in particular. The assessment related statement is extracted below.

*“Assessment activities are conducted annually and quite extensively. According to the Self-Study Reports from both programs, a range of useful data have been collected and presented including admission, retention, graduation, and time-to degree, etc. which are consistent with continuous curriculum improvement. In*

*addition, direct and indirect assessment tools have been employed to assess Student Learning Outcomes (SLOs). Collected data are compiled and analyzed by faculty every year for continuous monitoring and curriculum review. Both programs are commended for their continued assessment effort.”*

The University Graduate Committee also highlighted the assessment activities as one of the program’s strength by stating “The department has developed and implemented a strong Student Outcomes assessment Plan (SOAP)”. In the same evaluation, the committee approved the program with “Notation of Exceptional Quality”.

**Mission Statement**

The ECE Department has adopted the following mission statement:

*The ECE Department offers a quality graduate program that focuses on discovery and experiential learning in Electrical and Computer Engineering to resident students as well as practicing engineers working in the high-tech industries surrounding the Fresno metropolitan area. Graduates of this program shall be better positioned to advance their career and work on complex engineering problems dictated by continuing advances in technology. Additionally, the program seeks to prepare graduates for advanced research and engineering applications to fulfill the technical needs of local industry in the region and beyond.*

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**ECE Graduate Program Goals**

The MSE-ECE program prepares students for today’s technology driven careers with the following program goals:

∙ To enhance the students’ analytical skills by developing a deeper understanding of major theoretical and practical engineering concepts.

∙ To improve students’ written and oral technical communication skills.

∙ To increase the level of competence of students for solving practical yet increasingly complex discipline specific engineering problems.

∙ To develop students’ creative thinking skills required in understanding and solving complex engineering problems.

∙ To allow students to acquire and demonstrate a sufficient depth of knowledge in a substantive area of Electrical and Computer Engineering.

**Enrolment Data**

EE ENROLLMENT

40 35 30 25 20 15 10 5

0

3335

17

14

Fall 15 Fall 16 Fall 17 Fall 18

CE Enrollment

30

24 23

25

20

15

12

10

10

5

0

Fall 15 Fall 16 Fall 17 Fall 18

3

The noticeable Fall ‘18 drop in enrollment can be contributed in part to the significant increase of graduates during the 2017/18 academic year as well as the summer of 2018 (see graduation data below).

**Graduation Data**

EE Graduates

12 10 8

6

4

2

0

3

1

8

3

11

9

6

Spring '16 Fall '16 Spring '17 Fall '17 Spring '18 Summer

'18

CE Graduates

Fall '18

9 8 7 6 5 4 3 2 1 0

3

0

8

3

8

3 3

Spring '16 Fall '16 Spring '17 Fall '17 Spring '18 Summer

'18

Fall '18

**Note:** Final graduation data for Spring ’19 wasn’t available at the time of preparing this report.

***1. What learning outcome(s) did you assess this year? List all program outcomes you assessed (if you assessed an outcome not listed on your department SOAP please indicate explain). Do not describe the measures or benchmarks in this section. Also, please only describe major assessment activities in this report. No GE assessment was required for the 2016-2017 academic year.***

All SLOs were assessed:

A graduate with the EE-option or CE-option is expected to be able to,

1. Apply advanced mathematics/engineering/software concepts to practical problems. 2. Demonstrate knowledge in advanced electrical/computer engineering subjects and utilize advanced engineering tools to solve engineering problems.

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3. Utilize modern engineering tools, conduct experiments and analyze collected data (hands on).

4. Communicate effectively orally and in writing.

5. Conduct literature searches and formulate ideas via critical thinking practices.

***2. What assignment or survey did you use to assess the outcomes and what method (criteria or rubric) did you use to evaluate the assignment? If the assignment (activity, survey, etc.) does not correspond to the activities indicated in the timeline on the SOAP, please indicate why. Please clearly indicate how the assignment/survey is able to measure a specific outcome. If after evaluating the assessment you concluded that the measure was not clearly aligned or did not adequately measure the outcome please discuss this in your report. Please include the benchmark or standard for student performance in your assessment report (if it is stated in your SOAP then this information can just be copied into the report). An example of an expectation or standard would be “On outcome 2.3 we expected at least 80% of students to achieve a score of 3 or above on the rubric” instruments used to assess them?***

∙ Exit Survey (Indirect Assessment)

∙ Culminating Experience – Graduate Project/thesis (Direct Assessment) ∙ Course Embedded Questions (Direct Assessment)

The benchmark is 3.75 out of 5.0 for all SLOs.

