Electrical and Computer Engineering (ECE) Department

Master of Science
in
Electrical and Computer Engineering (MS-ECE)

Graduate Program Handbook
2021-2022 Academic Year

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General Information

The objective of the MSE-ECE program is to provide advanced engineering education in Electrical Engineering 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 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.

The MSE-ECE program builds upon a previously acquired foundation in basic science, mathematics, and electrical/computer engineering to advance skills in research and applied engineering science. The overarching goal of the programs is to **enhance the students' ability to be successful and advance in their chosen careers in industry, academia, and public institutions**. The programs prepare 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 the 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 or computer engineering.

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

The minimum number of units required to complete the MSE-ECE degree is 30 units including the culminating experience. The possible options for the culminating experience are Comprehensive Exam (0 units), Directed Project (3 units) and Directed Thesis (6 units). Through academic advising, students choose the option that fits their career goals most. The thesis option is usually recommended for those who have interest in pursuing doctorate studies. Students who 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 technical emphasis.

The graduate of the programs should be able to,
1) Apply advanced mathematics and engineering science to practical problems.
2) Demonstrate knowledge in advanced electrical engineering subjects and utilize advanced engineering tools to solve engineering problems.
3) Conduct experiments and analyze collected data.
4) Communicate effectively orally and in writing.
5) Conduct literature searches and formulate ideas via critical thinking practices.

Degree Requirements

30 units total	
Fundamentals 12 units	ENGR 200: Seminar in Engineering (1) ECE 201: Systems Modeling and realization (2) Three course from ECE 224, 230, 231, 240, 241, 242, 243, 245, 253, 274, 278
Electives 12-18 units (12 for thesis option, 15 for project option, 18 for exam option)	Up to six units may be taken from ECE 100-level courses; which are not required for a BS degree in the ECE Department (see list of BS course courses below) Up to six units of 200-level courses in program related subjects (Business, Engineering, Mathematics, Physics, and Computer Science) may be taken with the Graduate Coordinator's approval. 200-level ECE courses (Course prerequisites must have been completed before enrolling in the course).
Culminating Experience 0-6 units	Thesis (ECE 299): 6 units Project(ECE 298): 3 units Exam: 0 units

Electives List:
ENGR 206: Stochastic Theory in Engineering Analysis (3)
ECE 224: Advanced Signal and Systems (3)
ECE 230: Nonlinear Control Systems (3)
ECE 231: Digital Control Systems (3)
ECE 232: Optimal Control Systems (3)
ECE 240: VLSI Circuits and Systems (3)
ECE 241: Applied Electromagnetics (3)
ECE 242: Digital Systems Testing and Testable Design (3)
ECE 243: Modern Methods in Synch. Sequential Design (3)
ECE 244: Advanced Hardware Design of Computer Arithmetic (3)
ECE 245: Communications Engineering (3)
ECE 247: Modern Semiconductor Devices (3)
ECE 249: Advanced Comm. Engr. (3)
ECE 251: Antennas and Propagation (3)
ECE 252: Advanced Power Electronics (3)
ECE 253: Power Systems Dynamics (3)
ECE 255: Digital Signal Processing (3)
ECE 257: Optical Comm. and Lasers (3)
ECE 259: Radar System Design (3)
ECE 274: High Performance Computer Architecture (3)
ECE 278: Embedded Systems (3)
ECE 291T: Topics in ECE (1-3)
ECE 290: Independent Study (1-3) [Available only after advancement to candidacy and usually taken the semester prior to enrolling in ECE 298/299]
CSci 2xx: Require the approval of the graduate coordinator/advisor
Business-Administration/Science 2xx: Require the approval of the graduate coordinator/advisor

