

**Master of Science in Engineering - Electrical Engineering Option (MSE-EE) Student Outcomes Assessment Plan (SOAP)**

Updated February 2021

**Mission Statement**

The objective of MSE-EE Program is to provide advanced engineering education in Electrical Engineering to a broad class of students as well as practicing engineers working in the high-tech industries surrounding the Fresno metropolitan area. Graduates of this program should be able 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.

**MSE-EE Program Objective**

The Master of Science in Electrical Engineering program builds upon a previously acquired foundation in basic science, mathematics, and electrical engineering to advance skills in research and applied engineering science. The objective of the program is to **enhance the graduates’ ability to advance their chosen careers in industry, academia, and public institutions**. Career advancement can be in the form of successfully completing higher education or practicing engineering where assumed responsibilities are well beyond those expected of entry level engineering positions. Advancing careers in practice can be via,

1) A deeper understanding of engineering theoretical and applied engineering concepts. 2) Engaging in advanced technological endeavors including research.

These program objectives are consistent with the essential components of the mission and vision of California State University Fresno:

∙ Support and develop high quality graduate programs appropriate to the needs of the region

∙ Engage in high quality research, with particular emphasis on applications that support the region.

∙ Build upon existing academic programs and create new ones to help transform and develop the region

The ECE faculty members of the MSE-EE program offer courses and conduct scholarly work in the broader area of electrical engineering including communication, control systems, VLSI/digital systems, robotics, power systems, and high frequency electronics. These areas overlap and they provide opportunities for integration and cross-area projects. This facilitates providing students with broad backgrounds and programs of study that prepare them best for practice as well as more advanced studies.

1

The minimum number of units required to complete the MSE-EE degree is 30 units including the culminating experience. The possible options for culminating experience are Comprehensive Exam (0 units), Directed Project (3 units) and Directed Thesis (3-6 units). Through academic advising, students choose the subject that fits their career goals most. The thesis option is usually recommended for those who have interest in pursuing doctoral studies or practice positions with a major research component. Students who are interested most in applied engineering and intend to practice upon graduation are advised to pursue the project or the comprehensive exam option. The project option is usually preferred for those who desire to prepare themselves for development projects with advanced technical emphasis.

**Student Learning Outcomes (SLOs)**

The graduate of the program should be able to

1. apply advanced mathematics and engineering science concepts to practical problems. 2. demonstrate knowledge in advanced electrical engineering subjects and utilize advanced engineering tools to solve engineering problems.

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. Table 1 demonstrates how the curriculum supports the stated SLOs.

**Core Competencies:**

1) Written communication (SLO-4)

2) Advanced disciplinary knowledge (SLO-1, SLO-2, SLO-3, SLO-4)

3) Research methodology (SLO-5)

**Table 1** Curriculum Map

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Learning Outcome*** | ***ENGR 200 (core)*** | ***ENGR 201 (core)*** | ***ECE 224 (core)*** | ***ECE***  ***100-level Electives*** | ***ECE***  ***200-level Electives*** | ***ECE 290*** | ***Culminating Experience*** |
| ***1*** |  | 3 | 2 | 2 | 3 | 3 | 3 |
| ***2*** |  | 3 | 3 | 2 | 3 | 2 | 3 |
| ***3*** |  | 3 |  | 2 | 1 | 1 | 3 |
| ***4*** | 3 | 2 |  |  | 1 | 3 | 3 |
| ***5*** | 3 | 1 | 1 |  | 1 | 3 | 3 |

**3=strong, 2=moderate, 1=possible**

Table 2 summarizes the assessment tools utilized to collect data. Direct and indirect assessment tools are also identified.

