Graduate Handbook

Department of Electrical and Computer Engineering

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1 Electrical and Computer Engineering Graduate Program Overview

Electrical Engineering has its origins in the study and application of electrical phenomena. The field embraces a diverse range of problems in applied physics and mathematics. The BYU Department of Electrical and Computer Engineering offers advanced study in four broad areas:

- ***Computer Engineering*** concentrates on the architecture and implementation of digital logic and computing systems.
- ***Electromagnetics*** explores the theory, physical properties, and applications of electromagnetic radiation and includes emphases in optics, remote sensing, and numerical computation.
- ***Microelectronics*** focuses on the design and fabrication of microelectronic circuits for digital and analog applications, including device physics, modeling, processing, and fabrication.
- ***Signals and Systems*** studies fundamental and applied issues in information processing and includes emphases in communication theory, linear and nonlinear control systems, digital signal processing, and estimation theory.

The department offers two degrees at the graduate level:

1. Master of Science (MS) in Electrical and Computer Engineering
2. Doctor of Philosophy (PhD) in Electrical and Computer Engineering

This handbook provides department graduate program policies associated with these degrees. The outlined policy complements and extends but does not replace the University policy on graduate programs found in the University Graduate Catalog. Other information regarding graduate education at Brigham Young University can be obtained from the University Graduate Studies website. Information about the department graduate program and research areas can be found at the department website.

2 Educational Objectives

2.1 MS Degree

- Apply knowledge in service to community and family and engage in lifelong learning through personal study and continuing education.
- Obtain employment appropriate for the M.S. Degree, engage in technology-based entrepreneurship, government lab service, or complete further graduate study.
- Play a meaningful role in research or technical development leading to significant contributions to engineering and technology; serve in responsible positions of technical leadership.
- Be examples of faith, character, and high professional ethics.

2.2 PhD Degree

- Apply knowledge in service to community and family and engage in lifelong learning through personal study and education.
- Obtain employment that utilizes PhD level training, including positions such as academic faculty appointment, post-doctoral research, research within industrial or government laboratories, and other principal positions of technical creativity, leadership, and management.
- Play a leading role in making significant contributions to engineering and technology.
- Be examples of faith, character, and high professional ethics.

3 General Information

3.1 Admissions

All applicants must meet the general university minimum standards for admission as a graduate student. Student who fails to meet these standards will not be considered for admission to our program. These university requirements include the following:

- Complete and submit application before the deadline.
- Agree to live BYU's standards of personal conduct as stated in the Honor Code.
- Earn a bachelor's degree in electrical or computer engineering or allied discipline from an accredited U.S. university or the equivalent from a university outside the United States.
- Receive at least a 3.0/4.0 grade-point average in the last 60 credit hours of coursework from an accredited university in the United States, or a comprehensive grade-point average of 3.0/4.0 from an equivalent foreign university.
- If your native language is not English, and you have not received a four-year bachelor's degree (or higher) from an educational institution within the United States, you must take the IELTS or TOEFL and satisfy the minimum score requirements for admission.
- International students will submit electronic or scanned copies of all marksheets, transcripts, diplomas, and graduation certificates with their online applications. Admission decisions will be made using these document copies. Upon acceptance for admission to the program, official and/or original copies of these documents are to be sent to IERF or WES for credential evaluation and authentication. The application for a student visa will be submitted by BYU to the US government upon completion of this credential evaluation.

In addition to the university requirements, applicants applying to the graduate program in Electrical and Computer Engineering must complete the Graduate Record Examination (GRE).

3.1.1 Application Deadline

All applicants must use the university online application for graduate students. The ECEn Department application deadline for Fall and Winter semesters are:

- Fall Semester: January 15
- Winter Semester: August 15

3.1.2 GRE

The Graduate Record Exam (GRE) is required for all applicants including applicants with a BS degree from BYU. While the department does not publish minimum scores for the GRE, the average GRE scores of students accepted into our program are as follows:

	Score	Percentile
• Quantitative	160	81
• Verbal	75	70

3.1.3 International Students

International applicants are required to demonstrate an acceptable level of proficiency in the English language to satisfy the university's requirements for admission to graduate study. Applicants who have not received a bachelor's degree (or higher) from an educational institution in the United States or from one of

the exempt countries (Canada, the U.K., the Republic of Ireland, New Zealand, or Australia) are required to submit IELTS or TOEFL scores to be considered for admission.

