

ELECTRICAL ENGINEERING DEPARTMENT

**California Polytechnic State University
San Luis Obispo, California**



MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

PROGRAM HANDBOOK

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I. Introduction

The *Master of Science* program in Electrical Engineering has the following objectives:

- Job-entry education for the more complex areas of engineering, such as research and development, innovative design, systems analysis and design, and managerial engineering;
- Updating and upgrading opportunities for practicing engineers;
- Graduate preparation for further study in engineering, leading to the Doctor of Engineering or Ph.D. degree;
- A base which allows graduates to maintain currency in their fields.

This is a post-baccalaureate degree program consisting of a minimum of 45 quarter units of advanced studies in Electrical Engineering or closely-related fields that must be completed within 7 years from the start of the program.

Two program options are available for the MS in Electrical Engineering degree:

1. A thesis program - which requires coursework, a formal thesis under the guidance of an EE department faculty member, and an oral defense of the thesis; or
2. A non-thesis option - which requires additional coursework and a comprehensive examination.

The thesis option is strongly encouraged for all students.

All students should become familiar with the Cal Poly Catalog which gives information pertinent to graduate studies in the EE Department. Cal Poly Graduate Education Handbook is an additional important source of information, and is available at <http://www.grad.calpoly.edu> under Policies. **This handbook supplements the catalog and the Cal Poly Graduate Education Handbook and should not be interpreted as replacing or superseding information therein.**

Students who are pursuing the MSEE degree under the *Blended BS/MS Honors Program* should consult the separate handbook for that program.

II. Eligibility

An applicant to the MS Electrical Engineering program must hold a bachelor's degree in engineering or a closely related physical science with a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted, from an institution accredited by a regional accrediting association.

Applicants for graduate engineering programs are also required to submit satisfactory scores for the General (Aptitude) Test of the *Graduate Record Examination* (GRE) - Verbal, Quantitative, and Analytical Writing scores.

Applicants with a GPA below 3.0 may still be considered for the MSEE Program if their GRE scores indicate particularly strong academic potential beyond that indicated by their GPA, and if their application is accompanied by multiple, strong faculty recommendations.

Students applying and accepted to the MS Electrical Engineering program while still completing their undergraduate degree will be required to provide an additional certified transcript showing the successful completion of their undergraduate degree before beginning their MS degree program.

International Students

All graduate and post-baccalaureate applicants, regardless of citizenship, whose native language is not English and whose preparatory education was principally in a language other than English must demonstrate competence in English. Those who do not possess a bachelor's degree from a postsecondary institution where English is the principal language must take either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing system (IELTS) exam. The TOEFL must have been taken within the last two years with a minimum score of 550 (paper version), 213 (computerized version) or 80 (internet based). The minimum acceptable score for the IELTS is 6.0. International students can only apply to Fall quarter with the application deadline of March 1st.

III. Application

All applicants must file a complete graduate application as described in the admission materials at <https://www.calstate.edu/apply>. The procedures and deadlines for graduate program application can be found on the Admissions website (<https://www.calpoly.edu/admissions/graduate-student/dates-and-deadlines>). Contact the Cal Poly Admissions Office (gradadmissions@calpoly.edu) if you have questions about the application process.

The following items are required for completion of the application: 1) statement of purpose, 2) an official transcript obtained from your undergraduate institution, 3) GRE results, and 4) three official letters of recommendation.

IV. Admission

Admission to the program will be determined by the Graduate Coordinator in consultation with the EE Graduate Committee. Final notification of the admission decision to the applicant is made by the Office of Admissions.

V. General Academic Guidelines

Academic Advising

The EE Department has a faculty member designated as the department's Graduate Coordinator. Although you are encouraged to seek advice and consultation from any faculty member, the Graduate Coordinator is your official program advisor and he/she must approve and sign all

the required forms.

Once you begin work on thesis research (if following the Thesis program), your Thesis Advisor can also provide advice on appropriate coursework to prepare for the thesis research or for work in your particular field of interest. Therefore, it is helpful to engage a Thesis Advisor as soon as possible in your MS degree program.