2

**Table 2** Assessment Tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Learning Outcome*** | ***Student***  ***Course work (direct)*** | ***Embedded questions***  ***(direct)*** | ***Evaluation of***  ***culminating experience (direct)*** | ***Exit***  ***survey***  ***(indirect)*** | ***Hands-on***  ***(direct)*** | ***Alumni***  ***Survey***  ***(indirect)*** |
| ***1*** | X | X | X |  |  | X |
| ***2*** | X | X | X | X |  | X |
| ***3*** |  |  | X |  | X | X |
| ***4*** |  |  | X | X |  | X |
| ***5*** |  |  | X |  |  | X |

**Standard**: On a scale of 1 (poor) to 5 (excellent), the faculty members consider a rating of 3.75 or higher to be satisfactory. A rating below 2.75 for any of the outcomes requires immediate attention, and a rating between 2.75 and 3.75 requires further observation as a “carry over item” in the next evaluation cycle.

Rubrics for assessing student learning outcomes have been developed and utilized. (Attached)

**Time Schedule and Closing the Loop**

Table 3 presents the time schedule for administering the assessment tools. It should be noticed that this schedule facilitates collecting a minimal amount of data on all SLOs every year.

**Table 3** Time Schedule

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Student***  ***Course work***  ***(direct)*** | ***Embedded***  ***questions***  ***(direct)*** | ***Evaluation of***  ***culminating***  ***experience***  ***(direct)*** | ***Exit***  ***survey***  ***(indirect)*** | ***Lab***  ***Performance (direct)*** | ***Alumni Survey***  ***(indirect)*** |
| One  core course  every other  year  (starting 2021) | One  200-level  elective course  every other year (starting 2022) | Every year | Every  year | Every year | Every fourth year (starting 2025) |

Collected data is to be compiled and analyzed by the faculty every year for continuous monitoring. Rating below 3.75 may require immediate attention and further data gathering before the end of the four-year cycle. A comprehensive review of the program takes place every four years to examine patterns in data and determine action items for program improvement.

3

**Rubric**

**Application of MATH, SCIENCE, and ENGR Principles**

**MSE-EE Student Learning Outcome 1**

Course#: \_\_\_\_\_\_\_\_\_\_\_\_

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Item** | Proficiency | | | | | |
| 5 | 4 | 3 | 2 | 1 | N/A |
| **Proper selection of**  **math/science/engr principles** | *Selection of*  *math/science/engr principles was*  *well justified and explained* |  | *Selection of*  *math/science/engr was partially*  *justified* |  | *Selection of*  *math/science/engr was not justified* |  |
| **Application of**  **math/science/engr to problems** | *Advanced*  *math/science/engr principles were applied with depth to solve key*  *problems in depth* |  |  |  | *Math/science/engr principles were referred but not applied to solve key problems* |  |
| **The effectiveness of applying**  **math/science/engr principles to**  **problems** | *Application of*  *Math/science/engr principles was*  *essential to solve key problems* |  |  |  | *Application of*  *Math/science/engr principles was not related to solve key problems* |  |

Average Score: \_\_\_\_\_\_\_\_\_\_

Evaluator: \_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_

4

**Rubric**

**Knowledge in EE Subjects and Engineering Tool Skills**

**MSE-EE Student Learning Outcome 2**

Course#: \_\_\_\_\_\_\_\_\_\_\_\_

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** |  | Proficiency | | | | | |
| 5 | 4 | 3 | 2 | 1 | N/A |
| **In-depth**  **Knowledge on EE Subjects** | *Problem*  *formulation* | *Conduct*  *research to*  *Identify and*  *formulate a*  *problem using mathematical*  *tools and*  *engineering*  *models* |  |  |  |  |  |
| *Problem*  *solving* | *Solve problem mathematically or using*  *engineering*  *tools* |  |  |  |  |  |
| *Analyzing*  *results* | *Analyzing results quantitatively* |  |  |  |  |  |
| **Engineering**  **Tool**  **Skill** | *Modeling*  *Tools* | *Fluent* |  |  |  | *Learning* |  |
| *Design Tools* | *Fluent* |  |  |  | *Learning* |  |
| *Analysis Tools* | *Fluent* |  |  |  | *Learning* |  |
| *Manufacturing Tools* | *Fluent* |  |  |  | *Learning* |  |