ECE 103: Professional Development Skills (2)
ECE 107: Digital Signal Processing (3)
ECE 132: Design of Digital Systems (3)
ECE 135: Wireless Communication Systems (3)
ECE 136: Electromagnetics Theory and Applications (3)
ECE 140: VLSI System Design (3)
ECE 148: Analysis and Design of Digital Circuits (3)
ECE 150: Cloud Cyber Security (3)
ECE 151: Electric Power Systems (3)
ECE 152: Power Systems Protection (3)
ECE 153: Power Electronics (3)
ECE 156: Fundamentals of Cryptography and Computer Network Security (3)
ECE 162: Integrated Circuits and Applications (3)
ECE 166: Microwave Devices and Circuits Design (3)

ECE 168: Microwave Amplifier and Oscillator Design (3)
ECE 171: Quantum Electronics (3)
ECE 172: Sequential Machine and Automata Theory (3)
ECE 173: Robotics Fundamentals (3)
ECE 119L: Programmable Logic Controllers (1)
ECE 134L: Communication Lab (1)
ECE 136L: Electromagnetic Theory and Applications Lab (1)
ECE 141L: Algorithmic Computations Lab (1)
ECE 155L: Control Systems (1)

BS Core Courses List (not eligible for graduate credit but may be taken as prerequisites as needed)

ECE 1, 71, 72, 85, 85L, 90, 90L, 102, 106, 111, 114, 115, 118, 118L,121,124, 124L, 125,126,128,128L,134, 138, 138L, 141, 141L, 144, 146, 155, 174,176,178

Academic Standing

Admission to the programs occurs at two levels. First, you must be admitted to the University; second you must be admitted by the Division of Graduate Studies to the specific program of interest.

Admission to a master's degree program places you in one of two categories:
- Conditionally Classified Graduate Standing
- Classified Graduate Standing (full admission)

Conditionally Classified Graduate Standing
If you are admitted as a Conditionally Classified Graduate Student, your admission statement will list the condition(s) required for program admission. It is required that you fulfill all these conditions. For example, if you are accepted conditionally with the requirement to earn a 3.00 GPA in the first 9 units and/or complete prerequisite courses (not part of the required 30-units), you must earn a cumulative GPA of 3.00 and/or pass the prerequisite courses with a B grade or better. To be advanced to classified standing, you must submit the "Classified Standing Form" to the Division of Graduate Studies. Failure to satisfy any condition may delay your admission into the program and graduation.

Classified Graduate Standing
Classified standing is granted to those students who meet all program admission requirements, and have satisfied all professional, scholastic or other expectations of entering graduate students. To qualify for classified standing in a timely fashion, you must enroll in all the prerequisite courses required of you as soon as the courses are available. Prerequisites should have priority over graduate credit courses until all prerequisites are completed.

Advancement To Candidacy (ATC)
Soon after you attain classified graduate standing, you should plan to achieve advancement to candidacy. Advancement to candidacy is a critical step in your graduate degree process as it establishes an official roadmap for completing your degree. Approval of Advancement Petition signifies a formal agreement between the student, program, and university. Once you have been advanced to candidacy, you have official permission to proceed toward qualifying for your graduate degree. Students should be advanced to candidacy as soon as possible, after satisfying the following conditions:

1. Attained classified graduate standing.
2. Completed nine units of graduate credit at Fresno State with 3.0 GPA or better.
3. Identified a project advisor or thesis committee or consult with the graduate coordinator regarding the comprehensive Exam option.
4. Fulfilled the graduate writing skills requirement (ENGR 200).

Timeline
Achieve advancement to candidacy as soon as possible after you earn classified graduate standing. Advancement must be achieved no later than the semester prior to the term in which you wish to register for culminating experience and/or apply for your graduate degree to be granted. Check with the Division of Graduate Studies website for the petition deadline.

Advisement
When you arrive on campus the ECE Graduate Coordinator will serve as your temporary advisor and answer questions you may have regarding the regulations, requirements, and procedures of graduate study within the program. The Graduate Coordinator serves as your provisional graduate advisor until you identify a Graduate Advisor who meets your academic needs. The Graduate Advisor helps you to explore thesis/project research topics, identify appropriate courses, suggests possible project/thesis committee members, and oversees your progress towards your degree. The nature of a graduate degree presumes that you will master a specific relevant area. It is important that you work closely with a faculty member who specializes in an area related to your academic and professional interests. The Graduate Coordinator on the other hand oversees general issues relevant to all graduate students in the program.

