# Undergraduate Academic Advising Resources

## Electrical and Computer Engineering

## Table of Contents:

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>Overview of Program Components</td>
<td>3</td>
</tr>
<tr>
<td>Freshman Year</td>
<td>5</td>
</tr>
<tr>
<td>Sophomore Year</td>
<td>7</td>
</tr>
<tr>
<td>Junior Year</td>
<td>9</td>
</tr>
<tr>
<td>Senior Year</td>
<td>10</td>
</tr>
<tr>
<td>Transfer Students</td>
<td>11</td>
</tr>
<tr>
<td>Non ECE Majors</td>
<td>12</td>
</tr>
<tr>
<td>Graduation and Beyond</td>
<td>13</td>
</tr>
</tbody>
</table>
Undergraduate Academic Advising Resources

Planning a Program in ECE
This resource is intended to be a guide for planning your undergraduate ECE degree program. Of course, it is by no means a complete guide—you should consult several important sections of the undergraduate catalog for further information. These sections include WPI's general degree requirements, information regarding the two required projects, MQP and IQP, Humanities and Arts Requirement, the Social Science Requirement, and the specific descriptions for any courses we have mentioned. Also, be sure to consult your academic advisor in any matters related to the course scheduling and the fulfillment of degree requirements.

A Note on Academic Advising
Our department—and WPI as a whole—offers you the opportunity of an education that is highly individualized. As no two students are identical in terms of their academic skills, interests, and aspirations, no two students should have identical academic programs. This chance to tailor a degree program to your individual needs is indeed a great opportunity, and the burden of seizing such an opportunity falls primarily on you the student. However, adapting to WPI’s complex system of courses, projects, and other degree requirements is certainly not an easy task.

Fortunately, you possess a great set of resources to help you, including your peers, the faculty and staff of the ECE department—and most importantly—your academic advisor. As you proceed through four years of undergraduate education, always remember that your academic advisor can be of great assistance. He or she is a source of advice and information, helping you with decisions about what courses to take, what projects to pursue, your personal and professional development, and how ultimately to make the most of your WPI experience. Your academic advisor can even help you find a job or get accepted to a graduate program.

As you get to know your academic advisor, remember: though he or she may contribute as much guidance as possible, most of the effort in planning your program must come from you. If you simply cannot work well with your academic advisor for any reason, it is your responsibility to find one with whom you are more comfortable.
Overview of Program Components

The path toward a degree in the ECE Department varies greatly from student to student. To be successful, you must tailor your program to fit your academic needs, working within the boundaries of the major’s distribution requirements and WPI's general degree requirements. This section is intended as a guide to clarify the program components you will need to fulfill the distribution requirements for the ECE major. It also contains information about general WPI requirements, and advice on how to integrate these elements into your degree plan.

Major Qualifying Project (MQP)

In many cases, the pinnacle of a student’s undergraduate work at WPI is the MQP, the senior-level design project. The ECE degree requires all students to complete an MQP worth 1 unit of study in the major area (the equivalent of 3 courses). Note that this 1 unit is part of the 6 total needed to fulfill the "Engineering Science and Design" distribution requirement. Of the remaining 5 units, 4 units (12 courses) are met by courses in the major area. The breakdown of courses needed is discussed further in the section titled "Overview of Other Program Components."

Also note that projects that lack a significant engineering design component are typically not approved. Thus, the 1/3 unit of "Capstone Design Experience" required for the ECE major is almost always a part of the MQP, and need not be fulfilled by a separate course.

The MQP is an extremely important part of your degree program: it is a single project that is equivalent to three ECE-related courses, and provides some of the most directly relevant preparation you will receive for graduate school or a job in industry. Your MQP can be very rewarding, exciting, and even fun. However, it can also be quite frustrating if you are not adequately prepared.

Consequently, when planning your degree program, a good deal of effort should be made to ensure you have developed a solid foundation in all areas of ECE before attempting to begin your project.

Off-Campus MQP Opportunities

The ECE Department offers off-campus MQP opportunities at numerous locations and during various terms throughout the academic year. The locations include: Silicon Valley, California; MITRE in Bedford, MA; Wall Street (New York/London); China; and MIT Lincoln Laboratory in Lexington, MA. These projects are performed as one-term, fulltime MQP experiences; some require a PQP or specific background preparation. Students can submit applications for these programs during B term of the academic year prior to their MQP (typically their junior year). For more information on these and other WPI off-campus programs, please visit the WPI the Global Perspective Program website.

