WSU Five-Year Graduate Program Review
Self-Study

Cover Page

Department/Program: Electrical & Computer Engineering/MSEE

Semester Submitted: Fall 2023

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A. Brief Introductory Statement

The WSU Master of Science in Electrical Engineering (MSEE) program provides an avenue for students in Electrical and Computer Engineering to pursue a graduate degree in a high-demand and growing discipline. Further, it offers professionals in the local work force an opportunity to earn an advanced engineering degree, bolster innovation in the community, and thereby promote economic growth. Finally, for those students who are interested, this program provides the necessary preparation for doctoral programs at other institutions of higher learning.

B. Mission Statement

The mission of the Master of Science Program in Electrical Engineering, in adherence to the core themes of the mission of Weber State University, is to provide students a high quality graduate-level education in Electrical Engineering. This education, which emphasizes advanced engineering principles coupled with hands-on experience, enables students to make significant contributions to society as professional engineers. The program stresses design and problem solving using math, science and advanced electrical engineering principles

C. Program and Curriculum

a. Program Description

Admission, retention, degree requirements and course descriptions can be found at: https://catalog.weber.edu/preview_program.php?catoid=22&poid=11236&hl=msee

Program Website can be found at: http://weber.edu/msee

Program level learning outcomes are as follows:

At the end of their study at WSU, students in this program will:

- Demonstrate the ability to apply knowledge of math, science and engineering.
- Demonstrate the ability to design a system, component or process.
- Demonstrate the ability to identify, formulate and solve engineering problems.
- Demonstrate the ability to apply master's level knowledge to the specialized area of electrical engineering.

Curriculum Map

Core Courses in Department/Program	Program Learning Outcomes			
	Learning Outcome 1	Learning Outcome 2	Learning Outcome 3	Learning Outcome 4
ECE 6010 - Design Project	H	H	H	H
ECE 6020 - Thesis	H	H	H	H
ECE 6110 - Digital VLSI Design	H	H	H	H
ECE 6120 - Analog VLSI Design	H	H	H	H
ECE 6130 - Advanced Semiconductor Devices	H	H	H	H
ECE 6140 - Sensors and Instrumentation	L	H	L	H
ECE 6150 - Thin Film Engineering	H	H	L	H
ECE 6210 - Digital Signal Processing	H	L	H	H
ECE 6220 - Image Processing	H	L	H	H
ECE 6230 - Engineering Applications in Deep Learning	H	L	H	H
ECE 6310 - Electromagnetics II	H	L	H	H

Core Courses in Department/Program	Program Learning Outcomes			
	Learning Outcome 1	Learning Outcome 2	Learning Outcome 3	Learning Outcome 4
ECE 6320 – Antennas and Wave Propagation	H	H	L	H
ECE 6410 - Communication Circuits and Systems	H	H	L	H
ECE 6420 - Digital Communication	L	H	H	H
ECE 6440 – Optical Communication Systems	L	H	H	H
ECE 6510 - Advanced Power Systems	H	L	H	H
ECE 6620 – Digital System Testing	L	H	H	L
ECE 6640 - Model Based Engineering	L	H	H	H
ECE 6710 - Real-Time Embedded Systems	H	H	H	L
ECE 6730 - Robotics	H	H	L	H
ECE 6750 - Quantum Computer Engineering	H	H	L	H
ECE 6800 - Individual Studies	-	-	-	-
ECE 6900 - Special Topics	-	-	-	-
CS 6610 - Computer Architecture	H	L	H	H

b. Evidence of ongoing demand for the program
    i. Data on the last five academic years on admissions, enrollments, and degrees awarded:

Academic Year	New applications	Admitted Applicants	Selectivity (%)	Applicants Enrolled	Yield (%)	Total Matriculated Students [IR]	Matriculated Domestic Students	Matriculated International Students [IR]	Number of Graduates (Sum, Fall, Spr) [IR]
2022-23	5	3	60%	3	100%		3		4
2021-22	6	5	83%	5	100%		5		2
2020-21	7	4	57%	4	100%		4		5
2019-20	7	7	100%	4	57%		4		1
2018-19	4	4	100%	4	100%		3	1	0

ii. Enrollment History:

