I. What’s NEW!

15 February 2012 We’ve added text in two places emphasizing that ECE 3400 is a pre-requisite for all CDE courses.

21 October 2011 We’ve added to the Advanced ECE Electives page material regarding ECE courses at the 4000-level or above that list ECE Foundation Courses as pre requisites. We’re hoping this material will help students choose courses to satisfy the breadth and depth requirement.

21 September 2011 Please note that ECE 4760 will be offered during the fall semester rather than the spring semester starting in academic year 2012-2013.

13 September 2011 We have decided to allow students to count ECE 5830 --- Introduction to Technical Management --- as an Outside-ECE Technical Elective. Keep in mind that ECE 5830 still does not count as an Upper-level ECE Elective.

31 March 2011 We have updated the list of CDE classes for AY 2011-2012. Please note that Fall 2011 will be the last semester during which ECE 4750 is a CDE course. Students who take ECE 4750 as a CDE during Fall 2011 must complete at least one other CDE class to fulfill the CDE requirement.

31 March 2011 We have updated the list of ECE Foundation Courses to include ECE 3250 starting in Fall 2011. Please review the ECE Core and Foundation Course Requirements section below for important information related to this update.

17 November 2010 We have added text stating explicitly that ECE majors may not count ECE 3100 toward satisfying the engineering distribution requirement.

24 August 2010 We have finally updated the Handbook content to include the new ECE major requirements that apply to students who entered Cornell during Fall 2009 or after (nominally Class of 2013 or later). The Handbook still works for students operating under the old set of rules, as well --- have a look!

23 September 2009: We have updated the list of CDE classes for AY 2009-2010.

26 August 2009: To all first-year students entering this fall (nominally Cornell class of 2013): we have instituted changes in the ECE major requirements that apply to you. The paper version of the Engineering Undergraduate Handbook describes these changes,
and we will soon be adding language to this site describing the changes.

24 March 2009: We have updated the rules on ROTC courses under Excluded Courses to conform with College of Engineering requirements.

16 February 2009: We have made changes to the rules governing credit for project-team work and independent-study courses under Technical Electives Outside of ECE. Which set of rules applies to a given student depends on the date the student affiliated with ECE.

3 February 2009: We have updated the information on eligibility and minimum grade requirements for the ECE minor.

16 January 2009: We have added CS 3200 to the list of courses that satisfy the ECE advanced-programming requirement.

8 October 2008: We have suspended the ECE Honors Program indefinitely due mainly to lack of enrollment.

29 September 2008: We have updated the list of student project teams under Technical Electives Outside of ECE.

II. Affiliation

Engineering students formally select their engineering major, or what we call “affiliate with a major”, by the end of the first semester of their sophomore year. Once you have submitted your application for affiliation, the ECE major coordinator reviews your grades to determine if you have satisfied the major affiliation requirements. (If you are ahead or behind a semester, consult with an ECE Major Coordinator to determine appropriate coursework and procedures.)

The ECE affiliation requirements are:

- Be in good academic standing in the College of Engineering
- Must have completed with a grade of C+ or better MATH 2930, PHYS 2213, and either ECE/ENGRD 2100, ECE 2200, or ECE/ENGRD 2300
- Must have an average GPA of at least 2.5 in the following courses if completed: MATH 1920, 2930, 2940, PHYS 2213, ECE/ENGRD 2100, ENGRD 2110, ECE 2200, ECE/ENGRD 2300

If your application is approved, you will be affiliated with ECE and an ECE faculty advisor will be assigned to you. If you do not fully meet the requirements listed above, we encourage you to describe your particular circumstances during the affiliation process and we will work with you to prepare for entering in the ECE major. For more information please contact the Undergraduate Office at 223 Phillips Hall for assistance.
**III. Electrical and Computer Engineering**

