BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING

UNDERGRADUATE HANDBOOK (2010-2011)

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The B.S. degree programs in Electrical Engineering and Computer Engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology. (See Mission Statement, Educational Objectives, and Program Outcomes.)

The University of Utah is committed to policies of equal opportunity, affirmative action, and nondiscrimination. The University seeks to provide equal access to its programs, services, and activities for people with disabilities. Reasonable prior notice is needed to arrange accommodations.

The information in this bulletin is current at the time of publication but is subject to change without notice. This bulletin is not a contract between the University of Utah or the Department of Electrical and Computer Engineering and any person or entity.

MISSION STATEMENT

The Electrical and Computer Engineering Department is one of seven departments in the College of Engineering at the University of Utah. The Department offers a B.S. degree in Electrical Engineering, a B.S. degree jointly with the School of Computing in Computer Engineering, and master and doctoral programs in Electrical Engineering.
The mission of the Department of Electrical and Computer Engineering is:

- To excel in undergraduate and graduate education in Electrical and Computer Engineering by providing the students the tools necessary to prepare them for careers that involve a lifetime of learning.
- To perform cutting-edge research in selected areas of Electrical and Computer Engineering, preparing our graduate students to be tomorrow's professors and technical leaders of industry.
- To serve the University of Utah and the State of Utah by performing its teaching and research missions well.

EDUCATIONAL OBJECTIVES

Graduates of the Electrical Engineering program are expected to:

- Be competent and productive in the practice of modern Electrical Engineering
- Engage in careers that provide opportunities for growth and leadership
- Keep informed of new technological developments and contribute to the expansion of engineering knowledge

Every year the Department surveys alumni to evaluate how well the educational objectives are achieved. The BSEE Program has also been designed so that specific outcomes are attained in support of these objectives.

PROGRAM OUTCOMES

The Electrical Engineering curriculum provides the students with the knowledge of probability and statistics, mathematics through differential and integral calculus, linear algebra and complex variables, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components. To ensure that the graduates of the program consistently accomplish the objectives described above, the curriculum has been designed so that the students demonstrate the following outcomes by the time they graduate:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multidisciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- A recognition of the need for, and an ability to engage in, life-long learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
# TABLE OF CONTENTS

INTRODUCTION ....................................................................................................................... 1  
  Overview of the Electrical and Computer Engineering Professions .......................... 1

UNDERGRADUATE ADVISING .................................................................................................. 2  
  Orientation .......................................................................................................................... 2  
  Advisors .............................................................................................................................. 2

ELECTRICAL ENGINEERING DEGREE ................................................................................ 3  
  Becoming an Electrical Engineering Major ................................................................. 3  
  Sample Four-Year Program ............................................................................................... 4  
  Prerequisite Flow Chart .................................................................................................. 6  
  Required Courses ............................................................................................................ 7  
  Technical Elective Courses .............................................................................................. 8  
  General Education .......................................................................................................... 9  
  Obsolete Classes ............................................................................................................. 13  
  Grade Requirements ....................................................................................................... 13  
  Repeating Classes .......................................................................................................... 14  
  Cooperative Education ................................................................................................... 15  
  Special Studies Policy ..................................................................................................... 15  
  Getting a Minor in Another Subject ................................................................................ 16  
  Leave of Absence ............................................................................................................ 17  
  Advanced Placement Credit ........................................................................................... 18

TRANSFER STUDENTS ............................................................................................................ 19  
  Acceptance of Transfer Classes ....................................................................................... 19  
  Transfer Articulation Guide ............................................................................................. 20  
  Grades for Classes from Schools with Accredited Engineering Programs .............. 23  
  Students in Other Majors .................................................................................................. 23

COMBINED BACHELOR/MASTER DEGREE PROGRAM ..................................................... 24  
  Typical Student Timeline ................................................................................................. 26

GRADUATE SCHOOL ................................................................................................................ 27
INTRODUCTION

The Electrical Engineering program provides a broad foundation of scientific principles, hands-on laboratory work, and practical design experience necessary for our graduates to succeed in careers that will see significant and fast-paced changes in the technology during their lifetimes. Even though the curriculum is designed primarily to prepare students for careers in Electrical Engineering, it can also provide those students who are interested in pursuing careers in medicine, law, and other professions with a technical and scientific edge as they start on their new careers.

At the University of Utah, you will have many opportunities for hands-on experience in our teaching and research laboratories. With the help of generous funding from the National Science Foundation, we have developed premier project-oriented laboratories for all required and many elective ECE courses. Qualified undergraduates can also work alongside graduate students and professors on groundbreaking research through the UROP, honors, and senior project programs. The University of Utah's Electrical and Computer Engineering Department welcomes you to these challenging and exciting opportunities.

The information in this handbook is to help you navigate the path from student to professional. Please also call on your professors and ECE staff for individualized advice.

We are proud of our graduates and the contributions they are making to society, and we look forward to counting you among them in the future.

OVERVIEW OF THE ELECTRICAL AND COMPUTER ENGINEERING PROFESSIONS

Electrical Engineering is the discipline that employs the largest number of engineers. It is a broad discipline which involves the use of mathematics, physics, and other sciences in the design of electrical devices and systems. Electrical Engineering is one of the driving forces that power the high-tech industry. Electrical engineers are involved in the design of computers, microelectronics, communication systems, audio and video entertainment systems, medical systems, space satellite systems, robots, electrical power systems, and many other forms of technology that have an impact on the quality of our lives. The manufacturing process for almost all products involves the use of Electrical Engineering principles, at least in part.