Academic Year	Number of Majors
2022-23	10
2021-22	7
2020-21	6
2019-20	7
2018-19	0

Academic Year	Faculty/Student ratios across program curr.	Average class size
2022-23	N/A	
2021-22	8.3	
2020-21	7.18	
2019-20	8.77	
2018-19	8.10	

iii. Average time to degree completion (semesters): 4

iv. Enrollment projections – Based on current enrollment trends plus the influx expected from the new course-only option, we expect 7 applicants per year of which we expect 4 will enroll. We also expect this number to grow gradually as the undergraduate program grows inasmuch as a significant number of our applicants are WSU alumni.

c. Student profile

i. Information on the entering class for each of the past 5 years:

Entering Class	Ave. GRE	Ave. GMAT	Ave. GPA (undergrad)	Ave. Age (years)	Ave. Relevant Work Experience (months) (optional)
2022-23	N/A		3.76		
2021-22	150		3.53		
2020-21	147		3.4		
2019-20	N/A		3.53		
2018-19	151		3.38		

ii. What do you know about your students post-graduation? Please describe attempts to contact and track graduates.

Graduating Class	# of Graduates (A)	# of Graduates Employed in Field (B)	# of Graduates in Add'l Graduate Program (C)	# of Graduates with unknown status	Placement Rate (B+C)/A
2022-23	4	4		0	100%
2021-22	2	2		0	100%
2020-21	5	5		0	100%
2019-20	1	1		0	100%
2018-19	0	N/A			

Note that most students who apply to our program are already employed in the field and receive tuition assistance from their employer.

iii. Program career placement services:

Career placement services for our program are handled by the College of Engineering career placement office, which is shared amongst the other programs in our college, however, since (as noted earlier) most of our students are already employed, the need for career placement is minimal.

D. Student Learning Outcomes and Assessment

<u>Measurable Learning Outcomes</u>

At the end of their study at WSU, students in this graduate program will

- Demonstrate the ability to apply knowledge of math, science and engineering.
- Demonstrate the ability to design a system, component or process.

- Demonstrate the ability to identify, formulate and solve engineering problems.
- Demonstrate the ability to apply master's level knowledge to the specialized area of electrical engineering.

Assessment of Graduating Students

Students electing the project report or thesis option

All faculty (minimum of 3) attending the final design review (defense) of a student's project or thesis complete a project or thesis defense assessment, which is a direct assessment instrument that assesses the student's mastery of the program-level learning outcomes listed above.

The project or thesis defense assessment instrument works as follows: Faculty attending a final design review or defense answer four questions corresponding to the four learning outcomes listed in Section C. Responses from these questions fall into a four-point asymmetrical Likert scale:

4 = strongly agree (Student Exceeded Expectations for that outcome)
3 = agree (Student Met Expectations for that outcome)
2 = mixed (Student Met some expectations for that outcome but not all), and
1 = disagree (Student did not meet expectations for that outcome).

The student's committee chair calculates the mean response for each question. These responses are recorded in the Project Defense Assessment Report, which the chair submits to the program director. The director computes a graduating cohort average for each of the four questions and enters those averages into the continuous improvement record. If the mean value for any question falls below 2.67, the program faculty must initiate action to address the unsatisfactory learning outcome result(s). Conversely, if all mean values are at or above 2.67, no action is initiated by the faculty.

Students electing the coursework-only option

Students who elect the coursework only option are required to compile a portfolio consisting of research and/or project work that is required of 6000-level students but may not be required of 5000-level students (who meet at the same time and place). Prior to graduation, students submit these portfolios, which are circulated to all the faculty in the program. The faculty then rate the portfolios using an instrument similar to the project defense report described above. The director compiles the results and enters them in the continuous improvement record. The same trigger for initiating action (2.67) applies.