This undergraduate handbook has been designed as a reference guide for Electrical and Computer Engineering (ECE) students at Cornell University. The College of Engineering Undergraduate Handbook is available at: [http://www.engineering.cornell.edu/studentservices/ academic-advising/engineering-handbook/](http://www.engineering.cornell.edu/studentservices/academic-advising/engineering-handbook/)

The curriculum of an electrical engineer has two components:
- The Common Curriculum
- The ECE Major Program

In these pages we answer some common questions regarding these requirements. You may want to look particularly at the [Graduation Checklist](http://www.engineering.cornell.edu/studentservices/academic-advising/engineering-handbook/) for an overview of all the requirements before you begin reading the other sections of this handbook. **NOTE:** These requirements apply to students entering fall 2008 and later. Students graduating before May 2012 who have questions about graduations requirements should consult their faculty advisor.

General information such as Academic Standing, Dean's List requirements, Advanced Placement, Transfer Credit, Adding/Dropping courses, and Leaves of Absence can be found in the [Courses of Study](http://www.engineering.cornell.edu/studentservices/academic-advising/engineering-handbook/) publication. These are also described online in the Engineering Advising and Student Records Resource Guide.

If you have any questions regarding graduation requirements or the ECE Major Program that are not answered in this handbook, feel free to contact one of our ECE Major Consultants or their assistants:
- Professor Sheila Hemami, Associate Director
- Professor David Delchamps, Advising Coordinator
- Jennifer Rought, Undergraduate Program Coordinator

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IV. Common Curriculum

<table>
<thead>
<tr>
<th>COURSE CATEGORIES</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>16</td>
</tr>
<tr>
<td>Physics</td>
<td>12</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Freshman Writing Seminar</td>
<td>6</td>
</tr>
<tr>
<td>Computer Programming (usually CS 1110 or 1112 and 1130 or 1134)</td>
<td>5</td>
</tr>
<tr>
<td>Engineering Distribution3 (including ECE/ENGRD 2300)</td>
<td>7</td>
</tr>
<tr>
<td>Introduction to Engineering (ENGRI course)</td>
<td>3</td>
</tr>
<tr>
<td>Liberal Studies Distribution4 (6 courses, 18 credit minimum)</td>
<td>18</td>
</tr>
<tr>
<td>Advisor Approved Electives</td>
<td>6</td>
</tr>
<tr>
<td>Total Minimum Common Curriculum Credits:</td>
<td>77</td>
</tr>
</tbody>
</table>

You must also:

Fulfill the Technical Writing Requirement by taking a technical course that has a substantial amount of writing. Courses that meet the technical writing requirement are listed in the Courses of Study publication.

Fulfill the requirement of at least three credits of computer programming at a level above that of CS 1110 or 1112 and CS 1130 or 1134 or an advanced computer-engineering course at a level above ECE 3140. (See: Advanced Programming/Computer Engineering Requirements in section IX. Culminating Design Experience)

Note: The courses taken for all three of these requirements may be used to fill credits in other areas, such as Liberal Studies, Engineering Distribution, Advisor Approved Electives, or Major Program requirements.

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V. Liberal Studies Distribution

For more information on the Liberal Studies Distribution, please visit the Liberal Studies web page maintained by the College of Engineering. You will need to scroll down the page in order to find the appropriate information.

VI. Technical Writing

The ability to communicate is essential to successful professional practice. In addition to taking two first-year writing seminars, engineering students must have a significant amount of instruction and practice in technical or scientific writing. They can fulfill the college's technical-writing requirement by enrolling in an Engineering Communications course (e.g., ENGRC 3350 or ENGRC 3500), enrolling in selected courses in the Department of Communication (COMM 3030 (formerly 2630) or 3520), or in an approved writing-intensive engineering course. The third option includes the following writing intensive courses:

- BEE 4890
- BEE 4730 (with co-registration in BEE 4930)
- ENGRD / AEP 2640
- CHEME 4320
- MAE 4272
- MSE 4030-4040
- MSE 4050-4060

Please see the College Technical Writing Program for more details on how the Technical Writing Requirement can be fulfilled.