Computer engineers work with and design computers from large supercomputers to minicomputers and microcomputers. Of particular importance to computer engineers is the interfacing of computers with other devices and computers. Computer engineers also design and develop large software systems to analyze and control sophisticated instrumentation. If you are interested in the Computer Engineering program, see www.ce.utah.edu.
UNDERGRADUATE ADVISING

Orientation

New freshman and transfer students are required to attend one of the University’s orientation sessions. Students who attend and select Electrical Engineering (EE) as their potential area of interest, have a meeting with a staff or faculty advisor from the Electrical and Computer Engineering (ECE) Department. In this meeting, the EE advisor discusses the procedure for being admitted to major status, requirements for graduation, technical electives, General Education requirements, areas of specialization, and careers.

In the freshman-level course, ECE 1270, the orientation presentation is repeated. Faculty members in the Department’s areas of specialization describe employment opportunities for their area and discuss the courses offered by the Department in each area.

In ECE 2280 (spring of sophomore year), you will turn in your program of study, indicating your schedule to graduation and which courses you will take each of the following semesters. You will not need to choose technical electives at that time, but should show which semesters you plan to take them. You will also select a faculty advisor in the technical area that interests you most to help you with your program of study plans for the remainder of your stay at the University of Utah.

In ECE 3300 (fall of junior year), you will turn in your complete program of study, planning which technical electives you plan to take and when. You should meet with a faculty member in your area of interest to discuss technical elective choices. If you don’t have a specific area of interest chosen at this time, meet with ANY ECE faculty member for guidance.

In Sophomore Seminar, ECE 2910, and Junior Seminar, ECE 3900, students attend presentations given by faculty and industry representatives. These presentations are designed to guide you in selecting technical electives and choosing areas of specialization.

Advisors

An academic advisor should be your first stop if you have administrative questions about the EE program, including registration, transfer of credits, degree requirements, changes in degree requirements, requirements for admission and graduation, and referral to faculty for career counseling. Transfer students are especially encouraged to meet with an academic advisor as soon as they receive their U of U summary of transfer credit form. They should fill out a request for transfer credit prior to this visit.

The academic advisor for all undergraduate Electrical Engineering students is:

Arlene Padilla Arenaz
3313 MEB, 801-581-4657, arlene.arenaz@utah.edu
If you want information regarding careers or technical elective choices, or for help in resolving your special situations relating to the EE program, see the undergraduate faculty advisor:

Neil Cotter, Ph.D.
3104 MEB, 581-8566, necotter@ece.utah.edu

When you receive your confirmation of admission to the EE major letter in the mail, the letter will contain the name and contact information of the advisor you’ve been assigned. If you transfer in after taking ECE 2280, you will be assigned a faculty advisor at that time. You are encouraged to meet with your faculty advisor or another ECE faculty member whenever necessary to discuss career guidance, choice of electives, class scheduling plans, current academic issues, or other matters of concern to you. You are responsible for requesting an appointment with your faculty advisor. Please do your best to make appointments early, as to avoid “rush” times when registration deadlines are near.

The University Career Services office is also available to assist students who are beginning senior year course work. Their services include a Career Information Library and assistance in job searches, résumé writing, interviewing techniques, etc. Their office is located at 350 Student Services Building or phone them at 801-581-6186. Job ads are commonly sent to students via the ECE email list. Alumni may also request to be added to this email list.

**ELECTRICAL ENGINEERING DEGREE**

**Becoming an Electrical Engineering Major**

If you qualify for the University Honors Program (whether or not you actually choose to join that program), you can be admitted directly to the ECE Program. Please discuss this with our ECE Advisor.

Otherwise, before you are formally admitted to the Electrical Engineering Program, you must complete certain pre-major courses. We recommend that you become classified as a Pre-Electrical Engineering major when you are admitted to the University. This may be done by informing the University Registrar’s Office, or by calling the ECE office at 801-581-6941. You may also request that we put your address on our undergraduate e-mail list.

You may apply for major status during any semester in which you will complete the pre-major classes listed below. Applications are evaluated as soon as grades are available at the end of each semester. Complete the “Application for Major Status” form which is available on our website in Excel (preferred) or PDF (for students who cannot view Excel files). This form is also available in the ECE office.

You must be admitted to major status before you will be able to register for ECE classes beyond the freshman level. (See exception under “Students in Other Majors.”) The current GPA for admission to major status is 2.8 on the classes listed below (except for ECE 1020 and CS 1010 in which CR-credit- is required) and a cumulative University of Utah grade point average of 2.5 or higher.
ECE 1270  4.0  Introduction to Electrical and Computer Engineering
ECE 1020  1.0  Electrical Engineering Problem Solving with Matlab
CS 1010  0.5  Introduction to Unix
Math 1210 or 1270  4.0  Calculus I or Accelerated Engineering Calculus I (see below)
Math 1220 or 1280  4.0  Calculus II or Accelerated Engineering Calculus II (see below)
Phys 2210  4.0  Physics for Scientists and Engineers I

17.5

* CS 2000 or 1410  4.0  Program Design in C or Introduction to Computer Science I
*(Recommended during 1st year, but not required for major admission)

• If you have AP AB Calculus with a score of 3 or 4 or an ACT Math score of 30, you
should take Math 1270 and 1280. These classes are designed for Engineering students
and replace the three-semester series Math 1210, 1220, and 2210. Math 2210 is not
required if you take 1270 and 1280.

• You must have a C- grade or better in ECE 1270.

• You must take ECE 1020 in the same semester in which you take ECE 1270 or before
taking ECE 1270.

You should be able to complete the requirements for the Electrical Engineering degree in four,
full-time years of study if you complete the following classes during the freshman year:
Calculus, Computer Science, Electrical Engineering sequence, Physics, and English or Writing
(these courses are listed under the first year of the sample four-year program). You should plan
to take these courses during the freshman year only if you have gained a strong background from
your studies in high school. Otherwise, it may take you longer to graduate. You should take the
required pre-major classes early so that you can be admitted as a full major as soon as possible.