***3. What did you discover from the data? Discuss the student performance in relation to your standards or expectations. Be sure to clearly indicate how many students did (or did not) meet the standard for each outcome measured. Where possible, indicate***

**Exit Survey (August ’18 – May ‘19) \_ EE-Option**

**Number of students=11**

**SLO Rating of Achieving SLOs**

**Strongly Agree (SA), Agree (A), Ambivalent**

**(AM), Disagree (D), Strongly Disagree (SD)**

SLO 1

Apply math. engr., software SLO 2

Utilize advanced engr. tools SLO 3

Conduct experiments and analyze data

SLO 4

Communicate effectively

SLO 5

Conduct literature searches and formulate ideas

AM,SA,A,SA,SA,A,SA,SA,SA,A,A A,SA,A,SA,SA,A,SA,SA,A,A,A AM,A,AM,SA,SA,A,SA,SA,A,A,A

AM,SA,A,SA,SA,A,SA,SA,SA,A,SA AM,SA,AM,SA,SA,A,SA,SA,SA,A,A

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**Analysis:** The data shows that the EE students feel that they have attained the learning outcomes targeted by their program of study. Two students out of 11 were ambivalent about attaining most of the SLOs except “Utilizing Advanced Engineering” Tools.

**Exit Survey (Summer ’18-May ‘19) \_ CE-Option**

**Number of students=5**

**SLO Rating of Achieving SLOs**

**Strongly Agree (SA), Agree (A),**

**Ambivalent (AM), Disagree (D), Strongly**

**Disagree (SD)**

SLO 1

Apply math. engr., software SLO 2

Utilize advanced engr. tools SLO 3

Conduct experiments and analyze data

SLO 4

Communicate effectively

SLO 5

Conduct literature searches and formulate ideas via critical thinking

SA,SA,SA,SA,A A,SA,SA,SA,AM SA,SA,SA,SA,A

SA,SA,SA,SA,SA SA,SA,SA,SA,SA

**Analysis:** The data shows that the CE students feel that they have attained the learning outcomes targeted by their program of study. One student out of 5 was ambivalent about attaining SLO 2 (Utilize Advanced Engr. Tools) while all other students agree or strongly agree that this SLO has been attained.

**Graduate Project Assessments (August ’18 - May ‘19) \_ EE-Option**

**Number of students= 6 (17 evaluation forms total)**

**Oral Communication and Quality of Slides (Average=4.2/5)**

Clarity of Pronunciation 4.4

Ability to answer questions 4.1

Eye contact 4.6

Quality of slides 3.8

Ability to express ideas 3.9

Organization of presentation 4.2

**Technical Content (Average= 4.1 /5)**

Clarity of methodology 4.2

Soundness of Argument 3.8

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Suitability of work for a graduate level 4.3

Use of engineering tools 4.6

Significance of conclusions 3.5

Use of scientific tools 4.3

**Written Report (Average= 3.95/5)**

Organization 4.0

Trans. Between Paragraphs 3.7

Sentence structure 3.75

Spelling and Grammar 4.0

Literature Search and use of references 4.3

**Analysis:** The data shows that the EE students performed at a level higher than the benchmark of 3.75, in all main categories on the average. However, the subcategories of “significance of conclusions” and “transition between paragraphs” need monitoring. Compared to last year’s data, “quality of slides”, “sentence structure” and “spelling and grammar” were the identified subcategories that needed attention while this year’s are different.

**Graduate Project Assessments (August ’18 – May ‘19) \_ CE-Option**

**Number of students=8 (21 evaluation forms total)**

**Oral Communication and Quality of Slides (Average= 3.45 /5)**

Clarity of Pronunciation 3.5

Ability to answer questions 3.1

Eye contact 3.7

Quality of slides 3.5

Ability to express ideas 3.3

Organization of presentation 3.6

**Technical Content (Average= 3.8 /5)**

Clarity of methodology 3.5

Soundness of Argument 3.6

Suitability of work for a graduate level 3.8

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Use of engineering tools 4.5

Significance of conclusions 3.5

Use of scientific tools 4.0

**Written Report (Average= 3.64 /5)**

Organization 3.7

Trans. Between Paragraphs 3.4

Sentence structure 3.7

Spelling and Grammar 3.6

Literature Search and Use of References 3.8

**Analysis:** The data shows that the CE students performed at a level higher than the benchmark of 3.75 in the “Technical Content” Category; while the two other main categories (“Oral Communication and “Written Report”) fell below the benchmark. Also, most of the subcategories including those of the Technical Content have either fallen below the benchmark or barely met it. Compared to last year’s assessment, the sub-categories of “Soundness of Argument”, “Significance of conclusions”, “Transition between paragraphs”, “Sentence structure”, and “Spelling and grammar” continue to need further attention.