Continuous Improvement

Please describe changes to your program based on assessment findings, student demand, industry demand

Summary Information (as needed)

Evidence of Learning: High Impact or Service Learning (if applicable)

Each course in the MSEE curriculum grid marked "H" has an associated assessment rubric, which is a direct assessment instrument that articulates the expectations for student performance. The rubric consists of three elements:

Dimensions (performance indicators)
Scale (levels of performance) of 1, 2, 3 or 4
Descriptors (descriptions of the levels of performance)

The assessment rubric measures students' performance with respect to the 4 student learning outcomes listed above. Through the continuous use of these rubrics, assessment at both the course and program level is an ongoing process that provides a measurable means of program improvement.

The course assessment rubric works as follows. At the end of each semester, the instructor scores each performance indicator (PI) based on the performance of at least 80% of the class (or all but one student if class size is less than 5). A four-point scale is used. The rubrics are designed with a "trigger point." If the score of a PI is 1 (unsatisfactory) or 2 (improving), the instructor initiates action to make course level changes with respect to the applicable PI for the course. If the score of a PI is 3 (satisfactory) or 4 (exemplary), no action is taken by the instructor. Then, the mean PI score for each course and section* is transferred to a program level "continuous course improvement" record, a document that summarizes the mean PI scores. This document utilizes a trigger point of 2.67 and if a mean PI score falls below the trigger point, the faculty at the program level must make significant changes to the course or the program to remedy the problem. Thus, depending on the trigger points activated, both the instructor and program faculty have input to the continuous improvement process.
A specimen of a course assessment rubric is shown on the next page.

ECE 6110 (Digital VLSI) Course Assessment Form

Instructor Justin Jackson_____ Semester and Year **Spring 23**_____

The following instrument is used to assess the performance of students in ECE 6110 based on exams, homework and laboratory work. A rating of 1-4 is assigned by the instructor to each course outcome if at least 80% of students meet the corresponding criterion. If fewer than 80% of students meet the Improving (2) criterion, a rating of Unsatisfactory (1) must be assigned.

Performance Indicator	Improving (2)	Satisfactory (3)	Excellent (4)	Rating	Action Plan (if rating less than 3)
Ability to design a standard cell library from CMOS	Able to design standard digital logic utilizing a schematic capture tool.	Able to design standard digital logic utilizing a schematic capture and a layout tool.	Able to design standard digital logic utilizing a schematic capture and a layout tool, including verification and simulation of logic.	4	
Ability to design large scale integrated digital systems	Able to design large-scale digital systems utilizing schematic capture tool and hand layout techniques.	Able to design large-scale digital systems utilizing schematic capture tool, hand layout techniques, and auto routing tools.	Able to design large-scale digital systems utilizing schematic capture tool, hardware description languages, hand layout techniques, and auto routing tools.	3	
Ability to design custom digital systems to speed, power, and size constraints	Able to design custom digital systems to size constraints.	Able to design custom digital systems to size and power constraints.	Able to design custom digital systems to size, power, and speed constraints and understand trade-offs and impact on design.	2.5	Didn't require power analysis or size requirements since it was the first time using Magic tools. Will implement next time now that I am more familiar with the new tools. Did cover trade-offs and impact on design.

Detailed information provided by these course assessment instruments are filed in the biannual reports. Note, however, that the data are reformatted in those reports to conform with university convention.

It should be noted that each MSEE 6000-level course contains a project or research component that constitutes a high impact educational experience.

Program Changes Driven by the Assessment Process

As an example of this process, Fall 2021 the program assessment showed that there was an issue with our ECE 6730 Robotics course. We found that there was not enough time allocated to teach the necessary programming component as well as, time allocated to build the actual robots. The course rubric noted this issues and so we added an additional credit to the course and a dedicated lab to the class to complete these tasks. We also felt that part of the issue was that there was far too much material for students to learn the basics of the robot operating system (ROS) in this one class. So starting in 2024, we have added a new junior level course that covers some of the basics to properly prepare students for this graduate level course.