IELTS: There are two types of reading and writing modules: Academic and General Training. Candidates applying for admission to a graduate program at BYU are required take the Academic reading and writing modules of the test. The minimum score for the IELTS is 7.0 with a minimum band score of 6.0 in each module.

TOEFL: The TOEFL test measures English language proficiency in reading, listening, writing, and speaking. The test is administered by Educational Testing Service. The TOEFL is only required of applicants from countries where English is not the official language. The minimum TOEFL scores are as follows:

- Computer Based: 237
- Paper Based: 580
- iBT: 85 (min score of 22 in speaking and 21 in listening, reading, and writing)

Credential Evaluation: International applicants must send all marksheets, transcripts, and diplomas for a credential evaluation to IERF or WES for evaluation. Credential evaluations should include a course-by-course review. Applicants should request an electronic copy be sent to BYU Graduate Studies. In nations where the accepted academic credential documentary practice makes it difficult to send official documents for credential evaluation (for example when the student is given the only existing official copy of a diploma) then these original documents may be presented for authenticity verification upon arrival at BYU.

3.1.4 Admission Qualifications for non-ECEn Applicants

Study in Electrical and Computer Engineering requires a background in a range of technical, mathematical, and scientific subject areas. We welcome applications from students with non-ECEn degrees provided that there is sufficient evidence from their transcripts that they have adequate preparation to succeed in our program.

The following programs are considered sufficiently related to ECEn that those with such a degree may apply for ECEn graduate admission without additional coursework preparation:

> Any ABET accredited engineering program,
> Computer Science, Mathematics, Physics Chemistry, or Statistics.

Those who do not qualify under the related-degree policy may apply for ECEn graduate admission if their transcripts include graded credit for at least 15 hours from the following list of technical courses:

> Any BYU ECEn 3XX or 4XX course, PHY 121, Math 113, 313, 314, 334
> CS 3XX or 4XX, or equivalent from an accredited institution
> (where XX indicates any 2 digit number).

Non-ECEn applicants are encouraged to identify in their personal statement an intended general area of specialty for their coursework and thesis or dissertation research and a list of potential advisors in that area selected from our faculty. A research topic will be selected after enrollment under direction of your advisor. The department needs sufficient information in the application to determine whether your study interests align with our faculty expertise. Applications lacking this detail may not be reviewed favorably. Prior contact has been made with one or more faculty to explore common research interests strengthens the application and helps when selecting an advisor.

Undergraduate prerequisite requirements for non-ECEn applicants

In addition to the qualifications listed above, non-ECEn applicants may upon enrolment be required to include ECEn undergraduate preparatory courses on their approved programs of study. These courses will be selected in conjunction with the student's advisor and graduate advisory committee based on the applicant's preparation and research area. They will cover prerequisite material needed for follow-on graduate courses also on the study list. Since they are not graduate courses these prerequisites will not count toward the degree program credit hour requirements. Even with these required undergraduate prerequisite courses, a student may still find it necessary to seek other self-study learning opportunities to be fully prepared for the graduate courses on his or her program of study.

The study list, including any needed undergraduate prerequisites, is completed under direction of the student's major advisor. Since the official advisor may not be identified until near to end of the first semester of enrolment, it is not possible to provide a prior list of undergraduate courses a non-ECEn applicant should take in advance to satisfy the prerequisites. The student may seek prior advice from a faculty member in the intended area of research as to what undergraduate courses would likely be good preparation.

3.2 Financial Assistance from the Department of Electrical and Computer Engineering

For more information on financial aid at the University level consult the BYU Office of Financial Aid and the BYU Graduate Studies Office.