**Course Embedded Questions (on a scale of 5)**

Course LO 1 LO 2 LO 3 LO 4 LO 5

ENGR 201 3.66 4.27 3.38

ECE 230 4.37 4.45 4.33

**Analysis:** The data shows that the students’ performance in LO1 (Apply math. engr., software) is at a level higher than the benchmark of 3.75 in one course while it is slightly lower in another course. LOs 2 and 4 exceed the stated benchmark, while LO3 (Conduct Experiments and Data Analysis) needs attention. Compared to the assessment data of last year, LO 2 shows a significant improvement.

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**Rubric**

**Application of MATH, SCIENCE, and ENGR Principles MSE-EE Student Learning Outcome 1**

Course#: ENGR 201

Evaluate each item on a scale of 1 to 5 (5 is the highest). Proficiency

**Item**

5 4 3 2 1 N/A

Proper selection of math/science/engr principles

Application of

math/science/engr to problem

Selection of

math/science/engr

principles was well

justified and

explained

xxxx

Advanced

math/science/engr

principles were

applied with depth

to solve key

problems in depth

Selection of

math/science/engr was partially

justified

xx

Selection of

math/science/engr was not justified

Math/science/engr principles were referred but not applied to solve key problems

The effectiveness of applying

math/science/engr principles to

problems

xx xx xx Application of

Math/science/engr

principles was

essential to solve

key problems

x xxx xx

Application of

Math/science/engr

principles was not

related to solve

key problems

Average Score: 3.66

Evaluator: Bengiamin Date:12/9/18

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**Rubric**

**Knowledge in EE Subjects and Engineering Tool Skills MSE-EE Student Learning Outcome 2**

Course#: ENGR 201

Evaluate each item on a scale of 1 to 5 (5 is the highest).

Proficiency

**Item**

In-depth

Knowledge on EE Subjects

*Problem*

*formulation*

Problem

solving

Analyzing results

5 4 3 2 1 N/A

Conduct research

to Identify and

formulate a

problem using

mathematical

tools and

engineering

models

xxx xx x

Solve problem

mathematically

or using

engineering tools

xx xx xx

Analyzing results

quantitatively

xxx xx x

Modeling Tools

Fluent

xxxx xx

Learning

Design Tools Fluent Learning

**Engineering Tool Skill**

Analysis Tools Fluent

xxxx xx

Learning

Manufacturing Tools

Fluent Learning Average Score: 4.27

Evaluator: Bengiamin Date: 12/9/18

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**Rubric**

**Conduct Experiments and Data Analysis**

**MSE-EE Student Learning Outcome 3**

Course#: ENGR 201

Evaluate each item on a scale of 1 to 5 (5 is the highest).

Proficiency

**Item**

5 4 3 2 1 N/A

Experiments and analysis of data

Predefined Objectives and Goals

Proper

Methodology

Understand the

objectives and

goals of

conducting

experiments

xxxx xx

Prepare the

experiments with

equipments and

well-thought

procedures

xxxx xx

Conduct

experiments without goals

x

No preparation x

Data analysis Data analysis

using

mathematical

tools and

engineering

modeling

xxx xx x

No verification of the data from experiments

x

Average Score: 3.38

Evaluator: Bengiamin Date: 12/12/18

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**Rubric**

**Application of MATH, SCIENCE, and ENGR Principles MSE-EE Student Learning Outcome 1**

Course#: ECE 230

Evaluate each item on a scale of 1 to 5 (5 is the highest).

Proficiency

**Item**

5 4 3 2 1 N/A

Proper selection of math/science/engr principles

Application of

math/science/engr to problems

Selection of

math/science/engr principles was well justified and

explained

xxxxxx xx

Advanced

math/science/engr principles were

applied with depth to solve key

problems in depth

Selection of

math/science/engr was partially

justified

x

Selection of

math/science/engr was not justified

Math/science/engr principles were referred but not applied to solve key problems

The effectiveness of applying

math/science/engr principles to

problems

xxxxx xx xx

Application of

Math/science/engr

principles was

essential to solve

key problems

xxxx xxx xx

Application of

Math/science/engr

principles was not

related to solve

key problems

Average Score: 4.37

Evaluator: Bengiamin Date:12/13/18

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**Rubric**

**Knowledge in EE Subjects and Engineering Tool Skills MSE-EE Student Learning Outcome 2**

Course#: ECE 230

Evaluate each item on a scale of 1 to 5 (5 is the highest).