The Culminating Experience

To bring your program of study to culmination, you must choose one of the following three options:

The Comprehensive Examination
A comprehensive examination is an assessment of your ability to integrate the knowledge of the area, show critical and independent thinking, and demonstrate mastery of the subject matter. The results of examination evidence independent thinking, appropriate organization, critical analysis, and accuracy of documentation. Meet with your graduate coordinator regarding the process, requirements and details of the comprehensive exam.

The following process is usually followed:
1) Student submits two preferred subjects to the graduate coordinator no later than the 10th week of the semester when the exam to be taken.
2) The graduate coordinator consults with the graduate faculty of whom one or two faculty members prepare an exam consistent with the objectives of this culminating experience. The exam can be a 3-hour written exam, and/or a short research paper or project. The student gets instructed in writing as to the format and content of the required paper/work.
3) The student submits his/her work in no more than 10 days from the date of receiving the exam.
4) The student's work is reviewed and an oral quiz is administered to ensure the authenticity of the work.
5) The student is given no more than two attempts to pass the comprehensive exam. The second attempt may be on a different technical subject as the department sees fit.

The Project (ECE 298)
A project is a significant undertaking of a pursuit appropriate to the professional field. The project must evidence originality and independent thinking, appropriate organization, and rational. It must be described and summarized in a well written project report that includes the project's significance, objectives, methodology, and a conclusion or recommendation. An oral defense of the project is required. Meet with your graduate coordinator regarding the process, requirements and details of the ECE298 project.

The following procedure is recommended for the project experience:
1. While the project can be completed in one semester, it is highly recommended not to leave it in its entirety for the semester of graduation. Start some of the following steps one semester earlier such that you spend the graduation semester mainly to complete the work you already started.
2. Build on the advanced knowledge you gained in the graduate courses by visiting with the professors with whom you took the courses and discuss possible relevant projects.
3. Determine the scope of the project with the help of the professor in your area of interest. This professor will become your "Program Adviser", with whom you may consult during the rest of your program.
4. Enroll in ECE 298 by completing the project form where the deliverables are stated clearly.
5. Include a research component to become informed of the state-of-the-art on the subject.
6. Work closely with your Program Adviser to sharpen your skills and focus your efforts.
7. Submit a progress report every other week to keep your advisor informed and to receive timely guidance.
8. Submit a draft final report no later than the 10th week of the semester of graduation.
9. Discuss with your Program Adviser the possibility of publishing your work in engineering outlets. Should you determine that your work is publishable, it is usually easy to extract from your report enough material for a paper style.
10. With the permission of your Program Adviser, determine a date for your oral presentation (usually within the last three weeks of the semester of graduation). This presentation must be attended by three graduate faculty members including your advisor. Your advisor would help identify the other two faculty members.
11. Your Program Adviser announces the oral presentation to the department one week before the presentation.

12. Share your work with the other two identified faculty members for your oral presentation by giving them a draft of your report after the approval of the Program Adviser.
13. After the oral presentation, meet with your Program Adviser to make the final changes to your report.
14. Submit the Bound Final Report. Original signed document is submitted to the Department.
15. Upon successful completion of all other curriculum requirements then submit the Master's Clearance form with required signature and the project grade to the Division of Graduate Studies by the posted deadline at the end of the semester.

The Thesis (ECE 299)
A thesis is the written product of a systematic study of a significant problem. The thesis identifies the problem, states the major assumptions, explains the significance of the undertaking, set forth the sources for and methods of gathering information, analyzes the data, and offers a conclusion or recommendation. The finished product evidences originality, critical and independent thinking, appropriate organization and format, and through documentation. An oral defense of the thesis is required. The thesis must be also reviewed at the university level in the Division of Graduate Studies before clearance. Meet with your graduate coordinator regarding the process, requirements and details of the ECE299 thesis.

