Institutional Effectiveness Report
2020-2021

Program: Electrical and Computer Engineering MS

College and Department: College of Engineering – Electrical & Computer Engineering

Contact: Allen MacKenzie

Mission: Provide quality undergraduate and graduate education and perform research in the areas of electrical and computer engineering to enhance the competitiveness of our graduates and contribute to economic, scientific, and social development.

Program Goals:

PG 1:   Graduates of the M.S. program will have the technical competence to be successful in the chosen area of study in electrical and computer engineering professional practice or research.

PG 2:   Graduates of the M.S. program will have the skills to undertake technically sound analysis independently and present their work at professional meetings or publish their work in scholarly journals.

PG 3:   Graduates of the M.S. program will have the technical competence to successfully undertake further advanced study at the doctoral level in electrical and computer engineering or a related area, and pursue lifelong learning through professional education.

Student Learning Outcomes:

Students of the MS program in Electrical and Computer Engineering will be able to:

SLO 1:   Demonstrate clear understanding of the chosen area of emphasis in electrical and computer engineering covered in course material in the graduate program.

SLO 2:   Apply advanced methods in the development of solutions in the chosen area of emphasis in electrical and computer engineering.

SLO 3:   Give professional presentations or write scholarly manuscripts worthy of publication in peer reviewed journals.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment Methods:

1. *Completion of Core Course and other Graduate Level Course Requirements:* Course work required for MSECE is as follows:

Thesis Track MS Program of Study

ECE 6910 Intro to Graduate Research -1 credit
Two ECE graduate breadth courses - 6 credits
Elective courses (some may be outside ECE) - 9 credits
Two ECE 6990 Research & Thesis courses - 6 credits
Total: 31 credits

Non-Thesis Track MS Program of Study

ECE 6910 Intro to Graduate Research - 1 credit
Three ECE graduate breadth courses - 9 credits
Four ECE Elective courses (some may be outside ECE) - 12 credits
Elective courses (some may be outside ECE) - 9 credits
ECE 6970 - Non-Thesis Design Project – 3 credits
Total: 34 credits

Each MS student must three ECE graduate breadth courses from a list maintained by the ECE Department. No more than six credits (2 courses) of 5000-level courses may be used to satisfy the MS requirements. No more than six credits (2 courses) of directed study ECE 6980/7980 may be used to satisfy the MS requirements. A maximum of nine credits (3 courses) of approved graduate coursework may be transferred from another university to satisfy the MS requirements. Admission to Candidacy is achieved following the term in which a student completes 9 hours, usually at the beginning of the second semester, at the same time the Program of Study is submitted. The basic requirements for candidacy are full standing, completion of nine credit hours of graduate work, and a TTU GPA of at least 3.0.

2. *Completion of Master's Thesis or Independent Project/Comprehensive Exam:* For the thesis option, this entails the requirement of writing a thesis, which must be successfully defended. The quality of the thesis is demonstrated by approval from the student's Advisory Committee. The Oral Defense of a thesis consists of an oral presentation by the student of her/his thesis research results, followed by questioning by colleagues and their committee. The overall intention is to test the breadth of knowledge in the discipline, depth in the specific area of research and ability to integrate concepts and techniques learned in the various courses. The defense begins with an open session in which the candidates make a presentation to their committee and other faculty and students. The audience then asks the candidate questions regarding their research work. Afterward, in a closed session, the committee examines the candidate on the details of their thesis, as well as any other relevant material. Then the candidate is asked to leave the room, and the committee discusses the candidate's performance and then votes to pass or fail the candidate. The student must pass this defense by three (3) positive votes or three-fourths of the committee members eligible to vote. A signature form is then forwarded to the Office of Graduate Studies with the results of the defense. If the candidate passes the defense, the committee instructs the candidate on any required changes needed to complete their work. If the candidate fails the defense, the committee informs the candidate in writing regarding the additional work that the candidate must undertake before defending a second time. The second attempt may be scheduled as soon as these deficiencies are

rectified. However, failure on the second attempt results in dismissal from the graduate program.

For the non-thesis option, there is a 3 credit hour semester-long Non-Thesis Design Project course (ECE 6970) to address the University and program requirement that students be able to demonstrate the ability to engage in independent learning and discovery.

3. *ECE Department Graduate Program Committee Feedback:* The department has a Graduate Program Committee that includes representative faculty across the department. This committee meets several times a semester to discuss the performance, quality, and possible improvements applicable to the MSECE Program. It also receives input from faculty and students proposing changes to the curriculum or other aspects of the graduate program and monitors the impact of changes once implemented.

4. *Evaluation of Thesis and Defense:* For the thesis option, a survey form is used to evaluate the presentation. The survey is completed by the student's committee members as well as all others in attendance. The form is attached.

5. *Record of Presentations and Publications:* The Annual Student Research Day is an opportunity for graduate students to make presentations of their research. In addition, students are encouraged to submit publications to conferences and journals stemming from graduate course work and their thesis research. All MS students are required to either present a paper at a conference or participate in TTU Research Day as a graduation requirement.

Results:

SLO 1: *Demonstrate clear understanding of the chosen area of emphasis in electrical and computer engineering covered in course material in the graduate program.*

SLO 2: *Apply advanced methods in the development of solutions in the chosen area of emphasis in electrical and computer engineering.*

Completion of Breadth Course and other Graduate Level Course Requirements

Achievement of student learning outcomes has been satisfactory based on the many student-authored class project reports, in-class assignments, journal publications, presentations, and quality of the MS Theses produced.