Average Score: \_\_\_\_\_\_\_\_\_\_

Evaluator: \_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_

5

**Rubric**

**Conduct Experiments and Data Analysis**

**MSE-EE Student Learning Outcome 3**

Course#: \_\_\_\_\_\_\_\_\_\_\_\_

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** |  | Proficiency | | | | | |
| 5 | 4 | 3 | 2 | 1 | N/A |
| **Experiments**  **and analysis of data** | *Predefined*  *Objectives*  *and Goals* | *Understand the objectives and goals of*  *conducting*  *experiments* |  |  |  | *Conduct*  *experiments*  *without goals* |  |
| *Proper*  *Methodology* | *Prepare the*  *experiments with equipments and well-thought*  *procedures* |  |  |  | *No preparation* |  |
| *Data*  *analysis* | *Data analysis*  *using*  *mathematical*  *tools and*  *engineering*  *modeling* |  |  |  | *No verification of the data from experiments* |  |

Average Score: \_\_\_\_\_\_\_\_\_\_

Evaluator: \_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_

6

**Rubric**

**Technical Communication Skills**

**MSE-EE Student Learning Outcome 4**

Course#: \_\_\_\_\_\_\_\_\_\_\_\_

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | | Proficiency | | | | | |
| 5 | 4 | 3 | 2 | 1 | N/A |
| **Verbal**  **communication** | *Delivery* | *Proper choice of verbal language* |  |  |  | *Use of casual,*  *conversational, impolite*  *language* |  |
| *Time* | *Effective use of time* |  |  |  | *Untimely*  *delivery*  *(Overtime)* |  |
| *Interaction with*  *Audience* | *Eye contacts,*  *Posture, and*  *Q/A* |  |  |  | *Showing*  *nervousness* |  |
| **Written**  **Communication** | *Grammar* | *Free from*  *grammar errors* |  |  |  | *Need a proof*  *reading.* |  |
| *Technical*  *Writing Style* | *Paragraphs*  *were written and organized to*  *support thesis*  *statements.* |  |  |  | *Paragraphs*  *were written*  *without a*  *direction.* |  |
| *Focus and*  *Organization* | *Introduction,*  *main body, and conclusions were written*  *coherently to*  *deliver a main theme of the*  *document.* |  |  |  | *Lack of structure and focus* |  |

Average Score: \_\_\_\_\_\_\_\_\_\_

Evaluator: \_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_

7

**Rubric**

**Literature Search and Critical Thinking**

**MSE-EE Student Learning Outcome 5**

Course#: \_\_\_\_\_\_\_\_\_\_\_\_

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | | Proficiency | | | | | |
| 5 | 4 | 3 | 2 | 1 | N/A |
| **Literature**  **Searches** | *Relatedness* | *All the cited references were related to the*  *study.* |  |  |  | *Most references were not related to the*  *study.* |  |
| *Sufficiency* | *Enough number of*  *major references were cited and studied.* |  |  |  | *The number of*  *references is too*  *small.* |  |
| **Critical**  **Thinking** | *Formulate* | *Problem formulation was supported by*  *preliminary study and a sequence of logical*  *reasoning.* |  |  |  | *Problem formulation was not justified.* |  |
| *Approach* | *The solution of problem was approached*  *scientifically using a sequence of logical*  *steps.* |  |  |  | *No systematic*  *approach.* |  |
| *Correctness* | *The correctness of*  *problem solution was verified using scientific method, mathematically or engineering*  *modeling.* |  |  |  | *The correctness of problem was not*  *discussed.* |  |
| *Completeness* | *The pros and cons of the problem solution were discussed using well versed logic and*  *justification.* |  |  |  | *The problem solution was given without*  *reasonable*  *justification.* |  |

Average Score: \_\_\_\_\_\_\_\_\_\_

Evaluator: \_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_

8