Another example of the process, in Spring 2020, our students scored low in our ECE 6210 Digital Signal Processing (DSP) course. Students were not able to apply some of the theoretical concepts as well as the faculty had determined they should. After review of the course, the faculty decided that there was not enough "real-world" applications in the class to prepare students for solving DSP problems in hardware. So in 2021 we decided to also add lab to this particular course. This laboratory was designed to give students that needed application of concepts in hardware. The professor that typically teaches this class wrote a grant to purchase enough DSP development boards to allow for students to program real hardware with their calculated solutions.

There are several other examples of rubrics being used to strengthen the program as well. From software changes to changing the rubrics themselves to better align with the desired topics and skillsets as the courses mature and change to meet the needs of our industry partners.

E. Academic Advising

Advising Strategy and Process

The college has recently employed a graduate enrollment director. The enrollment director now serves as an advisor for prospective students and professional students (in conjunction with the MSCE, MSCS, MSDS, and MSSE programs).

The enrollment director establishes the initial working relationship with the applicants by ensuring that appropriate documents are submitted for admission committee review and addressing any questions they have about the program. When appropriate, the enrollment director connects prospective students with the graduate director in the case that prerequisites would be required based on an evaluation of their undergraduate transcripts. The enrollment director assists both prospective or professional students with the admissions and registration process.

The enrollment director serves as the entry point of contact for professional students and notifies the applicant of their acceptance into the program. Students are encouraged to meet with the enrollment director to discuss the student's intended degree track and establish a program of study, which will be stored in the student's academic file. The goal is to ensure that students understand the expectations of each track, how to seek any course overrides if applicable, and to encourage students to establish a relationship with a faculty advisor if they plan to pursue a thesis or project track.

The enrollment director makes referrals to the program director (or thesis/project) advisor when appropriate. Students are encouraged to meet with the program director when they have questions regarding career pathways or the coursework track option to discuss the requirements for the required portfolio. Students who plan to pursue the thesis or project track are encouraged to work closely with their faculty advisor or if they have not established an advisor or committee to work with the program director for guidance.

Effectiveness of Advising

Prior to 2020, program advisement was handled ad-hoc by the program director, and no records from which advising effectiveness could be derived were kept. The enrollment director recently has assumed most of the advising duties and we have not identified any major issues with the current format for advising. Students are able to meet with the enrollment director regarding questions and requirements for the degree. When advice is provided a note of the advising session will be made in the student's Cat tracks.

Past Changes and Future Recommendations

Past changes have been noted above. We have no current recommendations for advising, as the system works well for the number of students we serve in the program. However, our goal is to increase our enrollments and clean up our enrollment roles, removing students who confirmed enrollment, but did not end up enrolling in classes.

F. Faculty and Teaching

a. Minimum qualifications required of graduate faculty:

All faculty teaching in the MSEE program must have a Ph.D in Electrical Engineering or some other closely related field. Faculty must also have two or more years professional experience.

a. Faculty Demographic Information

The following table lists faculty who currently teach in this program as well as those who have taught during the reporting period for this review. Note that none of these faculty are dedicated exclusively to the MSEE program but teach undergraduate courses in their respective departments.

Name	Home Dept	Title/Qual	Type (tenure, tenure track, contract or adjunct)	Gender	Ethnicity
Fon Brown	ECE	Professor	Tenure	M	Cauc.
Shellee Dyer	ECE	Asst. Professor	Tenure Track	F	Cauc.
Tye Gardiner	ECE	Asst. Professor	Tenure Track	M	Cauc.
Eric Gibbons	ECE	Asst. Professor	Tenure Track	M	Cauc.
Christian Hearn	ECE	Assoc. Professor	Tenure	M	Cauc.
Justin Jackson	ECE	Professor	Tenure	M	Cauc.
Alyssa Mock	ECE	Asst. Professor	Tenure Track	F	Cauc.
Suketu Naik*	ECE	Asst. Professor	Tenure Track	M	Asian
Dhanya Nair*	ECE	Asst. Professor	Tenure Track	F	Asian
Trent Tholen*	ECE	Adjunct	Adjunct	M	Cauc.
Christopher Trampel*	ECE	Assoc. Professor	Tenure	M	Cauc.
Hugo Valle	CS	Assoc. Professor	Tenure	M	Spanish
Larry Zeng*	ECE	Assoc. Professor	Tenure	M	Asian
Jonathan West	ECE	Asst. Professor	Tenure Track	M	Cauc.