Registration and Continuous Enrollment

It is expected that you will be registered at Cal Poly each quarter until you complete all requirements for your degrees (except Summer quarter). If you have some special circumstance which requires a break in your studies, contact the Graduate Coordinator about this matter. For example, students on approved university leaves of absence as defined in the University catalog (Medical Leave or Planned Educational Leave) will not be required to enroll during the leave period. Except for these special cases, if you do not register continuously (except Summer), or register but fail to take coursework applicable to your degree objective, you may be dropped from the Graduate Program and will need to reapply for admission.

Effective Fall quarter 2009, graduate students will be required to maintain continuous enrollment from the time of first enrollment in a graduate program until completion of the degree. Students will maintain continuous enrollment either by being enrolled as a regular student (enrolling in coursework or thesis units), or by registering in a special course designated for this purpose during terms in which they are not otherwise regularly enrolled. Continuous enrollment will be defined as being enrolled during at least three quarters each academic year (usually Fall, Winter, and Spring quarters).

The special course, *GS 597 Continued Graduate Study*, is listed in the University catalog but taken through Cal Poly Extended Education to minimize the cost. It is a one-unit course, graded on a credit/no-credit (CR/NC) basis. Units earned in GS 597 will **not** count toward meeting any degree requirements.

Students who fail to fulfill this continuous enrollment requirement will not be permitted to graduate – even if all other degree requirements have been completed - until payment has been made for all quarters of non-enrollment. In such cases, the student must register in *GS 597* for a number of units equal to the number of non-enrolled quarters.

All students must be enrolled during the quarter in which they graduate, either through regular course enrollments or by registering in *GS 597* for that quarter.

Graduation Writing Requirement

All students must satisfy the Graduation Writing Requirement and you are advised to do this no later than your first quarter of graduate coursework. Failure to complete this requirement will prevent you from obtaining the MS degree. Students who recently completed this requirement as

part of a Cal Poly undergraduate degree program do not need to do so again as part of their graduate degree program.

See the Cal Poly Graduate Education Handbook for more details on this requirement and the options for fulfilling it.

The Formal Study Plan

The major element of the *Formal Study Plan* (*Working Formal Study Plan* and *Final Formal Study Plan*) is a display of your intended courses to satisfy the MSEE degree requirements. The *Formal Study Plan* will henceforth be referred to as the “Plan”. You are advised to review the Cal Poly catalog and this handbook, as well as consulting the proposed annual schedule of course offerings posted by the EE Department and any other department offering courses included in your Plan, before attempting to construct a comprehensive Study Plan. You may also wish to consult with faculty and the Graduate Coordinator while formulating your Plan. The forms are available on the GradEd website <http://grad.calpoly.edu/forms.html> to assist you with developing your Study Plan.

The *Working Formal Study Plan* should be submitted to the Graduate Coordinator before the end of the first quarter. The *Final Formal Study Plan* should be submitted within the first three weeks of the quarter in which you plan to graduate. The Graduate Coordinator must approve the Plan before forwarding it for further approval by the College of Engineering and the University GradEd Office.

The *Formal Study Plan* must meet the following requirements:

- The Plan must have a total of at least 45 quarter units.
- The only “required courses” in the Plan are 3 units of EE 563 Graduate Seminar (one unit for each of three quarters) and 4 units of EE 525 Stochastic Processes for Engineers or EE 513 Control Systems Theory.
- If you pursue a Plan that includes a Thesis, 9 units of the Plan will be in EE 599 Design Project -Thesis.
- At least 28 units in the Plan must be from graduate-level 500 series courses, and the remainder must be no lower than 400 level (advanced undergraduate) courses. Therefore, thesis option students will need at least 12 additional units in 500-level courses beyond the required MSEE courses and Thesis (EE 525/513, 563, 599). Non-thesis option students will need at least 21 additional units from relevant graduate-level 500 series courses.
- Inclusion of courses in the Plan from related technical support areas such as Computer Science, other Engineering disciplines, Mathematics, or Physics is encouraged but should not constitute more than 17 units of the 45 unit Plan. Computer Engineering courses (carrying a “CPE” prefix in the course number) are considered equivalent to Electrical Engineering (“EE” prefix) courses, and are not included in this 17 unit limitation.