The department provides financial assistance to some graduate students within departmental and university guidelines. Awards are granted on a competitive basis. Applicants may indicate their desire to be considered for financial assistance by checking the box on the University application form. Types of aid available include:

- *Tuition Awards*: The department offers a limited number of full and partial tuition awards on a competitive basis. PhD students receive priority for tuition awards.
- *Teaching Assistantships:* The department employs a limited number of teaching assistantships to well-qualified graduate students. Duties include helping with labs, mentoring, recitations, and grading for undergraduate courses. Teaching assistants are paid on an hourly basis and must apply at the beginning of each semester.
- *Research Assistantships*: Graduate students may be awarded research assistantships by individual faculty members to assist them with externally funded research. If you desire a research assistantship you must make arrangements with your faculty advisor.
- *Fellowships*: The department awards a limited number of research fellowships to graduate students engaged in productive research under the advisement of a faculty. Prestigious graduate research fellowships are available from organizations like the National Science Foundation.

3.3 Graduate Academic Standard

3.3.1 Biannual Reviews of Graduate Students

Your performance as a graduate student will be evaluated twice a year. The first evaluation occurs in January after fall semester grades have posted. The second evaluation occurs in July after winter and spring grades are posted. The evaluation will be based on:

1. Timely submission of the program of study ("study list") during the first semester of enrollment.
2. Previous semester grades.
3. Acceptability of the program of study GPA.

4. Timely completion of and performance on the PhD examinations (PhD only).
5. Progress toward completion of the degree.
6. Attend at least two graduate seminars each Fall and Winter semester.

The result of the evaluation is a rating chosen from the following possibilities:

S **Satisfactory**: You are in good standing with respect to grades, required examinations, and thesis or dissertation research work and writing.

S/W **Satisfactory with Warning:** You need to improve in some area. Failure to comply by the next biannual review will result in a marginal or unsatisfactory rating.

M **Marginal**: Your performance is less than satisfactory and you need to improve in some area. Failure to change your status to satisfactory by the next biannual review will result in termination of your graduate program.

U **Unsatisfactory**: Your performance is substandard. There are corrective measures you need to take. Failure to change your status to satisfactory by the next biannual review will result in termination of your graduate program.

If you receive an **S/W, M** or **U** rating, you will be informed by letter from the department. The letter will indicate the reason for the low rating and give conditions for remaining in the program. Two consecutive ratings of marginal or unsatisfactory will result in termination of your graduate program.

3.3.2 Grade Point Average (GPA) Requirements

Graduate students whose graduate (program of study) GPA falls below 3.0 will not be allowed to graduate and may be dismissed from their graduate programs. No D credit may apply toward a graduate degree. Substandard grades in courses not on the program of study may be used by the department graduate committee to evaluate your standing. A graduate student that receives a C grade or a semester GPA below 3.0 will be rated marginal even if the program of study GPA is above a 3.0.

Students that receive a D grade in any class on the program of study or whose program of study GPA falls below 3.0 will be rated unsatisfactory. Further, the study list is now invalid and the student must meet with their graduate advisory committee to discuss possibilities for continuing graduate work. Possible outcomes of this meeting include termination of the student's graduate program, formation of a new study list, or the student may be required to retake the course.

3.4 Department Graduate Program Registration Information

The official University Registration Policies are available from the university website. Policies regarding minimum registration requirements are repeated here for convenience. You should carefully plan your graduate studies to ensure that you do not violate these policies.

U.S. Students, Academic Year: To retain active status and to qualify for subsequent registration, graduate students must register for at least 6 semester hours each school year and receive acceptable grades (no D, E, UW, NS, or I grades are allowed, nor are audited classes). Students who do not fulfill this yearly requirement may be dropped from their graduate programs and lose graduate status, in which case the student must apply for readmission if they wish to continue.