For information on fulfilling the technical writing requirement by doing a writing-intensive Co-op, contact Engineering Professional Programs, 201 Carpenter Hall or the Engineering Communications Program in 465 Hollister Hall.

VII. Advisor Approved Electives

Your 6 credits of Advisor Approved Electives must form a relevant and appropriate part of an overall educational plan or objective, as determined by your faculty advisor (subject to the restrictions on Excluded Courses) -- and no one else. The Advisor Approved Electives can be used to broaden your education as an engineer. A wide variety of courses are acceptable; the key is to discuss your interests and educational goals with your advisor and obtain his or her approval. No one else may sign indicating
approval of your Advisor Approved Elective choices on behalf of your advisor. (See: Excluded Courses for courses that MAY NOT be used as Advisor Approved Electives.)

Advisor Approved Electives that are generally accepted by advisors include: one extra introduction to engineering course, engineering distribution courses, courses stressing oral or written communication, upper-level engineering courses, advanced mathematics, biological, and physical science courses. Selected business, economics, humanities, social science, and language courses are often acceptable depending on your career goals. Again, the courses you present to your advisor for approval must be sound choices that address your overall career or educational objectives.

Examples of how some students have used Advisor Approved Electives:

- Biology and chemistry course work as preparation for a career in medicine or biomedical engineering (e.g. BLOG 1105/1106, CHEM 3570/3580, BIONB 2220)
- Management and industrial relations courses for a career in management (e.g. AEM 2210/2220)
- Courses in communications; writing and public speaking from the Communication Department or the Engineering Communications Department
- Extra ECE courses in either your specialization area or for added breadth
- To acquire expertise in a career-related 'minor' or concentration, possibly computer science or ORE

Other Electives

The engineering curriculum permits you a great deal of elective flexibility. The only point that needs to be kept in mind is that we define the MINIMUM that you are absolutely REQUIRED to take. Following the minimal path gives a basic academic preparation with which to enter the profession. You are encouraged to take more than the minimum courses, as this will prepare you better to enter the job market or begin graduate studies.

Legitimate and beneficial opportunities can be engaged in that differ from traditional lecture courses. For example: independent design projects, Study Abroad, and an ECE Honors Program to name just a few. Such options can add a great deal of value to your engineering professional training, and enhance the value of your Cornell degree. The choice of whether to take extra courses, engage in meaningful extra-curricular activities, or avail yourself of other university programs is yours. It is important that you plan effectively to use the extra freedom within your engineering education.

The flexibility of the Major program courses --including those of an elective nature-- allows you to pursue diverse interests. You can use your course options to strengthen your electrical engineering program if your goal is to specialize or obtain depth within electrical engineering. Or, you can use Major Approved Electives to complement related interests in other majors of study.
Students interested in a career in medicine often select life science (such as BLOG 1105 / 1106), chemistry (CHEM 3570 and 3580), and bioengineering course work (in CHEME or EP) as their electives. Students who study energy systems can combine ECE course work with courses from the Nuclear Science or Mechanical Engineering departments. Students with an interest in computer engineering can focus on ECE course work in digital theory and microprocessor/microcontroller systems as well as selecting technical course work from the Computer Science department. The exciting area of MicroElectroMechanical Systems (MEMS) combines semiconductor fabrication with principles from courses like ENGRD 2020 & 2030.

You have greater flexibility in choosing and designing a particular program if you plan early and carefully, ask a lot of questions, and take the right combination of courses that suits your particular interests.

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**VIII. ECE Major Program: Core and Foundation Courses**

The Electrical and Computer Engineering major, which is fully accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology, builds on the **ECE Core Courses** and **ECE Foundation Courses** listed in the tables below.

In addition to the Core and Foundation Course requirements described in what follows, every ECE major takes additional upper-level elective courses. These break down into **Advanced ECE Electives** and **Outside-ECE Technical Electives**.