- At least 32 units of the Plan must be completed in residence. This means that up to 13 quarter units ($8\frac{2}{3}$ semester units) from another university could be accepted as part of the Plan, provided that they were not used to fulfill part of another completed degree program.
- Courses taken for credit/no credit (except for EE 563 Grad. Seminar) cannot be used in the Formal Study Plan, but may be taken as prerequisites or as supplemental coursework.
- Cooperative Education courses (EE 594, 595) may be taken during a student's graduate program. These courses can be used to fulfill the continuous enrollment requirement for a student while temporarily employed. However, credits earned in such courses can not be used to fulfill the 45 course unit requirements for the MS degree.
- The most important criterion is that the Plan as a whole must "make sense." Chosen electives should support some technical objective by providing sufficient breadth and depth within an area of specialization.

Academic Performance

You are required to maintain an overall GPA of 3.00 or higher in all coursework appearing on your *Formal Study Plan*. Failure to maintain this minimum cumulative GPA for your MSEE studies will prevent you from graduation.

Courses with grades of D+ or lower are not acceptable in fulfillment of the *Formal Study Plan* and may be retaken. However, while an improved grade (C- or better) in the second attempt at a course will fulfill this portion of the student's program of study (as defined by the Formal Study Plan), the grades from both course attempts are included in the calculation of the cumulative GPA for the MS degree.

Application for Graduation

You must file an *Application for Graduation* (E-form) one quarter prior to the quarter that you plan to graduate.

All requirements for the MS degree must be completed within seven years from the first quarter in which coursework listed in the *Final Formal Study Plan* was undertaken.

Supervised Courses

Supervisory courses EE 599 Thesis and EE 500 Individual Study are offered as required. You must have a supervising faculty member for these courses, and the topic for study must be approved by the supervising faculty advisor before enrolling in either of these courses. Contact the EE Department Office for supervisory course approval forms and registration permissions for these courses. The University recommends that no more than 30% of the Study Plan units for a graduate degree program should come from independent study courses (including the Thesis). Therefore no more than 4 total units of EE 500 Individual Study will generally be approved on a Formal Study Plan. Graduate students working on independent study projects for credit should enroll in EE 500, not the undergraduate equivalent course EE 400.

VI. Thesis Option

Selection of Thesis Project

The successful completion of a thesis is one of the options for a culminating experience available to MSEE Program participants. The thesis option is strongly recommended for all MSEE students. The general guidelines for a thesis according to Title 5 California Code of Regulations are: <https://govt.westlaw.com/calregs/Document/IF41B2430D48211DEBC02831C6D6C108E?transitionType=Default&contextData=%28sc.Default%29>

A thesis is the written product of a systematic study of a significant problem.

- It identifies the problem, states the major assumptions, explains the significance of the undertaking, sets 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 thorough documentation.
- Normally, an oral defense of the thesis is required.

Thesis Advisor

Your thesis adviser must be a permanent full-time faculty member of the Electrical Engineering department or the Computer Engineering program. You should consult the *Faculty Interest List* published by the Electrical Engineering department (available on-line) to find potential thesis advisors who have expertise in the specialization that you would like to work in for your thesis project. You must obtain an advisor's approval and signature on a *Supervisory Course Approval* form, before registering for EE 599 Design Project-Thesis.

The responsibilities of the Thesis Advisor include:

- Assist with the definition of the thesis project, including clarification of objectives and deliverables.
- Suggest appropriate preparation for the thesis research including relevant coursework to consider, as well as guiding and reviewing the search of relevant literature for background preparation.
- Provide technical advice and consultation for dealing with the challenges, roadblocks and dead-ends inherent in research projects.
- Review the thesis document draft(s) and provide feedback on needed changes and revisions.
- Determine the appropriate timing and units for EE 599 registrations.
- Recommend other faculty members with proper technical expertise to potentially serve on the Thesis Committee.
- Certify readiness for the Oral Defense of the thesis and assist with preparations (review of presentation materials, *etc.*)

It is recommended that you begin seeking a Thesis Advisor during your first quarter of studies in the MSEE program, so that you can gain the benefit of their advice on coursework to include in

your Study Plan and so that you have time to define a suitable project well enough to launch into your thesis research as soon as possible.