Sample Four-Year Program

A sample four-year program is shown below. Students who have AP AB Calculus with a score
of 3 or 4 or an ACT Math score of 30 are encouraged to take Math 1270 and 1280. These classes
are designed for Engineering students and replace the three-semester series Math 1210, 1220,
and 2210.

If you want to plan a program that takes more than four years, see EE Advising on our web site
for suggested five-year and six-year programs. To decide how many hours to take each
semester, you should consider personal circumstances such as family responsibilities and your
working/employment obligations. It is important to do well in your classes and not take more
classes than you can handle successfully. Eligibility for most scholarships and other financial
aid from the University, including ECE Department scholarships, requires taking at least 12
credit hours each semester. Keep in mind that most ECE classes are taught only once a year, and
some advanced ECE technical electives may be taught only in alternate years.
## Sample Electrical Engineering Degree Program

### First Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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<tbody>
<tr>
<td>CS 1010 0.5</td>
<td>ECE 1270 4.0</td>
</tr>
<tr>
<td>CS 2000 4.0</td>
<td>Introduction to Electrical &amp; Computer Engineering</td>
</tr>
<tr>
<td>or 1410</td>
<td>ECE 1020 1.0</td>
</tr>
<tr>
<td>Math 1210* 4.0</td>
<td>Math 1220* 4.0</td>
</tr>
<tr>
<td>Wrng 2010 3.0</td>
<td>Phys 2210 4.0</td>
</tr>
<tr>
<td>or ESL 1060</td>
<td>LEAP 1500** 3.0</td>
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<tr>
<td>LEAP 1501**</td>
<td>Ethical Implications of Engineering 3.0</td>
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<td>14.5</td>
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</table>

* Take Math 1270 & 1280 if you have a Math AP AB score of 3 or 4 or a Math ACT score of 30. Those not eligible take Math 1210, 1220, and 2210. Math 2210 is not required if you take Math 1270 and 1280.

** Engineering LEAP 1501 and 1500 is required (beginning Fall 2008)

### Second Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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</thead>
<tbody>
<tr>
<td>ECE 2260 4.0</td>
<td>ECE 2280 4.0</td>
</tr>
<tr>
<td>Math 2250 4.0</td>
<td>ECE 3700 4.0</td>
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<tr>
<td>Phys 2220 4.0</td>
<td>Math 2210* 3.0</td>
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<tr>
<td>Chem 1210 4.0</td>
<td>ECE 2910 0.5</td>
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<tr>
<td>Chem 1215 1.0</td>
<td>Calculus III* 3.0</td>
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<td>American Institutions (or test) 14.5</td>
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* Math 2210 is not required if you take Math 1270 and 1280.

### Third Year

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<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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<tbody>
<tr>
<td>ECE 3300* 4.0</td>
<td>ECE 3530 3.0</td>
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<tr>
<td>ECE 3500* 4.0</td>
<td>ECE 3200 3.0</td>
</tr>
<tr>
<td>ECE 3900 0.5</td>
<td>ECE 3160 2.0</td>
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<tr>
<td>Math 3150 2.0</td>
<td>ECE 3950 1.5</td>
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<tr>
<td>ECE 3940 1.5</td>
<td>ECE 3910 4.0</td>
</tr>
<tr>
<td>4.0 Breadth Technical Elective</td>
<td>Technical Communication II 4.0</td>
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<tr>
<td>16.0</td>
<td>Technological Elective 13.5</td>
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* It is recommended but not required that ECE 3300 and 3500 be taken in the same semester.

### Fourth Year

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<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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<tr>
<td>ECE 4900 2.0</td>
<td>ECE 4910 3.0</td>
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<tr>
<td>6.0 Technical electives</td>
<td>Senior Thesis II 9.0</td>
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<tr>
<td>4.0 Breadth Technical Elective</td>
<td>Technical electives</td>
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<tr>
<td>6.0 General Education*</td>
<td>General Education* 6.0</td>
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General Education classes may be taken whenever they fit best in your program.
# Electrical Engineering Pre-Requisites (Showing Pre-Req Chains)

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<th>1st Year Fall</th>
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<th>2nd Year Fall</th>
<th>2nd Year Spring</th>
<th>3rd Year Fall</th>
<th>3rd Year Spring</th>
<th>4th Yr. Fall</th>
<th>4th Yr. Spr</th>
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<td>MATH 1210</td>
<td>CS 1010</td>
<td>MATH 1220</td>
<td>PHYS 2210</td>
<td>ECE 1020</td>
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<td>MATH 1500</td>
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**Co-Requisite**

**Pre-Requisite**

**Major Status**

**Same Class Intersects**

Updated 8/19/2010
REQUIRED COURSES (79.5 credit hours required)

1. Basic Science and Mathematics (35 credit hours)

   - Chem 1210 4.0  General Chemistry I
   - Chem 1215 1.0  General Chemistry Lab I
   - ECE 3530* 3.0  Engineering Probability and Statistics
   - Math 1210** 4.0  Calculus I
   - Math 1220** 4.0  Calculus II
   - Math 2210** 3.0  Calculus III
   - Math 2250*** 4.0  Ordinary Differential Equations and Linear Algebra
   - Math 3150 2.0  Partial Differential Equations for Engineering Students
   - Math 3160 2.0  Complex Analysis
   - Phys 2210 4.0  Physics for Scientists and Engineers I
   - Phys 2220 4.0  Physics for Scientists and Engineers II

   *  Math 3070 does not fill the statistics requirement unless taken before spring semester 2003.
   **  Qualified Engineering students are encouraged to take Math 1270 and 1280. These two classes replace Math 1210, 1220, and 2210. Prerequisites are an AP AB score of 4, or AP BC score of 3, or a Math ACT score of 30. Math 2210 is not required for students who take Math 1270 and 1280.
   ***  A combination of Math 2270 and 2280 may be taken in place of Math 2250.