International Students: International students must normally register for at least 9 semester hours each fall and each winter semester to fulfill U.S. Immigration and Naturalization Service requirements. When a student nears completion of his/her program and only has 1-2 classes or thesis work left to complete, it is

possible to register for fewer than 9 credits and still be considered full-time. To do this, a petition must be filed by the department on behalf of the student and submitted to the International Services office. If you fall in this category, see the department Graduate Secretary to file the necessary petition. Other questions should be directed to BU International Student and Scholar Services.

Final Semester Registration: Before applying for graduation, a graduate student should have completed all coursework on his or her approved program of study or be registered for the remaining requirements. During the final semester of the graduate program, a graduate student must register for at least 2 semester hours of credit, not including audit and independent study credits.

4 Graduate Advisory Committees and Programs of Study

All graduate students within the Electrical and Computer Engineering Department must form a graduate advisory committee and submit an approved program of study, as discussed below.

4.1 Graduate Advisory Committee

Faculty Advisor: You must select an advisor who will assume the primary role of advisement during your graduate residency and will monitor and direct your research efforts. This advisor must:

1. Be selected during first semester of graduate residency
2. Be from the major department
3. Be a member of the graduate faculty
4. Serve as chair of your graduate advisory committee

At the time of your first arrival on campus, and if you have not made prior arrangements with a faculty member to server as your advisor, the department graduate coordinator will assign you a temporary advisor. The temporary advisor will assist you in selecting appropriate courses during your first semester, and guide you in selecting a permanent advisor and forming your graduate advisory committee. By the end of your first semester, you should arrangements with a permanent advisor and submit your program of study.

Advisory Committee: Master's and Doctoral advisory committees consist of a minimum of three and four members, respectively, including the committee chair (advisor). All committee members must have graduate faculty status. Committee members share in the responsibility for advisement concerning program of study, degree requirements, research, comprehensive and qualifying examinations, and final oral examinations. The individual contribution of your committee members may vary by kind, effort, and intensity. The most active role is assumed by the committee chair.

In consultation with your advisor, you should select additional faculty members for your committee whose areas of expertise match closely with the emphasis of your research. You must ask these individuals if they are willing to serve on your committee. At least two members of the committee (including advisor) must be from the ECEn Department. After selecting your committee, enter your proposed committee into the Graduate Studies online system.

Coursework MS Degree: For students completing a coursework MS Degree, members of the department graduate committee will be assigned by the department to serve as the graduate advisory committee and committee chair. The coursework MS Degree is not available for direct enrollment. Contact the Graduate Coordinator for more information.

Changing Advisor or Committee Members: If you desire to change your focus to an area where a different faculty member would be more appropriate, you may change advisors. It may also be necessary to change the committee composition. The first step in changing the advisor or committee members is to consult with your current advisor, proposed new advisor if applicable, and new committee members. Once a new proposed committee has been selected, contact the department Graduate Secretary to initiate the change. Committee changes must be approved by the new committee members.

4.2 Program of Study

The graduate program of study or "study list" is an approved course of study for your degree. Each degree program has specific course requirements that must be followed. Courses to satisfy these requirements should be selected in consultation with your advisory committee chair and committee. After consulting with your advisor, enter your proposed study list into the Graduate Studies online system and submit it for

approval by the graduate advisory committee. Submitted study lists are reviewed by the department Graduate Coordinator for final approval.

A good program of study will include both depth and breadth. Classes should provide a rigorous theoretical foundation, a mastery of a body of knowledge in a well-defined focus, and an understanding of fundamental concepts in a breadth of topics. As you choose courses, include a sufficient number of courses in your research area to allow you to develop expertise in your field. You are encouraged to take classes outside of your area of emphasis to facilitate greater understanding of the discipline as a whole.

Prerequisite Undergraduate Degree: Students who do not have a BS in Electrical and Computer Engineering, or whose ECEn BS degree provides inadequate preparation for their chosen area of specialty, may be required to take prerequisite classes before pursuing graduate courses as outlined in the Admissions section of this document. These courses do not count toward the credit hours required for the graduate degree but may be included formally as additional classes listed on the program of study as determined by the graduate advisory committee.