Compared to the project, the thesis usually includes a more intensive research component and it requires more advanced analytical work supported by theoretical development. Thesis work is usually original and well suited for publishing in engineering outlets. The thesis report is very formal and must meet the format of the graduate division since it get archived and made available to the engineering community. The thesis is a recognized publication in its

The following procedure is recommended for the thesis experience:
1. It is not usually realistic to complete the thesis in one semester. Therefore, it is highly recommended to enroll in ECE 299 the semester before graduation. Complete as many of the following steps during the first semester such that you spend the graduation semester mainly to complete the work you already started.
2. Build on the advanced knowledge you gained in the graduate courses by visiting with the professors with whom you took the courses and discuss possible relevant topics for your thesis.
3. Determine the scope of the thesis with the help of the professor in your area of interest. This professor will become your "Program Adviser", with whom you may consult during the rest of your program.
4. Conduct a brief literature survey to gain more knowledge to narrow down the scope of your work to determine the topic of your thesis and identify the possible methodology with your advisor.
5. In consultation with your Program Adviser, form the thesis committee. This committee is usually composed of three faculty members where the main advisor is the chair of the committee. One of the committee members can be an external graduate faculty (if necessary).
6. Enroll in ECE 299 by completing the thesis form where the deliverables are stated clearly.
7. Expand upon the literature survey you started and start to look further into the detailed of the published work to become informed of the state-of-the-art on the topic.
8. Work closely with your Program Adviser to sharpen your skills and focus your efforts on formulating and solving a specific problem.
9. Submit a progress report every other week to keep your Program Adviser informed and to receive timely guidance. Also, keep your committee members abreast of your progress and seek their input as the work evolves.
10. Submit a draft final report no later than the 6th week of the semester of graduation. [Consult the graduate division on the format and check on the deadline of submitting the final document.]
11. With the permission of your thesis committee, determine a date for your oral presentation.
12. Your Program Advisor announces the oral presentation to the department one week before the presentation.
13. Distribute a draft of your thesis to the thesis committee and ask for their input.
14. After the oral presentation, meet with your Program Adviser to make the final changes to your thesis.
15. Submit the Bound Final thesis. Original signed document is submitted to the Department.

16. Upon successful completion of all other curriculum requirements then submit the Master's Clearance form with required signature and the thesis grade to the Division of Graduate Studies by the posted deadline at the end of the semester.
17. Discuss with your advisor the possibility of publishing your work in engineering outlets. Should you determine that your work is publishable, it is usually easy to extract from your report enough material for a paper style

You need to be very careful when you make this choice because once you are enrolled in a particular culminating experience, you are not permitted to change the declared option on the advancement to candidacy form. Therefore, be sure to discuss with your graduate coordinator the culminating experience option that is most appropriate to your personal career goals and educational circumstances. During the time that you are working toward completion of your culminating experience, you must maintain enrollment through regular enrolment. Project and thesis students who have enrolled in all courses toward the degree, including ECE298 and ECE299, but have not completed their culminating experiences must maintain continuous enrollment by re-enrolling in project or thesis units each semester until the awarding of the degree. Students who have chosen the Comprehensive Examination as their culminating experience must maintain enrollment each semester, according to university policy, until the awarding of the degree.

Although this may not apply in all situations, it might be appropriate to provide you with some general guidelines that may help you make the right decision. The comprehensive exam is usually chosen by students who prefer not to immerse in significant research or individually explore cutting edge technologies in a laboratory environment.

Independent Study (ECE 290)

The main purpose of the independent study is to provide the student with the opportunity to work independently under the guidance of a faculty member on a subject of interest to the student and within the expertise of the faculty member. The knowledge gained from the independent study cannot usually be obtained from one of the regular courses offered in the department.