2. Electrical Engineering Core Courses (34 credit hours)

   - ECE 1020 1.0  Electrical Engineering Problem Solving with Matlab
   - ECE 1270 4.0  Introduction to Electrical and Computer Engineering
   - ECE 2260 4.0  Fundamentals of Electric Circuits
   - ECE 2280 4.0  Fundamentals of Engineering Electronics
   - ECE 2910 0.5  Sophomore Seminar
   - ECE 3200 3.0  Introduction to Semiconductor Physics
   - ECE 3300 4.0  Fundamentals of Electromagnetics and Transmission Lines
   - ECE 3500 4.0  Fundamentals of Signals and Systems
   - ECE 3700 4.0  Fundamentals of Digital System Design
   - ECE 3900 0.5  Junior Seminar
   - ECE 4900 2.0  Senior Thesis I
   - ECE 4910 3.0  Senior Thesis II

3. Computer Programming (4.5 credit hours)

   - CS 1010 0.5  Introduction to Unix
   - CS 2000 or 4.0  Program Design In C or
   - CS 1410  Introduction to Computer Science I
4. Writing (6 credit hours)

Wrtg 2010  3.0  Academic Writing and Research  
ECE 3940  1.5  Technical Communication I  
ECE 3950  1.5  Technical Communication II

TECHNICAL ELECTIVE COURSES (27 credit hours required)

1. Breadth Requirement. Take at least one class in three of the four following areas. Approved classes for each area are listed below. All breadth classes also count as technical electives. (F, S indicates semester course offered)

Electronics and Semiconductor Devices
ECE 3110 (F)  4.0  Engineering Electronics II

Microwaves and Optics
ECE 5320 (F)  4.0  Microwave Engineering I
ECE 5324 (S)  3.0  Antenna Theory and Design
ECE 5325 (S)  3.0  Wireless Communication Systems
ECE 5330 (S)  3.0  Introduction to Microwave Tubes and Electronic Devices
ECE 5340 (S)  3.0  Numerical Techniques in Electromagnetics
ECE 5410 (F)  3.0  Lasers and their Applications

Signals and Systems
ECE 3510 (S)  4.0  Introduction to Feedback Systems

Computer and Digital Design
ECE 3810 (F)  4.0  Computer Organization

2. Advanced Electrical Engineering Technical Electives. You are required to take additional advanced Electrical Engineering classes, making your ECE electives (including breadth classes) total 21 hours or more:

- ECE classes numbered 5xxx or higher, including special topics classes with numbers 5960, 5961, 5962, are acceptable technical electives.
- Some technical electives are numbered 3xxx, although most 3xxx classes are required.
- Classes with both 5xxx and 6xxx numbers should be taken as 5xxx classes by undergraduates.

New technical electives being taught for the first time are given temporary special topics numbers: 5960, 5961, 5952 for higher-level classes or 3960, 3961, 3962 for lower-level classes. When these classes become part of our regular curriculum they are given permanent numbers.
Most technical electives are numbered in accordance with the following system:

- Classes in the Microelectronics area are x1xx and x2xx.
- Classes in the Microwaves and Optics area are x3xx and x4xx.
- Classes in the Signal Processing, Communications, and Control Systems are x5xx.
- Classes in the Computer and Digital Design area are x7xx and x8xx.

For more information, see EE Advising on our web site and read the Information under Controls, Electromagnetics, and Microsystems.

3. Additional Technical Electives. You must complete at least 27 hours of technical electives. At least 21 of these hours must be ECE classes (from the Breadth electives and/or ECE technical electives). The remaining 6 hours of technical electives can be additional ECE technical electives or may be non-ECE classes selected from the list available in the ECE office.

4. Grades Counted for Graduation. If more technical electives are taken than the required number, the grades in all technical electives taken will be counted toward the graduation GPA.

GENERAL EDUCATION

1. University Requirements

To keep informed of University requirements, you should consult the Undergraduate Bulletin & Student Resource Guide at http://www.ugs.utah.edu/bulletin/. Students must satisfy all requirements set by the University and described in the Undergraduate Bulletin.

Intellectual Explorations (18 credit hours)

- You must take two classes in each of the three areas of Fine Arts, Humanities, and Social and Behavioral Science.
- Engineering students automatically fill the requirement in Physical and Life Science with classes required for the major.

Some Intellectual Explorations classes may double count for the Diversity requirement. However, you may count a class in only one Intellectual Explorations area. For example, if a class appears in both the Fine Arts and the Humanities lists, you may count it in either area but not both. When you register for a class, make sure the computer shows the General Education area that you expect it to fill.
Quantitative Reasoning and Quantitative Intensive

Engineering students automatically fill these requirements with classes required for the major. ECE 3300 Fundamentals of Electromagnetics & Transmission Lines and ECE 3500 Fundamentals of Signals & Systems fulfill the QI requirement.

Diversity

You must fill the Diversity requirement in accordance with University policy. There is a description of the Diversity requirement and a list of classes that fill the requirement in the University Undergraduate Bulletin & Student Resource Guide. Some Diversity classes may also count in Intellectual Explorations areas, as shown in the Bulletin. LEAP 1500 Leap Seminar for Engineers fulfills both the Humanities and Diversity requirements.

American Institutions (3 credit hours or CR in examination)

We recommend that you fulfill the American Institutions requirement by passing an examination. For information about the examination, contact the Testing Center in Room 498 Student Services Building or by phone 801-581-8733. If you prefer to take a class, any one of those listed below will fill the requirement.