Completion of Master's Thesis or Independent Project/Comprehensive Exam

The following table shows the number of MS students who successfully completed the requirements for Thesis/Project/Exam over the past 6 academic years. As pointed out earlier, several individuals must approve the completion of these milestones.

Academic Year	Number of Completed Thesis/Projects/Exams
2020-2021	7
2019-2020	6
2018-2019	7
2017-2018	7
2016-2017	9
2015-2016	7

Evaluation of Thesis and Defense

The following table lists presents the average ratings for the first two of nine questions asked in the Oral Defense and Thesis Assessment Form. This form has been in use since Fall of 2013

1   - shows little or no mastery of the sub-discipline
2   - shows marginal mastery of the sub-discipline
3   - shows basic mastery of the sub-discipline
4   - shows excellent mastery of the sub-discipline

Questions	2016-17	2017-18	2018-19	2019-20	2020-21
1. demonstrate mastery of the basic principles of at least one of the sub-disciplines of ECE.	3.68	3.67	3.83	3.80	-
2. able to apply these basic principles to solve advanced problems in their chosen sub-discipline	3.71	3.60	4.00	3.80	-
Number of students evaluated	10	5	4	5	-

Since the start of the pandemic in March 2020, many oral thesis defenses have been held via videoconference. In the transition to this online format, the completion of the survey was neglected for several months, and only 1 survey for a finishing M.S. student was conducted in 2020-2021. As such, we are not reporting survey data for the 2020-2021 academic year. Additional processes have been put in place to ensure that surveys are collected going forward; see below.

SLO 3: Graduates of the M.S. program will have the technical competence to successfully undertake further advanced study at the doctoral level in electrical and computer engineering or a related area, and pursue lifelong learning through professional education.

Evaluation of Thesis and Defense

The following table lists presents the average ratings for the remaining questions asked in the Oral Defense and Thesis Assessment Form**.** This form has been in use since Fall of 2013

1 - shows little or no mastery of the sub-discipline
2 - shows marginal mastery of the sub-discipline
3 - shows basic mastery of the sub-discipline
4 - shows excellent mastery of the sub-discipline

Questions	2016-17	2017-18	2018-19	2019-20	2020-21
Content	3.87	3.63	3.67	3.63	-
Visual Aids	3.64	3.70	3.83	3.76	-
Presenter	3.70	3.70	3.83	3.70	-
Presentation mechanics	3.62	3.70	3.83	3.77	-
Responses to questions and comments	3.58	3.50	3.67	3.70	-
Quality of English	3.52	3.77	3.83	3.73	-
Technical writing content	3.67	3.67	3.67	3.83	-
Number of students evaluated	10	5	4	5	-

Record of Presentations and Publications

The following table lists the number of MS students who either gave presentations and/or published scholarly papers.

Academic Year	Student Research Day	Publications
2020 – 2021*	-	-
2019 – 2020*	1	0
2018 – 2019*	1	0
2017 – 2018*	2	0
2016 – 2017	6	9
2015 – 2016	5	2

*It is unclear how this data was tracked prior to the 2017-2018 academic year, and incomplete records are available for 2017-2018 and subsequent years. Even though publication or participation in the TTU Research Day became a degree requirement in the 2015-2016 academic year, adequate records of publications and research day participation were not being maintained. Additional processes have been put in place to ensure that this data is adequately collected and maintained going forward; see below.

Modifications for Improvement:

As noted above, a survey used to evaluate the quality of the thesis and defense was not consistently distributed and collected after the start of the pandemic. To ensure that the survey is distributed and collected in the future, the department chair will not sign defense forms until surveys have been collected from (at least) the faculty members serving on the student's committee.

Data was not being consistently collected regarding participation in Student Research Day and publications resulting from M.S. projects. (Namely, the form certifying that the requirement that the student either publish a paper or participate in research day did not provide information regarding how this requirement was met.) The form is being revised to collect the desired information. Moreover, the form was not always collected; to ensure that the form is collected, the department chair will not sign defense forms until the form documenting participation in Student Research Day or publications has been collected.

Appendices

1. Curriculum Map – Thesis Option
2. Curriculum Map – Non-Thesis Option

Appendix 1: Curriculum Map – Thesis Option

ECE M.S. (Thesis): Curriculum Map			
	Student Outcomes		
Requirement	SLO1: Content Knowledge	SLO2: Advanced Methods in ECE	SLO3: Professional Communications
ECE Graduate Breadth Courses (9 credits)	X	X	
ECE Elective Courses (6 credits)	X	X	
Elective Courses (some may be outside ECE) (9 credits)	X		
ECE 6910: Intro to Graduate Research (1 credit)			X
ECE 6990: Research and Thesis (6 credits)		X	X
ECE Publication or Presentation Requirement			X

Appendix 2: Curriculum Map

ECE M.S. (Non-Thesis): Curriculum Map			
Requirement	Student Outcomes		
	SLO1: Content Knowledge	SLO2: Advanced Methods in ECE	SLO3: Professional Communications
ECE Graduate Breadth Courses (9 credits)	X	X	
ECE Elective Courses (12 credits)	X	X	
Elective Courses (some may be outside ECE) (9 credits)	X		
ECE 6910: Intro to Graduate Research (1 credit)			X
ECE 6970: Non-Thesis Design Project (3 credits)		X	X