Advanced ECE Electives are ECE courses at the 3000-level or above, some of which must be at the 4000-level or above. The Outside-ECE Technical Electives include 9 credits of appropriate course work with a total of 3 credits at or above the 3000-level.
### ECE Core Courses
*(See: [ECE Core Course Descriptions](#).)*

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course Title</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 2100</td>
<td>Introduction to Circuits for Electrical and Computer Engineers</td>
<td>4</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ECE 2200</td>
<td>Signals and Systems</td>
<td>4</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ECE 2300</td>
<td>Introduction to Digital Logic Design</td>
<td>4</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ECE 3400 (formerly ECE 2400)</td>
<td>Electrical and Computer Engineering Practice and Design</td>
<td>4</td>
<td>Spring</td>
</tr>
</tbody>
</table>

### ECE Foundation Courses
*(See: [ECE Foundation Course Descriptions](#).)*

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course Title</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 3030</td>
<td>Electromagnetic Fields and Waves</td>
<td>4</td>
<td>Fall</td>
</tr>
<tr>
<td>ECE 3100</td>
<td>Introduction to Probability and Random Signals</td>
<td>4</td>
<td>Fall</td>
</tr>
<tr>
<td>ECE 3140 (also CS 3420)</td>
<td>Embedded Systems</td>
<td>4</td>
<td>Spring</td>
</tr>
<tr>
<td>ECE 3150</td>
<td>Introduction to Microelectronics</td>
<td>4</td>
<td>Spring</td>
</tr>
<tr>
<td>ECE 3250</td>
<td>Mathematics of Signal and System Analysis</td>
<td>4</td>
<td>Fall</td>
</tr>
</tbody>
</table>
Core and Foundation Course requirements:

ECE majors who matriculated at Cornell before Fall 2009 (nominally Class of 2012 or earlier) must take the ECE Core Courses ECE 2100, ECE 2200, and ECE 2300 and the four ECE Foundation Courses ECE 3030, ECE 3100, ECE 3140, and ECE 3150.

ECE majors who matriculated at Cornell during Fall 2009 or after (nominally Class of 2013 or later) must take all four ECE Core Courses and at least three out of five ECE Foundation Courses. Students who take ECE 3250 as a Foundation Course must take it Fall 2011 or later and must complete at least one of ECE 3030 and ECE 3150.

ECE majors who matriculate at Cornell during Fall 2011 or after (nominally Class of 2015 or later) must take all four ECE Core Courses and at least three out of five ECE Foundation Courses, including at least one of ECE 3100 and ECE 3250 and at least one of ECE 3030 and ECE 3150.

ECE majors may not count ECE 3100 or ECE 2100 toward fulfilling the engineering distribution requirement.

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IX. Upper-Level Electives

ECE majors who matriculated at Cornell before Fall 2009 (nominally Class of 2012 or earlier) must take a minimum of 6 Advanced ECE Elective courses. These courses must be at the 3000-level or above and are subject to some restrictions; see Advanced ECE Electives. At least two of these courses must be Culminating Design Experience courses; see below.

ECE majors who matriculated at Cornell during Fall 2009 or after (nominally Class of 2013 or later) must take at least seven Advanced ECE Elective Courses. These courses must be at the 3000-level or above and are subject to some restrictions; see Advanced ECE Electives page. At least one of these courses must be a Culminating Design Experience course; see below.

Every ECE major must also take 9 credits of Outside-ECE Technical Electives, with a minimum of 3 credits of lecture course work at the 3000-level or above.

Culminating Design Experience Courses, known as CDEs, arose several years ago as a replacement for and enhancement of what were known formerly as laboratory courses. Every CDE includes a significant and open-ended engineering design assignment with realistic constraints. The principal goal of a CDE course is to help students develop the ability to design a component, system, or process to meet desired needs taking into account some or all of the following: economics, the environment, sustainability,
manufacturability, ethics, health and safety, society, and politics. CDE courses for 2012 – 2013 appear in the table below. A student must complete ECE 3400 prior to taking any course in this table that the student wishes to count as satisfying the CDE requirement. Please note that Fall 2011 was the last semester during which ECE 4750 was a CDE course. Students who took ECE 4750 as a CDE during Fall 2011 must complete at least one other CDE class to fulfill the CDE requirement.