- Econ 1740 3 U.S. Economic History
- Hist 1700 3 American Civilization
- Pol S 1100 3 U.S. National Government
- Honor 2212 3 American Institutions (for students getting an Honors degree)

Writing Requirement

The freshman requirement is filled by taking Writing 2010 or ESL 1060. LEAP students should sign up for the Wrtg 2010 section associated with LEAP. Senior Design, ECE 4910 Senior Thesis II, fills the upper division writing requirement for Electrical Engineering majors. ECE students are also required to take ECE 3940 and 3950, Technical Communication I and II.

2. Department Requirements

You must meet the Department requirements listed below even if you already have a degree and even if the University has waived General Education requirements. Transfer classes may count toward these requirements.

- Take two Intellectual Explorations classes in each of the three areas of Fine Arts, Humanities, and Social and Behavioral Science.
- Your total hours in the three areas must be at least 18 semester hours.
• Take LEAP 1501 & LEAP 1500, taught in Fall and Spring semesters (respectively). Be sure you take a section that is specifically designated for Engineering students. Together, these classes fulfill Social Science, Humanities, Diversity, Ethics, and departmental requirements. See the discussion of Engineering LEAP courses below.

• Include a class in Ethics as one of your Humanities classes.
  ▪ This requirement is filled by doing LEAP courses. Under certain circumstances, students who have not taken LEAP may take one of the following to fulfill the departmental ethics requirement. These classes will also fulfill the Humanities requirement:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Description</th>
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<tbody>
<tr>
<td>Phil 3500</td>
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<td>Ethics</td>
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<td>Phil 3510</td>
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<td>Phil 3530</td>
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<td>Environmental Ethics</td>
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<tr>
<td>Phil 4540</td>
<td>3</td>
<td>Engineering, Ethics, and Society (recommended)</td>
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</table>

3. Engineering LEAP Courses

Engineering LEAP is required of all students beginning Fall 2008. LEAP is a two-semester program for engineering students under the direction of the Office of Undergraduate Studies. Cohort groups are formed among first-year students who take the two classes below and also take additional classes together, including sections of Calculus, Physics, and Writing. To register for Engineering LEAP sections, go to the university class schedule, select LEAP, and find the sections associated with engineering.

LEAP 1501 3 Seminar in Engineering Ethics.
Fills a Behavioral & Social Science (BF) requirement and the EE Department Ethics requirement. Taught fall semesters.

LEAP 1500 3 Seminar in Humanities for Engineers
Fills a Humanities (HF) requirement and the Diversity (DV) requirement and a requirement. Taught spring semesters.
Do I Have to Take LEAP?

Effective Fall 2010

- I have transferred to U of U with more than 60 credit hours
  - I do not need to take LEAP 1 or 2 (Leap 1500, 1501)
- I have transferred to U of U < 60 credit hours
  - I have taken 2 gen eds in humanities
    - I do not need to take LEAP 1 (Leap 1500)
  - I have taken 2 gen eds in social science
    - I do not need to take LEAP 2 (Leap 1501)
OBSOLETE CLASSES

Classes numbered 4000 and above will not count toward graduation if they are more than seven years old at the time you graduate. For example, if you graduate in 2006-07, 4000-level and higher classes taken in 1999-2000 and later would count; those taken before that would not count.

All classes, including lower-level classes numbered below 4000, must be the equivalent of semester requirements current at the time of your graduation. The University of Utah General Catalog states: “All students graduating after Spring Semester 2005 must complete semester requirements.” If you have quarter classes on your transcript, see the academic advisor to determine their semester equivalent.

GRADE REQUIREMENTS

1. Grades in Technical Classes

The ECE Department requires letter grades in all technical classes required for the major, including electives. You may use the CR/NC (credit/no credit) option in other classes such as General Education in accordance with University of Utah policy. CR/NC is acceptable for ECE 1020 and CS 1010.

2. Grade-Point Average Requirement for Graduation

To qualify for graduation, you must have a 2.5 cumulative U of U GPA and a cumulative GPA of at least 2.5 on all University of Utah technical classes that count toward requirements or the Electrical Engineering degree. The technical GPA consists of all Electrical and Computer Engineering, Computer Science classes, and technical electives. Grades in Writing (including ECE 3940 and 3950 Technical Communication I and II), General Education, and transfer classes are NOT included in the technical GPA calculation for graduation. For majors admitted Fall 2010, technical GPA consists of all ECE and CS classes.

3. Grade Requirement in Core Courses

The minimum passing grade in the core courses listed below is a “C-“ and is required for graduation. You must have a C- or better in ECE 1270 to be eligible for major admission. You must have a C- or better in each core course before you register in the listed continuation course. No exceptions will be made to this policy.
Do not register for classes for which you are not qualified. Each semester we check registration in continuation courses, and if you have a final grade of D+ or lower in the applicable core course or if we have no record that you took the course, you must drop the continuation course.

As of Spring Semester 2011, automatic pre-requisite checking will be in force. Students will not be able to register for any ECE course unless they have completed the required pre-requisites.

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<thead>
<tr>
<th>Core Course</th>
<th>Continuation Course</th>
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<tbody>
<tr>
<td>ECE 1270</td>
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<td>ECE 2280</td>
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<td>ECE 2260</td>
<td>ECE 3500</td>
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<td>ECE 2280</td>
<td>ECE 3110</td>
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<td>ECE 5320, 5324, 5325, 5330, 5340, or 5410</td>
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<td>ECE 3500</td>
<td>ECE 3510</td>
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<tr>
<td>CS 2000 or 1410</td>
<td>ECE/CS 3700</td>
</tr>
</tbody>
</table>

4. Transfer Grades

Grades in courses taken at other schools will be used to calculate the pre-major admission GPA but will not be included in calculation of the GPA for graduation.