Proficiency

**Item**

In-depth

Knowledge on EE Subjects

Problem

formulation

Problem

solving

Analyzing results

5 4 3 2 1 N/A

Conduct research

to Identify and

formulate a

problem using

mathematical

tools and

engineering

models

xxxxx xxx x

Solve problem

mathematically

or using

engineering tools

xxxxxx

x x x

Analyzing results

quantitatively

xxx xx xxxx

Modeling Tools

Fluent

xxxxxxx xx

Learning

**Engineering Tool Skill**

Design Tools Fluent

xxxxxxx xx

Analysis Tools Fluent

xxxx x xxx x

Learning Learning

Manufacturing Tools

Fluent Learning Average Score: 4.45

Evaluator: Bengiamin Date: 12/9/18

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**Rubric**

**Technical Communication Skills**

**MSE-EE Student Learning Outcome 4**

Course#: ECE 230

Evaluate each item on a scale of 1 to 5 (5 is the highest).

Proficiency

**Item**

5 4 3 2 1 N/A

Verbal

communication

Delivery Proper choice of verbal language

Time Effective use of time

Use of casual, conversational, impolite

language

Untimely delivery (Overtime)

Interaction with

Audience

Eye contacts, Posture, and Q/A

Showing

nervousness

Grammar Free from

grammar errors

xx xxxx

Need a proof reading.

Written

Communication

Technical Writing Style

Focus and Organization

Paragraphs were

written and

organized to

support thesis

statements.

xxxx x x Introduction,

main body, and

conclusions were

written

coherently to

deliver a main

theme of the

document.

xxx x xx

Paragraphs were written without a direction.

Lack of structure and focus

Average Score: 4.33

Evaluator: Bengiamin Date: 12/19/18

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**Findings based on presented data:**

∙ While SLO-3 (Conduct Experiment and Data Analysis) data shows improvement compared to last year, more attention is still needed in this area.

∙ Communication skills (oral and written) continue to need attention.

**University and External Review findings related to the curriculum and students:** ∙ The University Graduate Committee commends the department on its strong faculty. It was noted that faculty are very productive with research, publications, and grants, despite a heavy teaching load.

∙ Graduates of the program are sought out as employees.

∙ The department has developed and implemented a strong Student Outcomes Assessment plan (SOAP).

∙ The program offers advanced-level, quality graduate coursework and research opportunities addressing complex discipline specific engineering problems. ∙ Many graduates of the program are successfully employed in industry achieving their career goals or have completed the doctorate degrees in leading universities. The program graduates are doing well and are competing at high level nationally and internationally.

∙ The program appears to be viable and has the potential to grow bigger in size, capacity, and scope.

**University and External Review recommendations related to the curriculum and students:**

∙ Presently there is a joint Master of Science in Engineering (MSE) within the ECE and Mechanical Engineering departments. The panel recommends offering a full-fledged MS degree in each discipline.

∙ Continue to seek ways to recruit domestic students.

***4. What changes did you make as a result of the data? Describe how the information from the assessment activity was reviewed and what action was taken based on the analysis of the assessment data.***

∙ To build on the existing strength of the ECE program and in response to the university graduate committee and the external review panel’s recommendation to offer independent ECE and Mechanical Engineering degrees, the faculty have decided to follow through with implementing this recommendation. In several of its weekly faculty meetings, the ECE faculty reviewed the curriculum in detail and made a final recommendations to elevate the two ECE options (EE and CE) to a single full MS-ECE degree. The required courses have been determined and a list of electives has been compiled to accommodate the special focus areas of students. A final review of this recommendation is planned for Fall ’19 such that the paperwork can be processed and the new programs starts in Fall ’20.

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∙ The major decision to elevate the options into a full independent program required intensive discussion among the ECE faculty including the review of assessment findings to insure a program that meets the expectations of the students and the

inspirations of the department and the college. Existing courses have been modified and new courses were also proposed.

**5. *What assessment activities will you be conducting in the 2017-2018 AY? List the outcomes and measures or assessment activities you will use to evaluate them. These activities should be the same as those indicated on your current SOAP timeline; if they are not please explain.***

The plan is to follow the SOAP and assess all SLOs with a special attention to the identified areas in the assessment data. This will be completed keeping in mind that the elevated ECE program will require major revisions in the SOAP and associated assessment activities.

**6. *What progress have you made on items from your last program review action plan? Please provide a brief description of progress made on each item listed in the action plan. If no progress has been made on an action item, simply state “no progress.”***

∙ The faculty followed through with the process for elevating the two ECE options to an independent ECE program.

∙ Communication skills have been emphasized further in assessing students’ work and some improvement has been observed.

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