4.2.1 MS Program of Study

The MS program of study must be submitted during the first semester of graduate study. Failure to submit an approved study list on time may result in an unsatisfactory progress rating from the department and a hold placed on registration privileges. The program of study should satisfy the following requirements:

Thesis Option: A minimum of 32 total credit hours satisfying the following:

1. 6 credit hours of ECEn 699R: Master's Thesis
2. 2 credit hours of ECEn 692: Professional writing.
3. A minimum of 12 additional graduate credit hours from Electrical and Computer Engineering.
4. Remaining credit hours from graduate courses in ECEn or related disciplines, subject to approval by the graduate committee and Graduate Coordinator.

Coursework Option: A minimum of 32 total credit hours satisfying the following:

1. 2 credit hours of ECEn 692: Professional writing.
2. A minimum of 18 additional graduate credit hours from Electrical and Computer Engineering.
3. Remaining credit hours from graduate courses in ECEn or related disciplines, subject to approval by the graduate committee and Graduate Coordinator.

The coursework option is not available for direct enrollment. Contact the Graduate Coordinator for more information.

4.2.2 PhD Program of Study

The PhD program of study must be submitted during the first semester of graduate study. Failure to comply may result in an unsatisfactory progress rating from the department and a registration hold. The program of study should satisfy the following requirements:

For students entering with a BS degree: A minimum of 56 total credit hours beyond the Baccalaureate degree:

1. 18 credit hours of ECEn 799R: Doctoral Dissertation.
2. 2 credit hours of ECEn 692: Professional writing.

3. 36 credit hours of graduate specialization courses as determined in consultation with your graduate advisory committee.

For students entering with an MS degree: A minimum of 38 total credit hours beyond the Master's degree:

1. 18 credit hours of ECEn 799R: Doctoral Dissertation.
2. 2 credit hours of ECEn 692: Professional writing.
3. 18 credit hours of graduate specialization courses as determined in consultation with your graduate advisory committee.

For students entering with an MS degree from BYU: A minimum of 30 total credit hours beyond the Master's degree:

1. 18 credit hours of ECEn 799R: Doctoral Dissertation
2. 12 credit hours of graduate specialization courses as determined in consultation with your graduate advisory committee.

4.2.3 Changes to the Program of Study

As research evolves over time or adjustments to the department graduate course offering are made, you may need to change your program of study. The first step is to consult with your advisor and graduate committee. Enter the proposed changes into the Graduate Studies online system and submit the changes for approval by the graduate advisory committee and Graduate Coordinator. If needed, contact the Graduate Secretary for assistance.

5 Doctor of Philosophy (PhD) Degree: Competency Exam, Qualifying Exam, and Advancement to Candidacy

Doctoral students must pass competency and qualifying examinations as part of their progress toward the PhD degree. This section outlines these examinations and as the process for advancing to doctoral candidacy.

5.1 The PhD Competency Exam

The purpose of the PhD Competency exam is to test your understanding of fundamental principles in your chosen area of study. The exam consists of three 30 minute to one hour oral interviews with members of the ECEn faculty. The exam will focus on material from your study list courses which you have already taken, from undergraduate prerequisite courses, and from your prior MS program (if any). Although any material or perspective related to your study in Electrical and Computer Engineering is open for discussion during the exam, the emphasis is generally on fundamental principles, simple examples, insight, and high-level understanding.

Students who enter the PhD program with an ECEn MS degree must take the exam the semester immediately following completion of three technical courses from their PhD study list, but no later than the 4th semester of enrollment. Those who enter without an ECEn MS degree must take the exam the semester immediately following completion of six technical courses from their PhD study list, but no later than the 6th semester of enrollment. The exam is administered each Fall and Winter semester as posted by the Department.

Each examiner will grade your performance and a pass/fail decision on the entire exam will be made by the faculty. If you fail the competency exam you must retake it the next time that it is offered. Failure to pass the exam the second time it is taken will result in dismissal from the PhD program.