5. Continuing Performance

In order to remain in good standing and to graduate, a student must maintain both a cumulative and a technical grade point average of 2.5 or higher on classes taken at the University (see #2 for definition of “technical GPA”). Students whose grade point average in either of these two categories falls below 2.5 are put on probation. Students on probation must raise their GPA’s (cumulative and technical) to 2.5 or higher within 12 months or they will be dropped from the program.

REPEATING CLASSES

If you take a class more than once, only the grade for the first repeat is counted either for major admission or for graduation. A grade that does not meet minimum requirements for admission, continuation, or graduation in a required class the second time you take it prevents your continuation in the program. In rare cases a technical elective may not be taught again in time for you to graduate in a timely fashion. In that case, you should apply through the undergraduate advisor for an exception. The BSEE committee may select a class covering similar material for you to take as a substitute. In this case, the grade in the substitute class is counted as one of the two times you may take the class. This policy applies to all required and elective technical classes. Allow four weeks for evaluation of exceptions.
If you take a course at both the University of Utah and at another institution, the grade you receive at the U of U is the grade used for major admission or graduation, regardless of which class is taken first. For example, you cannot count a class taken at SLCC or Weber to replace a class in which you get an "I", "E", or low grade at the U of U.

**COOPERATIVE EDUCATION**

**Technical Elective Credit**

To work in industry for one or two semesters in the Cooperative Education program, contact the Career Services Office (350 SSB) for information about co-op requirements and job availability. You may receive one hour of technical elective credit per semester (up to two semesters) in which you work on a co-op project.

Make arrangements ahead of time with the Career Services Office. No credit can be given for jobs held in the past. The job must be a genuine engineering project. Students must create a project proposal and have it approved ahead of time by Dr. Gandhi, the ECE faculty co-op advisor, in MEB 4508. The faculty co-op advisor determines your grade. Register for one credit hour of ECE 4990. You must submit a signed contract, a statement of objectives and description of the work experience, a midpoint report, and a final report.

**Senior Thesis Credit (ECE 4900/4910)**

If an appropriate project is developed with a company participating in the Cooperative Education program, it may be used for the Senior Thesis requirement. Faculty approval is required. You must register for ECE 4900 and 4910 and participate in the class meetings. You may not receive technical elective credit for Cooperative Education in the same semester you are receiving Senior Thesis credit in the co-op program.

**SPECIAL STUDIES POLICY**

In accordance with department policies, students may register for special studies as described below. A Special Studies Request form, available in the ECE office, must be completed and approved before you register for the course.

- **ECE 5950**: A professor and a student may be interested in doing a project on material not contained in any ECE class, but which is at a sufficiently high level to count as technical elective credit. The professor considers the student's academic record and the professor's own interests and work load in deciding whether a special studies project is appropriate. In this case, the professor may authorize the student to register for ECE 5950 and work under the professor's direction. The number of credit hours to be earned is determined by the professor.
• **ECE 4950**: A professor may decide that it is appropriate for students in a Senior Thesis section (usually a Clinic) to continue work on their project during Summer semester, if the project is too complicated to complete by the end of Spring semester or if an additional task is specified. The credit hours given must represent additional significant work beyond the five credit hours normally earned for Senior Thesis.

• **ECE 4990**: This number is used to register for Cooperative Education, one credit hour per semester for no more than two semesters, as described above.

The following restrictions apply to special studies credit:

• No more than four total semester hours earned as described above (including co-op) may count toward the technical elective requirement.
• Special studies may not cover material taught in any class.
• Special studies credit may not be given for work done for your job except in accordance with department policy in the co-op program (see above).
• You may not use special studies to avoid class work.
• The professor requires that you spend at least as much time and effort to earn special studies credit as would be spent on a class with the same number of credit hours.

**GETTING A MINOR IN ANOTHER SUBJECT**

To minor in another subject such as math or physics:

1. Determine the courses you must take. The department offering the minor will list the required courses. Web addresses are:

   • **Math**: See [www.acs.utah.edu/GenCatalog/1044/deptdesc/math.html](http://www.acs.utah.edu/GenCatalog/1044/deptdesc/math.html) (scroll down to "Requirements for the Minor").
   • **Physics**: See [www.acs.utah.edu/GenCatalog/1044/deptdesc/phycs.html](http://www.acs.utah.edu/GenCatalog/1044/deptdesc/phycs.html) (scroll down to "Requirements for the Minor").

2. If the EE program requires courses from the minor department that are different from the courses required for the minor, and if the courses required for the minor cover the same material as those required for the EE program, you may wish to propose an alternate course of study to fulfill your EE requirements. To make that proposal, fill out a Graduation Variance Petition. A faculty committee from ECE will review the proposal and decide what course of study will best meet the requirements of both the EE program and the department offering the minor.

3. When applying for graduation be sure to review any special rules for graduation the department offering the minor may have.
LEAVE OF ABSENCE

If you do not attend the University of Utah in the semester other than summer after being admitted to major status, or if you drop out for one or more semesters other than summer after attending, your major admission status is canceled unless you write a letter to the ECE office requesting a leave of absence. Reinstatement in major status requires that either your original admission GPA or your cumulative current GPA on technical classes at the U of U equals or exceeds the current admission GPA.

The following information is given in the University of Utah General Catalog for 2004-2006: “Undergraduate students who leave the University to participate in an ‘official assignment’ (usually served with a nonprofit or governmental organization, and normally without compensation, e.g., military duty, Peace Corps, VISTA, church service) may submit a copy of their official letter of assignment to the Admissions Office and have the period of registration eligibility extended to a total of two years (six academic terms) as provided under Utah Board of Regents policy. Students must submit a copy of their official letter of assignment to the Admissions Office before they leave the University of Utah.”
ADVANCED PLACEMENT CREDIT

You must arrange to have your Advanced Placement scores on your University of Utah record. AP scores on subjects that will count toward classes required for the EE degree are shown below and may be used toward major admission and graduation requirements. The grades listed are used only for admission to major status and do not affect your University of Utah GPA or your ECE GPA for graduation.

