



Program Assessment Report (PAR)

Electrical Engineering (EE) Masters Degree

REPORT PREPARED by: Ash, Josh

ACADEMIC YEAR COVERED BY THIS REPORT: 2021-2022

I. PROGRAM LEARNING OUTCOMES

The Department of Electrical Engineering offers a program of graduate study leading to a Master of Science in Electrical Engineering (M.S.E.E.) degree. The M.S.E.E. program is broad in scope and emphasizes portable concepts in the design and analysis of complex physical systems using modeling, synthesis, and optimization techniques, and bridges interdisciplinary engineering areas such as control systems, microwave engineering, power electronics, signal processing, very large scale integrated circuits (VLSI), and wireless communications.

Program Educational Objectives or goals (Program Learning Outcomes)

1. Graduates of the M.S.E.E. degree shall have the ability to apply advanced electrical engineering techniques to solve engineering problems in one or more of the following subject areas VLSI & Electronics, Controls, Signal Processing & Communications, and RF & Microwave.
2. Graduates of the M.S.E.E. degree shall have the ability to clearly communicate engineering solutions.

Assessment Team Members: Graduate Studies Committee, Department of Electrical Engineering

Alignment of program goals to course outcomes:

Item 1 Program Goal: 1 - VLSI & Electronics Course Number: EE 7520 Course Outcome: Understand the complex high-performance VLSI subsystems, and various levels of low-power design techniques.

Item 2 Program Goal: 1 - Controls Course Number: EE 7020 Course Outcome: Understand the solutions to linear state space model, controllability, observability, stability, and state feedback control.

Item 3 Program Goal: 1 – Signal Processing & Communications Course Number: EE 7610 Course Outcome: Understand the response of linear systems with stochastic inputs and discrete linear models.

Item 4 Program Goal: 1 – RF & Microwave Course Number: EE 7440 Course Outcome: Understand the principle of operation and performance of various types high-efficiency RF power amplifiers and learn relevant design techniques.

Item 5 Program Goal: 2 – Communication Course Number: EE 7990 Course Outcome: Communicate research results in a thesis document.

II. PROCEDURES USED FOR ASSESSMENT

A. Direct Assessment

** Assessment Schedule ** Item 1 Program Goal: 1 – VLSI & Electronics Data Collection Term: When offered Review Term: Subsequent term Item 2 Program Goal: 1 – Controls Data Collection Term: When offered Review Term: Subsequent term Item 3 Program Goal: 1 – Signal Processing & Communications Data Collection Term: When offered Review Term: Subsequent term Item 4 Program Goal: 1 – RF & Microwave Data Collection Term: When offered Review Term: Subsequent term Item 5 Program Goal: 2 – Communication Data Collection Term: Per thesis defense Review Term: Subsequent term **Course outcomes to assignment** Item 1 Course Number: EE 7520 Course Outcome: Understand the complex high-performance VLSI subsystems, and various levels of low-power design techniques. Assignment Title: Final Exam Item 2 Course Number: EE 7020 Course Outcome: Understand the solutions to linear state space model, controllability, observability, stability, and state feedback control. Assignment Title: Final Exam Item 3 Course Number: EE 7610 Course Outcome: Understand the response of linear systems with stochastic inputs and discrete linear models. Assignment Title: Final Exam Item 4 Course Number: EE 7440 Course Outcome: Understand the principle of operation and performance of various types high-efficiency RF power amplifiers and learn relevant design techniques. Assignment Title: Final Exam Item 5 Course Number: EE 7990 Course Outcome: Communicate research results in a thesis document. Assignment Title: Final thesis defense **As per collection schedule, the collection of student artifacts for 2021-2022 include** Item 1 Term: Fall 2021 (per previous schedule) Class: EE 7530 Collection Method: Final Project Item 2 Term: Fall 2021 (per previous schedule) Class: EE 6420 Collection Method: Midterm, final, and practicum exams Item 3 Term: Fall 2021 Class: EE 7610 Collection Method: Final Exam Item 4 Term: per MS thesis defense Class: EE 7990 Collection Method: Rubric completed by committee

B. Scoring of Student Work

The program educational objectives are mapped to specific learning outcomes of the program major (track) areas. Each student in the program is required to complete at least three courses from at least one of the four major (track) areas as part of their Program of Study (POS). Consequently, program learning outcomes are measured over at least one core course in the selected track of a student's POS. Specific learning outcomes are directly assessed by evaluating the student's performance in corresponding course assignments, projects and/or exam problems. Course data is collected at every offering of a course. All MS thesis data are collected.