It is expected that you will meet regularly with your Thesis Advisor, keeping them informed of your progress and to develop strategies for handling technical challenges and roadblocks you encounter.

Registration for Thesis Units

You must obtain an advisor's approval and signature on a *Supervisory Course Approval* form, before registering for EE 599 Design Project-Thesis. The thesis units are usually offered in 2 to 5 unit increments, and must total to 9 units for the Thesis Option. Normally, the thesis is taken in a 2, 2, 5 unit sequence for a total of 9 units. Your Thesis Advisor may choose to divide the 9 total thesis units differently across quarters, depending on the expected workload levels. Typically, thesis work will require enrollment in EE 599 for three consecutive quarters, with the possible exception of summer quarter. However, it is possible to register for all 9 units in two quarters, if this is approved by your Thesis Advisor and is indicated on your approved *Formal Study Plan*.

It is important that you do not sign up for thesis units unless you have clearly defined the work involved, have a faculty member willing to serve as your advisor, and have the necessary support (financial, equipment, etc.) to complete the project.

If your thesis work extends beyond the quarter for which you have registered for the last of the 9 required units of EE 599, you will likely be issued an "RP" (report pending) grade for at least that final quarter of EE 599 enrollment. You then have up to one year to complete and defend your thesis before this RP grade will revert to a failing grade ("F"). During any intervening quarters (except summers) between when you last register for coursework or thesis units and when you defend your thesis and complete all your degree requirements, you are required to maintain continuous enrollment by registering in GS 597 Continuing Graduate Enrollment for at least one unit per quarter (see *Registration and Continuous Enrollment* above).

Thesis Committee

You will need to assemble a Thesis Committee of at least three faculty members before Thesis defense. One of these members is your primary Thesis Advisor, who will also be the Chair of your Thesis Committee. Selection of the other two members should be done in consultation with your Thesis Advisor.

At least two of the Thesis Committee members must be from the Electrical Engineering department. One member of the committee is frequently from a support department outside the EE Department (such as Math, CSC, *etc.*), depending on the thesis topic. If your Thesis Advisor is a CPE faculty member from the Computer Science Department, then both additional Thesis Committee members should be from the EE Department faculty.

The responsibilities of the Thesis Committee members are to:

- Participate in the Thesis Proposal Presentation and provide feedback
- Review the Thesis document before the Oral Defense

- Formulate questions to ask during the Oral Defense
- Provide feedback and suggestions for improving the Thesis document, including needed clarifications, technical inaccuracies, sufficiency of exposition, and formatting issues.
- Assess the Thesis document, Oral Defense Presentation, answers to subsequent questions and merit of the thesis research to determine if the Thesis should be approved, approved following adequate revision (as spelled out by the committee), or rejected.

It is expected that any Thesis Committee member with serious reservations about the content of the Thesis document or the research undertaken will notify the Thesis Advisor of their concerns prior to the Oral Defense, so that remedies can be made or the Defense rescheduled to a time when it is more likely to be successful.

Thesis Proposal Presentation

The MS thesis student, at the discretion of thesis adviser, will present his/her thesis proposal at the time of committee selection, at the latest one quarter before the thesis defense when filing the “Advancement to Candidacy Form”. Thesis committee members can condition their participation based on the thesis proposal presentation.

Thesis Proposal Presentation Guidelines (if required)

Purpose

The purpose of the Thesis Proposal presentation is for the student to demonstrate the quality, feasibility, and academic merit of the proposed research and to receive constructive feedback from the committee. It is also an opportunity for the thesis committee members to confirm that the proposed research falls sufficiently within their areas of expertise and interest for them to be an effective member of the Thesis Committee.

Procedure

The MS thesis student will present his/her thesis proposal at the time of committee selection, at the latest one quarter before the thesis defense when filing the “Advancement to Candidacy Form”. It is the responsibility of the student to schedule a time acceptable to the committee. The committee should attend and provide feedback.