<table>
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<tr>
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<th>Equivalent Classes</th>
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<td></td>
<td>3</td>
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<td>4</td>
<td>Chem 1210</td>
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<td>B+</td>
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</table>
TRANSFER STUDENTS

Many of our graduates transfer courses from another institution. It is critical that you consult with an undergraduate advisor early in the semester before you attend the University of Utah to determine where you stand in your program of study.

ACCEPTANCE OF TRANSFER CLASSES

When the University of Utah Admissions Office accepted you for admission, they sent you a list titled “Summary of Transfer/Special Credit.” Those classes have been accepted by the University, but may or may not fill requirements for the EE degree. Technical transfer classes with grades below C- and technology classes are not accepted in the Electrical Engineering program. If an accepted transfer class has fewer hours than the comparable class at the University of Utah, you must make up the missing hours with extra technical elective hours. Submit a petition for the technical classes that you want us to transfer, using a petition form available on the ECE website or office.

Your petition is not an application for major admission. When you are eligible, complete the “Application for Major Status” available in the ECE office or for download in Excel (preferred) or PDF (for students who cannot view Excel files).

Articulated Transfer Classes

If your classes are from another Utah school or from BYU-Idaho, they may be on the articulated list. If so, list them on a petition form, attach a copy of your “Summary of Transfer/Special Credit,” and submit it to the ECE office to have those classes count toward major admission and graduation requirements.

Classes Not Articulated

For classes not on the articulated list, fill out a petition form and attach a copy of your “Summary of Transfer/Special Credit” and copies of official course descriptions. Typically, this is the online course description from the school where you took the course. Submit this material to the ECE office. You will be notified as to whether your classes are accepted toward your BSEE degree at the University of Utah.
## EE Articulation 2010-2011

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<tr>
<th>U of U</th>
<th>Descrip</th>
<th>SLCC</th>
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GRADES FOR CLASSES FROM SCHOOLS WITH ACCREDITED ENGINEERING PROGRAMS

For admission to major status, transfer classes from a school with Engineering accreditation are evaluated the same as University of Utah classes and are averaged with U of U class grades. For graduation, only grades from the University of Utah are used to compute the GPA.

“Accredited” refers to schools offering the B.S. degree in Electrical Engineering or Computer Engineering, accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). In Utah those schools are the University of Utah, Utah State University, and Brigham Young University. “Non-accredited” refers to programs without ABET Electrical Engineering accreditation (including foreign schools), although they may have technology or other types of accreditation.

STUDENTS IN OTHER MAJORS

ECE classes numbered below 2000 are open to U of U students who have the proper prerequisites. ECE 2910, 3900, 4900, and 4910 are open only to Electrical Engineering major students and may not be taken by students in other majors. Other ECE classes numbered 2000 or above may be taken by students in other majors only if all of the following requirements are met:

- You have passing grades in all required prerequisites.
- You have a cumulative GPA on technical classes that equals the EE admission GPA.
- You receive instructor's permission.
- Space is available in the class.

If you qualify, submit a request form available in the ECE office. You are put on a waiting list and are registered during open registration on a first-come, first-served basis.
COMBINED BACHELOR/MASTER DEGREE PROGRAM

Electrical Engineering drives the rapidly changing face of technology, making additional training beyond the typical B.S. degree an increasingly important asset. To address this need, we have created a program to ease the transition from undergraduate to graduate studies and expedite the completion of both degrees. The goals of the combined degree program are:

- To attract qualified undergraduate students into the graduate program at the end of the junior year.
- To offer benefits to students in obtaining Bachelor's and Master's degrees through the combined program.
- Accelerated admission process:
  -- Programmatic flexibility
  -- Specialized advising
  -- Link between senior project and M.S. thesis
- To stimulate development of academic and career goals.

Three Master of Science tracks are offered as they serve different needs.

- The MS-Coursework option requirements are fulfilled through graduate courses. The MS-Coursework option is available for students who want to pursue an in-depth study of a variety of topics in Electrical Engineering.
- The MS-Project option has a project component and a thesis is not required. A research advisor is chosen before admission to the program.
- The MS-Thesis option involves in-depth research in a specific area and a written thesis submitted to the Graduate School. The M.S. thesis topic is expected to be an outgrowth of the required senior project. A research advisor is chosen before admission to the program.

One member of the Electrical and Computer Engineering Graduate Committee is the primary academic advisor for all students participating in the program and serves as the Program Director. Professor V. John Mathews is currently the director of the combined degree program. Applications for admission to the combined degree program should be submitted by the middle of the spring semester of your junior year and are available from the Graduate Coordinator, Lori Walk. Minimum standards for admission are a cumulative GPA of 3.3; enrollment in or completion of ECE 3900, Junior Seminar; and prior consultation with the Program Director. Transfer students must complete 24 credit hours as degree-seeking students before applying. Only full-time students currently enrolled in major status in Electrical Engineering or Computer Engineering are admitted to the program. International students are not eligible for the combined degree program. Students on the M.S. Thesis/Project track must have a recommendation letter from their intended research advisor. Admission decisions are made by the Graduate Committee.
During the first semester of the Program, you must complete a Combined Degree Program of Study. Your B.S. program of study must be signed by the Undergraduate Advisor and your Master's Degree program signed by the Graduate Coordinator. This allows you to register for graduate courses in the following semester and to ensure that your proposed plan meets requirements for graduation. Students must review the EE/CE Undergraduate Handbook and the ECE MS Graduate Handbook for degree requirements. Upon completion of both degree requirements, you will receive both degrees at the next appropriate graduation ceremony. DO NOT apply for graduation for the undergraduate degree until you complete BOTH degrees.