A **maximum of three units** of independent study are allowed toward the MSE-ECE program. These units are allowed only **after advancement to candidacy** and prior written approval via the department independent study agreement. The agreement must be approved and signed by the professor under whose supervision the independent study will be taken before the Department Chair or the Graduate Coordinator signs off.

This course is usually completed the semester prior to enrolling in ECE 298/299.

Industrial Internship Experience

You may register under ECE 193 for no graduate credit to gain industrial experience during the summer and/or one fall or spring semester. One internship experience may be granted to students who have been,
1) Advanced to candidacy,
2) Completed at least 18 graduate units,
3) Had no prior internship experience since started the graduate program at Fresno state,
4) Making satisfactory progress in your program of study, and
5) Received the approval of your academic advisor.

You are responsible for arranging your own industrial experience and present the offer letter to the department.

FORMS AND DEADLINES

You will find that a component of your graduate experience will include following deadlines and protocols. It is your responsibility to complete appropriate forms, meet deadlines, and seek advice! Do not expect your advisor or the Graduate Coordinator to seek you out to complete forms; you must take responsibility for your own degree.

You are responsible for obtaining and completing forms such as the following:

Classified Standing Form - if you did not enter the program as a classified student.

Advancement to Candidacy Petition - after completion of nine units, the Graduate Writing Requirement, and selection of an advisor. This form should be executed as soon as possible (see Admissions). However it is due no later than the semester preceding the semester in which the student applies to graduate.

Catalog Year – The department requirement for the graduate degree is based upon the University General Catalog of the semester when advanced to candidacy.

Master Degree Clearance Form - after passing your culminating experience.

Application to Graduate Form - during the first two weeks of the semester you plan to graduate. If you plan to complete your degree during a summer session, application must be made during the first two weeks of the first summer session.

Thesis Assignment Form – if you select the thesis option, a form must be completed specifying the members of your committee.

Change in Advancement to Candidacy Petition - if you make any changes in your plan of study or committee, you must complete appropriate forms documenting and requesting those changes.

As frustrating as some of these details can be, they are often essential for expediting your graduation. Therefore, please make sure that you type clearly all forms and provide clean copies of requested materials. Be attentive to posted deadlines and requirements of the Division of Graduate Studies and the department. Annual deadlines are published in the University catalog, the schedule of courses, and available through the Division of Graduate Studies.

APPEALS AND PETITIONS

Graduate students wishing to make changes in a department's degree requirements should initiate their request through the Graduate Coordinator. Requests for exceptions to established university policies governing graduate study are to be addressed to the Dean, Division of Graduate Studies and also the University Graduate Committee. Grade protests are to be submitted to the Student Academic Petitions Committee through the Director of Advising Services. Information concerning grade protest procedures and dispute resolution is available in the Office of the Dean of Student Affairs.

RECEIVING THE MASTER'S DEGREE

To receive the Master's degree, the student must file an application with the Graduate Division within the first two weeks of the semester in which the academic requirements are to be completed. In addition, the applicant must be a registered student in the program during that semester. It is the student's responsibility to make sure that all necessary paperwork, including the Master's Degree Clearance form, is submitted to the Division of Graduate Studies by the published deadlines. Students completing the degree requirements will receive their diplomas approximately two to four months after the end of the semester.

HOODING CEREMONY

All students who have satisfied the requirements for the graduate degree may participate in the Convocation of the College of Engineering. They should also participate in the Hooding Ceremony that officially recognizes the completion of Master of Science degree program. The Hooding Ceremony normally takes place the evening before the University Convocation.

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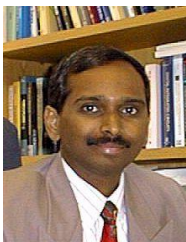
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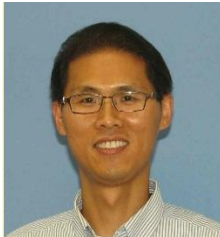
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