ECE Design Course

The most explicit educational background for the MQP is the course ECE2799, Electrical and Computer Engineering Design. In ECE2799, students spend the term working on a specific design project. The students not only gain experience in the design of a particular system, component, or process, but they also learn a great deal about the design process itself. Moreover, the course is a great opportunity to work on an exciting project with a team of students. (For more information please see the course description.)

Since ECE2799 is direct preparation for the MQP, students are strongly encouraged to successfully complete the course before seeking a senior project. Most ECE faculty will not accept MQP students until they have passed ECE 2799.
Before you can pass ECE 2799 though, you need to be adequately prepared. As is true for most ECE applications, the projects in ECE2799 require solid background in a variety of sub-disciplines, and thus it is necessary to learn these fundamentals before taking the course. As background for ECE 2799, we strongly recommend three of the four courses in the "basic core", especially ECE 2019 and ECE 2049. These core courses are explained further in the next section.

Given these recommendations, the best time to take ECE2799 is at the end of your sophomore or beginning of your junior year, once the recommended background has been completed.

**Core Courses**

Although electrical and computer engineering is a vast and rapidly expanding field, there remains at its center a core of basic principles. These fundamental concepts, which have changed remarkably little throughout the rich history of electrical and computer engineering, continue to serve as a basis for even the newest technologies. Accordingly, we consider developing a mastery of these fundamentals to be one of your most important tasks as an undergraduate student.

Core courses in the ECE department represent the bulk of ECE fundamentals, constituting much of what you will need to know as you prepare for ECE2799 and your MQP.

The basic core is composed of four courses taken after ECE 2010:

- ECE 2019 – Sensors, Circuits and Systems
- ECE 2029 – Introduction to Digital Circuits and Computer Engineering
- ECE 2049 – Embedded Computer Systems
- ECE 2311 – Continuous-Time Signal and System Analysis

These courses provide a comprehensive introduction to the fundamentals of ECE. Although you should consult the individual descriptions for each course to obtain detailed information about all the topics covered, the basic core amounts to an overview of central topics in ECE, including basic analog and digital circuits, introductory computer engineering, continuous signals and systems, electric power applications, and basic electromagnetic field theory.

Before you attempt ECE2799, we strongly recommend that you take at least three of these four courses, especially ECE 2019 and ECE 2049.

After completing ECE 2010 and the basic core courses, students will begin taking progressively more advanced ECE courses. While many course selection options exist, all students should complete ECE 2112 (Electromagnetic Fields), ECE 2201 (Microelectronic Circuits I) and ECE 2312 (Discrete-Time Signal and System Analysis) prior to graduation. Courses that may be of particular help to your MQP should usually be completed by the end of the Junior year.
Freshman Year

Planning your first year at WPI may appear confusing and difficult, especially since there are so many different options. This section will help you make sense of these options, and identify the courses that are most important to complete freshman year. Always remember, though, that there is no single "perfect" academic program.

As mentioned earlier, before you can begin coursework in the ECE Department, you need a proper foundation in mathematics. You should begin by completing differential and integral calculus as soon as possible. If you have insufficient background in pre-calculus topics, you may begin with the semester-long MA 1020 course. If not, then you should begin with MA 1021. In either case, you should definitely follow with MA 1022. Students with a background in high school calculus (such as an AP course) may skip ahead to begin with MA 1022, MA 1023, or even MA 1024. Consult your advisor to find out which starting point is right for you.

Incidentally, note that MA 1020/1021 and MA 1022 fulfill the differential and integral calculus part of the "Mathematics and Basic Science" distribution requirement.

The next step in planning your first year is to address the science requirement. The physics courses most directly relevant to ECE are PH 1120 or PH 1121 (which deal with electricity and magnetism) and PH 1140 (which deals with oscillations and waves). When choosing physics classes, be sure to pay attention to any recommended background such as calculus. You may also consider taking a chemistry or biology course in your first year. We encourage students to investigate further any mathematics or science courses that they find interesting; as always, consult your academic advisor for help.

For many students—in particular those with little experience in programming—first year is the best time to address the computer science requirements of the ECE major. For students with a moderate background in computers, either CS 1101 or CS 1102 provides a suitable introduction to programming concepts. You may then continue on to more advanced computer science courses. The course CS 2301 is highly recommended for ECE students.