Undergraduate status is maintained until the mid-program review; however, students are able to take courses for graduate-level credit at any time. Transfer from undergraduate to graduate status occurs after completion of a minimum of 122 semester credit hours of qualified undergraduate studies and completion of no more than 12 semester hours of approved graduate work. Students should plan to have a total of two to three semesters in graduate status and may begin the process of applying to the Graduate School if they have been in the program for at least one semester. Admission to the combined Degree Program guarantees admission to the Graduate School as long as a minimum GPA of 3.3 is maintained, so this step is simply a matter of some additional paperwork. Students should be aware that after they are admitted to graduate status they will no longer be eligible for undergraduate financial aid or scholarships.

Before being formally admitted to the Graduate School (and therefore, obtain the status of a graduate student), the following items need to be fulfilled:

- Choose a supervisory committee
  - B.S./M.S. Coursework/Project option: The chair is chosen by the student; the two remaining members are assigned by the department. The chair of the committee must be a regular ECE faculty member.

  - B.S./M.S. Thesis option: The research advisor will be Chair and the student chooses the remaining two members.

- Submit a combined degree program of study as stated above

To apply to the Graduate School, students must download and complete the University of Utah Graduate Application and submit the form along with the $55 University application fee (by check or credit card payment form) to the Graduate Secretary in the ECE Department. Application deadlines are:

- Fall semester: April 1
- Spring semester: October 1
- Summer semester: February 15
Upon recommendation by the Director, the Graduate Committee makes a formal recommendation for admission to the Graduate School. Students not progressing to graduate status are dropped from the program and complete their Bachelor's degree. After acceptance into graduate status it is the student's responsibility to register for remaining undergraduate courses under their undergraduate career and graduate courses under their graduate career.

In the first semester of graduate status the Request for Graduate Credit in B.S./M.S. Program, the Request for Supervisory Committee, and the Admission to Candidacy forms are due to the Graduate Coordinator from all combined degree students. The due date is the course drop deadline of that semester. Students must refer to the ECE M.S. handbook for the specific MS option requirements.

Upon successful completion of the combined degree program, both the Bachelor's and Master's degrees are awarded simultaneously. Students must apply for graduation to the Registrar's Office for the Bachelor's degree to be awarded in the appropriate semester, and the Department submits the necessary paperwork for awarding of the Master's degree in the same semester. You must satisfy all Department and University requirements for each degree. Coursework may not be applied to more than one degree. Enrollment in a Ph.D. program may not occur until completion of the combined degrees.

**TYPICAL STUDENT TIMELINE**

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<tr>
<th>Junior – Fall Semester</th>
<th>Junior – Spring Semester</th>
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<tbody>
<tr>
<td>Enroll in ECE 3900 (Junior Seminar)</td>
<td>Choose graduate advisor (M.S.)</td>
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<td>Apply for combined status</td>
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<tr>
<th>Senior – Fall Semester</th>
<th>Senior – Spring Semester</th>
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<tr>
<td>Enroll in ECE 4900</td>
<td>Enroll in ECE 4910</td>
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<td>Undergraduate (+ graduate) coursework</td>
<td>Undergraduate (+ graduate) coursework</td>
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<tr>
<td>Develop a B.S./Master's program of study</td>
<td>Mid-program progress review (at 122 hours)  Apply for graduate status</td>
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<td>Form supervisory committee</td>
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<th>Graduate – Fall Semester</th>
<th>Graduate – Spring Semester</th>
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<tr>
<td>Complete the Request for Graduate Credit in B.S./M.S. Program, the Request for Supervisory Committee, and the Admission to Candidacy forms</td>
<td>Enroll in ECE 6910 (Graduate Seminar)</td>
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<tr>
<td>Enroll in ECE 6900 (Graduate Seminar)</td>
<td>Graduate coursework</td>
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<tr>
<td>Graduate coursework</td>
<td>Complete B.S. requirements</td>
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<td>Comprehensive exam (proposal) (M.S. Thesis option)</td>
<td>Thesis defense (M.S. Thesis option)</td>
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<td>Course Designation for Final Exam (MS Coursework only option)</td>
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GRADUATE SCHOOL

The Department of Electrical and Computer Engineering offers two main graduate degrees:

- Master of Science Degree
  
  **Thesis option.** This degree is research oriented and requires the writing of a Master’s thesis. Applicants must have an undergraduate degree, preferably in an engineering or related field. Admission requirements include a minimum undergraduate GPA of 3.2.

  **Project option.** This degree is research oriented with a project component and a thesis is not required. Applicants must have an undergraduate degree, preferably in an engineering or related field. Admission requirements include a minimum undergraduate GPA of 3.2.

  **Coursework option.** This degree is available for those students who want to pursue an in-depth study of a variety of topics in Electrical and Computer Engineering. Applicants must have an undergraduate degree, preferably in an engineering or related field. Admission requirements include a minimum undergraduate GPA of 3.2.

- Doctor of Philosophy. This degree requires the writing of a doctoral dissertation. Admission requirements include a minimum GPA of 3.5.

Visit http://www.ece.utah.edu for the application instructions. Because we are a prescreening department, carefully follow ALL instructions.

Admission applications must be received by the Electrical and Computer Engineering Department by the listed deadline. We admit international graduate students for fall semesters only. Please read through the above website for more information.

Financial support in the form of teaching and research assistantships and fellowships is available to many M.S. Thesis/Project option and Ph.D. students. Teaching assistantships are available to many M.S. Coursework option students. Consult Sally Reed in the ECE office about teaching assistantships. Faculty members are the best sources of information about research assistantships and fellowships.