The thesis presentation will be scheduled for 50 minutes with a 15 minute overview of the proposed research addressing the following:

- Significance of the proposed study
- Scope and objectives of the proposed research
- A review of the major findings of previous research in the related field
- Relevant work completed/preliminary observations
- List of research questions to be investigated
- A schedule outlining the anticipated dates of completion of each task
- List of references reviewed

The oral presentation is followed by questions and suggestions from the committee.

Although it is expected that all thesis research will include a Thesis Proposal presentation, your individual Thesis Advisor may choose not to require it as part of your particular project. Thesis

Committee members, however, can condition their agreement to participate further based on whether or not the Thesis Proposal presentation is completed, or on the information conveyed at the presentation.

Thesis Oral Defense

An oral presentation in defense of your thesis must be scheduled prior to submission of the thesis document for final approval. The presentation must have all the members of your Thesis Committee present. The policy of the EE Department is to also make the initial presentation open to other interested faculty and students.

You should work out the scheduling (time and room) and announcement of the Thesis Oral Defense with the EE Department Office staff. Announcement of the presentation should be made by e-mail and posted flyers at least one week in advance.

The Thesis Oral Defense is usually scheduled for two hours, and typically consists of:

1. Thesis Oral Presentation (presented by the Thesis student, open to all interested faculty and students) [40-50 minutes]
2. Questions on the Presentation (from attending faculty, students, and committee members) [10 – 15 minutes]
3. Closed Session Questioning (Thesis Committee, Thesis student only) [20 – 45 minutes]
4. Thesis Committee Deliberation (Thesis Committee only) [10 – 30 minutes]

Thesis Document

General instructions for Master's Thesis Formatting Guidelines should be carefully followed in order to minimize the time and number of revisions that will be required during the approval process of the final thesis document. Master's Thesis Templates can be found at <https://grad.calpoly.edu/masters-thesis/masters-thesis.html>.

It is suggested that you develop your thesis document in stages while conducting your project, rather than waiting until the very end of the project to write this extensive document. Your Thesis Advisor may ask you to provide report section drafts as part of the grade determination for early quarters of EE 599 registration.

A draft of your complete thesis document should be provided to your Thesis Advisor **at least four weeks** before you intend to defend your Thesis. This is needed to provide them with sufficient time to thoroughly review your Thesis and suggest needed revisions that can be completed before the document is supplied to the other members of the Thesis Committee.

A revised and complete hardcopy version of your thesis document should be provided to each member of your Thesis Committee **at least two weeks** before you plan to hold your Thesis Oral Defense. This version must have been previously reviewed and approved by your Thesis Advisor.

Thesis Document Approval

Final approval of your thesis report involves two steps:

1. Thesis Committee approval for content, and
2. Graduate Programs Office approval for format.

As a result of your Thesis Committee's review of your thesis document and oral defense presentation, you will likely be asked to make revisions to the content of your thesis document, to add required information, clarify explanations, expand upon critical topics, or resolve typographic or grammatical errors. The Committee may request additional reviews of the revised document, or may choose to delegate the task of final review to your Thesis Advisor.

Once the thesis document is approved by your Thesis Committee, you should obtain their signatures verifying this approval using the *Master's Thesis/Project/Exam Approval Form*, by the last day of the quarter in which you intend to graduate. Refer to Master's Thesis Submission Process (<https://grad.calpoly.edu/masters-thesis/masters-thesis.html>) for detailed instructions.

VII. Comprehensive Exam

If you choose the non-thesis option for your Study Plan, you must take a Comprehensive Examination on your completed coursework. The Comprehensive Exam would normally be taken during your last quarter in residence, and you should inform the Graduate Coordinator of your intention to take the exam the quarter before you plan to take the exam. The Graduate Coordinator will inform you of the format of the exam.

Your *Formal Study Plan* and *Advancement to Candidacy* must indicate the Non-Thesis option for completing the MSEE degree, and must include at least 45 units of degree-applicable coursework, since Thesis units will not be included in the Plan.

Students must have completed at least 45 units on their Formal Study Plan by the end of the quarter in which they plan to take the Comprehensive Exam.