* Faculty who are no longer employed at Weber State University

i. Percentage of graduate courses and/or credits taught:

Note, except for ECE 6010 (Design Project) and ECE 6020 (Thesis), all graduate courses are taught same-time same-place as undergraduate senior electives but with added rigor to justify the 6000-level designation. This table lists the total number of graduate credits taught and the average overload of the faculty teaching or supervising them

	# of courses or credits taught in-load	# of courses or credits taught in overload	Percentage of courses or credits taught in overload
2022-23	6	0	0%
2021-22	9	0	0%
2020-21	6	0	0%
2019-20	6	0	0%
2018-19	6	0	0%

ii. *The faculty compensation model for thesis advising, directed study, supervision of student consulting projects / internships, etc.*

The faculty compensation model consists of two parts: (a) compensation for teaching a graduate course at the same time and place as an undergraduate elective, and (b) compensation for serving on a student's supervisory committee.

(a) Faculty who teach graduate courses same time and place as undergraduate electives are compensated $500 per course. Note that the total number of students is capped as it is for any other course, just some of the students are graduates who require additional time from the professor to prepare and grade the graduate level assignments. The graduate and undergraduate courses are counted as a single course for the purpose of faculty load calculation.

(b) Students working on a design project or thesis register for either ECE 6010 or ECE 6020. Each member of the student's supervisory committee is compensated $50 per credit of ECE 6010 or ECE 6020 in which the student is enrolled. (This works out to $300 by the time a student graduates.) This money is primarily to compensate faculty for their time reviewing and editing project reports and theses. Additionally, the student's major professor is

given a load reduction of half a credit for each credit of ECE 6010 or ECE 6020 in which their student is enrolled. Load reduction is limited to a maximum of 3 credits per semester.

Programmatic/Departmental Teaching Standards

Faculty Qualifications
All faculty are required to have a Ph.D. in Electrical Engineering or a related field (e.g. Computer Engineering, Biomedical Engineering, etc.)

Evidence of Effective Instruction
For both regular and adjunct faculty, courses are evaluated and evidence of effective instruction is obtained as described under Section D, "Evidence of Learning: Courses within the Program".

Mentoring Activities
The MSEE program does not have a mentoring program per se inasmuch as all faculty belong to the ECE department, which has a mentoring program established already.

Diversity of Faculty
Of the 14 faculty who taught in this program during the reporting period of this review, 3 were Asian, 1 was Spanish, and 3 were female. Since then, the number of Asian faculty has dropped to 0 and the number of female has dropped to 2, while the other category has remained unchanged.

Ongoing Review and Professional Development
The MSEE program does not incorporate professional development programs or faculty reviews inasmuch as all faculty in the MSEE program belong to the ECE department. The department utilizes ongoing development programs and reviews already.

G. Support Staff, Administration, Facilities, Equipment, and Library

Adequacy of Staff

i. Ongoing Staff Development

Adequacy of Administrative Support
During the reporting period of this review, there was inadequate support staff to handle recruitment, admissions, or advising. Advising was handled by the

program director, admission was handled as an added load for the administrative assistant of the Electrical and Computer Engineering department, and recruitment was neglected entirely. Starting Fall 2020, we have an enrollment director (Rainie Ingram) who is handling these three areas. Rainie is not dedicated to the MSEE program exclusively, but is shared amongst the MSCE, MSEE, MSSE, MSDS, and MSCS programs.

Adequacy of Facilities and Equipment

The MSEE program has access to equipment and software necessary to do its job, and so far no faculty request for software or equipment has gone unsatisfied. However, the research facilities are adequate for our program since moving into the new Noorda Engineering building where facilities have been designed to support our programs.

Adequacy of Library Resources

The only library resource required by this program is (full) access to the IEEE Xplore database. Although the library has indicated that they may have to discontinue this database due to cost, at the moment we still have access to the database.