5.2 The PhD Qualifying Examination

The PhD Qualifying Examination assesses your ability to conduct independent research and complete your PhD dissertation. This examination should take place no later than your third year of graduate study. The procedure for taking this exam is outlined in the following steps:

1. The student must have previously completed the Ph.D. competency exam.
2. The form “Scheduling of Oral Qualifying Examination and Prospectus Defense” is used to certify that the student is ready for the examination. The form must be submitted with a copy of the prospectus to the Graduate Secretary before the scheduled exam date. You must allow sufficient time for each member of the graduate advisory committee to review your material before the examination. The scheduling form must be approved by all advisory committee members to acknowledge acceptance of the scheduled date and receipt of the prospectus material.
3. The student's program of study must be up to date and approved by the committee at the time of scheduling.
4. The student is responsible for scheduling a room for the examination for a two-hour time block.
5. The oral presentation of the prospectus should be limited to 30 minutes (barring questions). The entire exam including presentations and question and answer periods should take approximately one hour.
6. Following the exam, the committee discussions the results privately and votes to determine whether or not you have passed the oral examination.

The written prospectus and oral presentation will be graded based on the following criteria:

1. *A substantial written prospectus*. The student must submit to the committee a written document that allows the committee to assess the student's ability to write at the PhD level and describes current

progress and future plans for dissertation research. The document should include a detailed, technical treatment of at least one research problem on which the student has made significant contributions and an overview of other previous and planned research. Content may be drawn from the student's published conference or journal papers, papers in preparation, or dissertation draft.

2. *Problem statement, literature review, and research contributions.* The research problem being addressed should be clearly explained. The current literature that is relevant to the problem should be surveyed so that the research plan is placed in the context of existing results. The new knowledge, understanding, or capability that the student's research activity have enabled should be described.
3. *Evidence of progress in the proposed research.* Preliminary results are most convincing here. It is not expected that all, or even most of the proposed research goals will have been met, but the preliminary work and research contributions should build confidence that the chosen topic is viable and that the student is capable. Evidence of progress in the ideal case is provided by the inclusion of a published or submitted paper in the prospectus document.
4. *A plan for future research.* The prospectus document should give a plan for future research with sufficient detail that the committee can determine that the work will likely lead to a successful dissertation. The target topic, research goals, and proposed methodologies should be presented.
5. *Evidence that the work will be publishable*. Papers on preliminary work that have been peer reviewed and accepted for publication are most convincing. Papers currently in review, or accepted conference papers with less than full paper review provide some evidence. The prospectus document or presentation may include a list of published and submitted journal or conference papers and papers in preparation. A case should be presented that future work will lead to contributions that will likely be published.
6. *Evidence that the student can think, present, write, and respond to questioning at a PhD level*.

5.3 Advancement to Candidacy

Advancement to Candidacy is an important step in your progress toward the PhD degree. You will be advanced to Candidacy based on the following criteria:

1. The grades you have received in your graduate courses (program of study GPA).
2. Your performance on the PhD Competency Exam.
3. Your performance on the PhD Qualifying Exam.
4. Recommendation of your graduate advisory committee.

Once you have been advanced to PhD candidacy, it remains to complete planned research, finish writing the dissertation, and defend the dissertation at the final oral examination.

6 Theses, Dissertations, and Graduation

A thesis or dissertation documents the theoretical developments, mathematical analysis, algorithms and software, modeling and simulation, hardware designs, and experimental demonstration associated with your research. The document should motivate a research problem, survey related work in the technical literature, provide background necessary for understanding the work, describe in detail the research, and summarize the key contributions and ideas for future research. A typical outline for the chapters in a thesis or dissertation is as follows:

1. Introduction: Motivate the problem, survey related work in the literature, and list the contributions made in the work.
2. Background: Technical material from prior work needed to understand the research
3. Technical chapters. These chapters include design goals, derivations, algorithms, numerically simulated results, hardware descriptions, and experimental results. A thesis serves a documentary purpose for future students and researchers interested in your work, and may include more detail than a journal paper. For some dissertations, early chapters may focus on theory and design and built towards later chapters with culminating results and experimental measurements. In others, each chapter may treat a different topic and include a standalone literature survey, theory, design, and experimental results.
4. Conclusion and future work

There is no minimum length requirement for a thesis or dissertation, but detailed discussion of a research topic and careful documentation of your work generally require a substantial manuscript with several chapters each comparable in length to a typical journal paper. Excessive lengths should be avoided.