ECE 4760 will be offered during the fall rather than the spring starting in academic year 2012-2013.

Culminating Design Experience (CDE) Courses

<table>
<thead>
<tr>
<th>COURSE #</th>
<th>COURSE TITLE</th>
<th>FA</th>
<th>SP</th>
<th>CRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 4370</td>
<td>Fiber &amp; Integrated Optics</td>
<td>X</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>ECE 4530</td>
<td>Analog Integrated Circuit Design</td>
<td>X</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>ECE 4760</td>
<td>Digital Systems Design using Microcontrollers</td>
<td>X</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

X. Other ECE requirements

Advanced Programming/Computer Engineering Requirement

The courses that an ECE major takes to satisfy the ECE Major Requirements or the ENGRD requirement must include at least three credits of computer programming at a level above that of CS 1110, 1112,1113, 1114, 1130, and 1132, or an advanced computer engineering course at a level above ECE 3140. Current courses that meet this requirement are:

CS 2110, CS 3200, CS 3220, CS 2042 and CS 2044 (both must be taken), ECE 4740, ECE 4750, or ECE 4760. Other courses may be allowed by an ECE petition.

Probability and Statistics Requirement

The courses that an ECE major takes to satisfy the ECE Major Requirements or the ENGRD requirement must include at least one course with significant probability content. ECE/ENGRD 3100 and ENGRD/ORIE 2700 are appropriate such courses, but keep in mind that those two course are quite different and are by no means
interchangeable. Other courses satisfying the probability and statistics requirement may be allowed by an ECE petition.

XI. Academic Standards

No course with a grade less than C- may be used to satisfy degree requirements in the Major program or serve as a prerequisite for a subsequent ECE course. Students must satisfactorily complete the following requirements: (a) two of: ECE/ENGRD 2100, ECE 2200, or ECE/ENGRD 2300; (b) all mathematics and physics courses through MATH 2940 and PHYS 2214 by the end of the first semester in the Major (typically the second semester of the second year) and make adequate progress toward the degree in subsequent semesters. To maintain good standing, students must achieve at least a 2.3 GPA every semester, must not have any failing or missing grades, and must achieve a passing grade in at least 12 credit-hours' worth of course work every semester.

XII. ECE Minor

Eligibility:

Engineering undergraduates affiliated with the following majors are eligible to participate in the Electrical and Computer Engineering minor: ABEN, EP, CEE, CHEME, CS, GEOL, MAE, MSE, ORE.

Requirements:

To complete the minor, the student must take at least six (6) courses (minimum of 18 credits), chosen as follows:

I. Two of the following:

- ECE/ENGRD 2100, Introduction to Circuits for Electrical and Computer Engineers (4 credits)
- ECE 2200, Signals and Systems (4 credits)
- ECE/ENGRD 2300, Introduction to Digital Logic Design (4 credits)

II. Two of the following:

- ECE 3030, Electromagnetic Fields and Waves
- ECE3140/CS 3420, Embedded Systems
- ECE 3100, Introduction to Probability and Random Signals
- ECE 3150, Introduction to Microelectronics
- ECE 3250, Mathematics of Signal and System Analysis

III One other technical ECE lecture course at the 3000 level or above (3-credit minimum)

IV One other technical ECE lecture course at the 4000 level or above (3-credit minimum)

Students must receive a grade of C- or better in every ECE course counted toward the minor and a GPA of at least 2.3 across all such courses.

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XIII. Contact Information

Jennifer Rought, Undergraduate Major Coordinator
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Ithaca, NY 14853 USA
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Fax: (607) 254-3508