H. Relationships with External Communities

Description of Role in External Communities

The MSEE program at Weber State University was established at the behest of Hill Airforce Base and several other defense contractors. Many students in the program are employed by these entities and will remain so after graduation.

These entities are well represented in our industrial advisory board which the MSEE program shares with the BSEE, BSCE and MSCE programs.

Summary of External Advisory Committee Minutes

I. Results of Previous Program Reviews

This is a new program and there have been no previous program reviews

J. Action Plan for Ongoing Assessment Based on Current Self Study Findings

Action Plan for Evidence of Learning Related Findings

No problems were identified that have not already been addressed.

Problem Identified	Action to Be Taken
Issue 1	Current 5 Year Program Review:
	Year 1 Action to Be Taken:
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:

Action Plan for Staff, Administration, or Budgetary Findings

Problem Identified	Action to Be Taken
Issue 1	Current 5 Year Program Review:
	Year 1 Action to Be Taken:
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:

K. Tracking program graduates:
Please describe strategies for staying in touch with your graduated students. What information do you gather from program graduates and how is that information used?
We ask all of our graduates to join our linked in group to track graduates as they move through their careers.

APPENDICES

Appendix A: Student and Faculty Statistical Summary: *Note*: **Data provided by the Office of Institutional Effectiveness**

	2018-19	2019-20	2020-21	2021-22	2022-23
Student Credit Hours Total	2,231	2,414	2,117	2,255	1,976
Student FTE Total	91	82.9	72.6	78.8	63.4
Students in the Program	0	7	6	7	10
Program Graduates	0	1	5	2	4
Student Demographic Profile					
Female	0	0	0	0	1
Male	0	7	6	7	9
Faculty FTE Total	11.23	9.46	10.12	9.50	N/A
Adjunct FTE	1.74	2.60	2.38	2.28	N/A
Contract FTE	9.49	6.86	7.74	7.22	N/A
Student/Faculty Ratio					

This data is not available for graduate programs at this time.

Program Name:		2019	2020	2021	2022	2023
Expectation of time to graduation?	# of years					
Number and percent of majors meeting expectation for graduating	Department					
Number and percent of majors graduating w/in 1 year of expectation	Department					
Number and percent of majors graduating w/in 2 years of expectation	Department					
Number and percent of majors who don't complete by 6 years	Department					
Average overall hours of graduates	University					
	Department					
Average 'years to degree' for master's degree recipients	University					
	Department					
Other Analyses		2019	2020	2021	2022	2023
Percent of courses with adequate completion	Department					

(adequate completion = 80%+, A and B grades)	University					

Appendix B: Contract/Adjunct Faculty Profile

Name	Rank	Tenure Status	Highest Degree	Years of Teaching	Areas of Expertise
Trent Tholen	Adjunct	N/A	MS	7	Power

Summary Information (as needed)

Appendix C: Staff Profile

Name	Job Title	Years of Employment	Areas of Expertise
Judy Smith*	Admin. Assistant	2	Clerical
Rainie Ingram**	Enrollment Dir.	13	Recruiting & Advising

Summary Information (as needed)

* The majority of Judy Smith's time is allotted to the BSEE and BSCE undergraduate programs.
** Rainie also serves as the enrollment director for the MSCE, MSSE, MSDS, and MSCS programs.

Appendix D: Financial Analysis Summary
Note: Data provided by Office of Institutional Effectiveness

This data is not available for our graduate programs at this time.

Program Name					
Funding	**14-15**	**15-16**	**16-17**	**17-18**	**18-19**
Appropriated Fund					
Other:					
Special Legislative Appropriation					
Grants or Contracts					
Special Fees/Differential Tuition					
Total					

Summary Information (as needed)
This data was requested from the Office of Institutional Effectiveness and is clearly incorrect for the MSEE program. Unfortunately, it appears that we cannot collect the actual cost for this program. It should be noted though that it does cost $500 per class offered for our ECE 6XXX courses, but for many of the classes that differential is shared with the MSCE program.

Appendix E: External Community Involvement Names and Organizations

Name	Organization