6.1 MS Thesis Preparation

The master's thesis should display original work suitable for publication but its scope and depth are not as great as those of the PhD dissertation. An MS thesis is normally shorter than a dissertation but follows a similar outline. While a dissertation should answer an open research question, a thesis may expand a known design to a new set of requirements or extend a known result to a new application.

6.2 PhD Dissertation Preparation

Preparation of your Doctoral dissertation should be completed under the close supervision of your advisor and committee. The PhD dissertation represents a serious scholarly work that must be a significant contribution to knowledge in the field of Electrical and Computer Engineering. Given the breadth of the discipline, there is a wide range of acceptable dissertations. These guidelines may be of value in ascertaining the appropriateness of a proposed dissertation:

1. Excerpts from the dissertation should be publishable in a peer-reviewed archival journal. While actual acceptance for publication is not a requirement for acceptance of the dissertation, it is anticipated that students will submit materials from their dissertation for publication to appropriate journals. Acceptance of papers in journals or by technical conferences with peer review may constitute external evidence of quality research work and will strengthen claims of originality and significance of results. Publications in popular and trade journals without peer review are not considered evidence of academic contributions.
2. The research should be pursued to a successful conclusion. Research that ends in the failure to achieve meaningful goals will usually be considered inadequate for satisfying the dissertation requirements. Though a student may follow the methods outlined in the prospectus, if the results are disappointing, the research may be insufficient for the PhD degree. This is one of the risks of doing research. Decisions regarding the acceptability of negative results lie with your doctoral advisory committee.

3. You must be able to identify specific contributions of the research, which should be explicitly stated in the dissertation. Research activities, experiments, tutorial efforts, product development, or applications software, though perhaps indispensable to the research, are not, by themselves, adequate contributions. Contributions to knowledge include new theoretical developments, experimental results and conclusions, generalizations, and new viewpoints.
4. Commercial or industrial benefit is incidental to the academic value of the research and does not imply the acceptability of the dissertation. The patentability of a research result alone is insufficient evidence of its acceptability for fulfilling the dissertation requirements.

6.3 Thesis or Dissertation Submission and Scheduling the Final Oral Examination

When your advisor agrees that your MS thesis or PhD dissertation is ready for committee review, submit the manuscript to your committee using the Graduate Studies online system. The committee will review the document and determine whether your work is ready for the defense.

The advisory committee must determine that your work is adequate for the final oral examination before the examination is approved. Committee members may require up to one week to review the thesis or dissertation before approving the examination. The review time period is the prerogative of the committee member and can vary between faculty members and from student to student. If you do not allow a faculty member adequate time for review of the thesis or dissertation, he or she may not approve the examination and your graduation may be delayed. When it is critical to you to graduate in a given semester, submit your thesis or dissertation to the committee no later than 1-2 weeks before the Graduate Studies final deadline.

If during review of the thesis or dissertation a committee member feels the document needs further work before a defense can be scheduled you will need to work with him or her and your advisor to address the concerns.

The following steps should be followed for scheduling your final oral exam:

1. After approval from your advisor, submit the thesis or dissertation to the committee using the Graduate Studies online system. This must be done with enough advance time prior to submitting the scheduling form that each committee member will be allowed their requested time period for review.
2. Communicate with your advisory committee to determine a time when all are available for the final defense. Given the busy schedules of faculty members, this step can take some time and effort. As the thesis or dissertation nears completion, you may begin gathering availability information from committee members to select a possible date and time for the examination.
3. Communicate with each advisory committee member to determine how much time they will each need to review your thesis or dissertation.
4. Apply for graduation.
5. Provide the agreed upon date and time of the exam to the Graduate Secretary for formal scheduling with the university.