C. Indirect Assessment

The Electrical Engineering Department has established an active External Advisory Board (EAB) comprised of local and regional business leaders, hiring managers, practicing engineers and well-established alumni. Most of the EAB

members are responsible for hiring departmental graduates or student-trainees for their respective organizations. The EAB meets with the department faculty twice a year in Spring and Fall when they review the department's current status and progress in existing programs, as well as future plans. EAB provides guidance on any proposed curriculum changes, new courses, and overall program evolution to meet local and regional market demand as well as industry expectations. The EAB participants make strategic recommendations and specific course and curriculum suggestions to the program based on their own organizations' requirement and to cater to general market direction. This is a continuous evaluation process and all major program changes and all program learning outcomes as well as any new courses or new programs developed over the past five years were reviewed and approved by the EAB. College of Engineering and Computer Science's "Master of Science Assessment of Learning Outcome Survey" used during Exit Interview serve as additional measures for indirect assessment. The survey collects graduating students' assessment of self-efficacy for the learning outcomes. For each outcome the students are asked to rate their own level of ability/achievement that provide additional data point to the department faculty.

III. ASSESSMENT RESULTS/INFORMATION:

2021-2022 Assessment Items
Item 1: EE 7530 -- Final Exam (per previous schedule)
Item 2: EE 6420 -- Midterm, final, and practicum exams (per previous schedule)
Item 3: EE 7610 -- Final Exam
Item 4: EE 7990 -- Rubric completed by committee

For each assessment item, an individual scoring at least 70% is deemed satisfactory. Below, we summarize student performance as the percentage of students achieving satisfactory performance. Item 1: EE 7530 No data was collected because course was not offered. See Section IV (Actions: Information Sharing and Changes) Item 2: EE 6420 No data was collected because course was not offered. See Section IV (Actions: Information Sharing and Changes) Item 3: EE 7610 Percentage of students achieving satisfactory performance = 73% Course learning outcome achieved. No concern is raised. Item 4: EE 7990 Percentage of students achieving satisfactory performance = 100% Course learning outcome achieved. No concern is raised.

Understand various level of VLSI Synthesis and corresponding algorithms. Understand the solutions to linear state space model, controllability, observability, stability, and state feedback control. Understand the response of linear systems with stochastic inputs and discrete linear models. Understand physics represented by Maxwell's equations and related mathematical and measurement techniques for analyzing and designing microwave transmission lines, couplers, and filters. Communicate research results in a thesis document.

IV. ACTIONS TO IMPROVE STUDENT LEARNING

Course outcome data were collected per schedule by the course instructors and transmitted to the Graduate Studies Committee, Graduate Academic Advisor, the Graduate Program Director and the Department Chair on schedule. The responses are reviewed to identify any potential issues. The Graduate Studies Committee, academic advisor and the Department Chair formally meet at least once every semester to review all program and track courses, relevance of pre-requisites, course modifications and new course additions to ensure that the program is aligned to the student education objectives. Recent program changes that have been instituted include:

- Due to a significant number of retirements in our department (approximately 25%) and slightly lower enrollment, some of the assessment courses have not been offered as scheduled, thus leaving gaps in our collection effort. To address this, we have analyzed our future expected offering schedule to determine alternative assessment courses that still cover our objectives. Additionally, we have increased the assessment frequency of these courses. (2022)
- Removed some prerequisite courses in 7000-level offering in order to lower the barrier-to-entry. (2022)
- Added a hybrid (online/in-person) offering of EE6000 as a pilot study in order to evaluate recent best-practices in online education and gauge student interest (2022)
- Combine lecture/labs of 7000-level courses for efficient utilization of department resources (2020)
- Remove some 7000-level service courses that are not aligned with EE student interests (2019)
- Cross-list some CEG/CS courses that are aligned to EE Track requirements so that these courses can be treated as EE courses as part of a student's MS Program of Study (2019)
- Added new courses that are more aligned to the current market needs on emerging technologies
- Added new MS Certificate programs to provide students with theoretical concepts and practical know-how to earn university certified credentials on one of EE track specializations. (2018)
- Future actions: Based on earlier feedback, we are in the process of aligning the narrowly-focused objectives used in our HLC report with the broader objectives used in our program description in Curriculumlog.

V. SUPPORTING DOCUMENTS

Additional documentation, when provided, is stored in the internal Academic Program Assessment of Student Learning SharePoint site.