Students on academic probation or with a current MSEE GPA below 3.0 (based on completed courses on the Formal Study Plan) will not be permitted to take the Comprehensive Examination until the GPA deficiency or other cause of probation is resolved.

VIII. Department Facilities Available to MSEE Students

Students who are working on a thesis and/or special projects may be assigned workspace in one of the EE Department labs. Students who are working on sponsored projects will typically work in the area assigned for that project – in some cases this could be in the ATL research facility or Bonderson Building. All Graduate students may have access to the EE Graduate Lab (20-121) with priority given to Teaching Associates for office hours and lab preparation (key can be requested through EE office).

IX. Financial Assistance Available to Graduate Students

Teaching Associates

The EE Department typically has a number of paid Teaching Associate (TA) positions for graduate students capable of serving as an instructor for selected undergraduate laboratories. Typically, non-major introductory circuits and electronics labs are staffed using graduate student TAs. Only qualified students who are maintaining satisfactory academic performance and sufficient progress toward completion of their degrees will be appointed to these positions. Student TAs are only permitted to teach a maximum of one laboratory course section per quarter. Applications for these positions should be submitted to the EE Department Office.

In order to be considered for a Teaching Associate position, a student must meet the following minimum academic qualifications:

- 1) Student instructors must have earned a minimum B average in their undergraduate circuits lecture courses, and also in their undergraduate electronics lecture courses.
- 2) Student instructors must have earned a minimum B+ average in their undergraduate circuits laboratory courses, and also in their undergraduate electronics laboratory courses.

Once appointed to a Teaching Associate position, a student must meet the following requirements in order to be reappointed to a teaching position in a subsequent quarter:

- 1) Students must maintain a minimum 3.3 GPA in the quarter in which they are teaching.
- 2) Students must receive a signature from their thesis advisor indicating that adequate progress has been made on their Master's thesis.

Note that tuition waivers are NOT automatically awarded to students receiving teaching associate positions (as more typically occurs at PhD-granting universities).

Research Assistants

Sponsored research by departmental faculty frequently employs students in the conduct of the research as Research Assistants (RA). On occasion, individual faculty members have sponsored projects that provide a stipend to the students participating in the project (usually thesis students). Check with the EE Department Office and individual faculty members on the availability of these appointments.

Again, note that tuition waivers are also NOT automatically awarded to students receiving research assistantships (as more typically occurs at PhD-granting universities).

Graders and Laboratory Assistants

Hourly wage jobs assisting faculty as laboratory assistants or graders are also generally available each quarter (except Summer). Available positions are posted by the EE department at the beginning of each quarter. Selection to these positions is made by the individual faculty course instructors. These positions are staffed by both graduate students and advanced undergraduates, and so employment in these positions each quarter is not guaranteed. The number of hours per

week required may be different for each specific position, and subject to confirmation and approval by the hiring faculty member.

Fellowships and Scholarships

Both current and prospective graduate students may apply for Student Financial Aid or Cal Poly scholarships through Cal Poly's Financial Aid Office

The Graduate Education Office manages several other financial support opportunities such as TA/GA programs, Resident and Non-resident Tuition Waiver, Graduate Equity Fellowship Program. Please visit <https://grad.calpoly.edu/resources/financial-opportunities/financial-opportunities.html> for descriptions of each program and instructions of application.

X. Checklist

Students are responsible for initiation, completion and submission of all necessary forms. Failure to complete and submit forms at the appropriate times may delay the completion of your program(s) and the granting of your degree(s).

(All forms required can be downloaded from <http://grad.calpoly.edu/forms.html>.)

- ☐ First quarter — submit *Working Formal Study Plan and Advancement to Candidacy* (e-Form). Fulfill Graduation Writing Requirement (GWR).
- ☐ Present thesis proposal to the thesis committee (if choose Thesis option) one quarter before the thesis defense (This step is not mandatory but recommended).
- ☐ One Quarter prior to graduation— submit *Application for Graduation* Form.
- ☐ Final quarter — submit *Final Formal Study Plan* Form within the first 3 weeks.
- ☐ Final quarter — Submit *Master's Thesis/Project/Exam Approval* Form once the thesis or Comprehensive Exam is completed.