Scheduling Requirements

1. To graduate in a given semester, the thesis or dissertation and final oral exam and must be completed before the Graduate Studies final deadline for the semester of graduation. The deadline can be found on the Graduate Studies website.
2. According to Graduate Studies requirements, no examinations can be held during interim periods between semesters.

6.4 Final Oral Examination

The Final Oral Examination (or "defense") is open to the public. During this examination, you will present to the faculty advisory committee and public attendees a summary of your research work. You should consult with your advisor in preparing this presentation to ensure it is appropriate in length and scope. The typical presentation length is 20 minutes for a thesis and 30 minutes for a dissertation. To allow sufficient time for questions and discussion, verify the length of your presentation before the defense and avoid unusually long presentations.

A typical outline for the presentation is as follows:

1. Problem statement and motivation for the research topic
2. Background including other approaches and previous work
3. Approach to the problem solution
4. Discussion of the results, comparing to results from existing approaches when applicable
5. Summarize research contributions, key insights, and the potential impact of the work
6. Conclusions including limitations, applications, possible extensions, and a list of publications associated with the research.

At the conclusion of your presentation, the committee chair may invite audience members to ask questions. The public will then be excused and your committee will begin their examination of your work. The committee may explore with you technical issues, clarifications, or possible additional requirements. They may ask questions about your coursework and other aspects of your graduate program.

The committee chair provides an orderly way for each committee member to ask questions. When other committee members ask questions, the committee chair should refrain from intervening or answering for the student and would normally only offer clarifying comments when necessary.

The questioning phase of the examination is a vital part of the defense. You should prepare beforehand to answer challenging technical questions and to articulate and expound on detailed aspects of the research and material from courses taken. Do not feel the need to be rushed to answer. Take time to think quietly and ask for clarification if needed as you answer questions from the committee.

The committee will then excuse you and vote for one of the following options:

1. Pass.
2. Qualified pass – you must complete minor revisions specified by the committee, who upon completion will send an approval of the revisions to the Graduate Secretary.
3. Recess – you must retake the defense from the same committee no sooner than one month later. Only one recess will be granted to a candidate.
4. Fail – the graduate degree program of the student is terminated.

Family and friends are encouraged to attend the defense presentation. Children who could be disruptive generally should not attend. Food at the defense is not required or expected but simple refreshments provided by the student are allowed.

6.5 Final Manuscript Submission

After appropriate revisions of the manuscript, complete the following:

1. Make sure your manuscript adheres to the published standards (See Standards for Dissertations and Theses).
2. Create a PDF file of your thesis that satisfies the requirements for electronic submission as outlined on the Graduate Studies website.
3. Submit your thesis per the instructions at the Office of Graduates Studies website. You may be required to pay for printing and binding fee at the time of final submission to cover the cost of printing and binding copies for your advisor if your advisor requests a bound copy and any personal copies you want.

In special circumstances, the University permits a student to have his or her thesis/dissertation secured for a designated period of time. The thesis is bound and secured and it is not catalogued or made available for access until after the designated period of time has elapsed. These cases are exceptions to policy and are permitted only in extenuating circumstances (e.g., pending patent, sensitive subject, etc.). Contact the Graduate Secretary for further instructions.

6.6 Application for Graduation

Early in the semester in which you plan to graduate you must apply for graduation using the Graduate Studies online system. After the request is reviewed by the Office of Graduate Studies, a status report will be issued and you will be notified of any deficiencies in your graduate requirements.

A current ecclesiastical endorsement at the time of graduation is a graduation requirement. If you are not on campus at the time of graduation, you are still required to have a current ecclesiastical endorsement to graduate.

6.7 Standards for Theses and Dissertations

Requirements regarding the format of theses and dissertations have been created to ensure uniformity and continuity of style. University standards can be found on the Graduate Studies website. Additional dissertation and thesis standards imposed by the College of Engineering are available on the college website. Department standards can be found on the department website.