If you have planned properly, you should be ready to begin coursework in ECE by the spring semester of your freshman year. The first course for all students should be ECE 2010, usually followed by ECE 2029. A majority of ECE students begin their major coursework with ECE 2010 in C-term of their first year, followed by ECE 2029 in D-term. If you feel that you are not ready to take ECE 2010 by C-term, you can wait until A-term of your sophomore year. Whenever you begin with your major coursework, be sure to complete the recommended background for ECE 2799 in time to take it in your sophomore or junior year.

In addition to all of your major coursework and its related background, do not forget that, at some point, you will need to complete the Humanities & Arts Requirement! You may want to schedule some HUA-related coursework for your first year, especially if you want to complete the requirement in your sophomore year. Also, as social science courses, such as economics, are typically helpful for the IQP, you may want to take those courses as soon as possible (or at least at some point before your junior year). Finally, do not forget the physical education requirement.

In choosing your courses for your first year, keep in mind that the WPI degree requirements call for three "free elective" courses; if you pass all of your classes at WPI, you will end up with a total of six courses which you can choose with no restrictions whatsoever. You will have even more unrestricted course selections available if you enter WPI with advanced placement (AP) course credits. This flexibility can be used for a variety of purposes, such as pursuing another major or minor, delving deeper into your Humanities & Arts area, honing your skills within your major beyond the minimum courses required, or even just taking a few extra courses that interest you. In other words, do not be afraid early on to take a course simply
because it may not be "worth credit" toward your degree. The first year is a great time to explore the wide array of topics a WPI education has to offer.
**Sophomore Year**

As you plan for your sophomore year, one important task will be to continue progress in your major. This process is assisted by careful planning on your part, particularly if you want to take ECE 2799 by D-term of your second year.

The following tables display two examples of desirable course sequences for an ECE student. Both show series of courses that would allow a student to arrive at ECE 2799 in D-term with the proper recommended background (without considering such factors as recommended mathematics or science).

Example #1:

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
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<tbody>
<tr>
<td>C</td>
<td>ECE 2010</td>
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<tr>
<td>D</td>
<td>ECE 2029</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ECE 2019</td>
</tr>
<tr>
<td>B</td>
<td>ECE 2311</td>
</tr>
<tr>
<td>C</td>
<td>ECE 2201 or ECE 2049</td>
</tr>
<tr>
<td>D</td>
<td>ECE 2799</td>
</tr>
</tbody>
</table>

Example #2:

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>ECE 2010</td>
</tr>
<tr>
<td>D</td>
<td>ECE 2029</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
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<tbody>
<tr>
<td>A</td>
<td>ECE 2201 or ECE 2049</td>
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<tr>
<td>B</td>
<td>ECE 2311</td>
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<tr>
<td>C</td>
<td>ECE 2019</td>
</tr>
<tr>
<td>D</td>
<td>ECE 2799</td>
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Of course, if you desire even greater flexibility in your schedule, there are many paths besides these two. For example, you may take two ECE courses concurrently in a term, provided that one is not recommended background for the other. Also, you may wait until B-term of your junior year to take ECE 2799; this decision may be helpful if you chose not to start your ECE classes until later, or if you want to have a stronger background in ECE, mathematics, or
science before attempting the course. However, we do advise against waiting until the end of junior year (or later) to take ECE 2799, as it may hinder your ability to find an MQP on time.

By the end of sophomore year, you should have finished taking most of your mathematics and science classes, as these courses serve as background for further work in your major. Also, all ECE students should complete the computer science requirement in this year, if they have not yet done so.

Many students choose to complete their Humanities and Arts Requirement in the sophomore year. If you did not make much progress in completing humanities courses as a freshman, you should do so in this year. Do not feel rushed, though—you do not necessarily have to complete this requirement as a sophomore.

Another important task in your second year is to investigate WPI’s "Global Perspective Program". Many WPI students perform their IQP at an off-campus project site; this is especially true in the ECE Department. However, if you are planning to complete your IQP off-campus as a junior, the application process begins in your sophomore year. For more information about off-campus projects, see the "Projects" section of the undergraduate catalog, or contact the Interdisciplinary and Global Studies Division (IGSD).

Finally, keep in mind that by the end of sophomore year, you should be sufficiently educated in ECE to attempt an internship in industry during the following summer, if you so desire. If you are interested, be sure to talk to your academic advisor and investigate the resources available at WPI's Career Development Center.
Junior Year

With all the freshman- and sophomore-level background finally completed, your third year of education in the ECE department offers you a chance for greater flexibility and control over your degree program. However, if you have yet to do so, your first priority is to complete ECE 2799. Also, once the design course is completed, you should finish the remaining courses in the advanced core as soon as possible.

After that, you will finally have a chance to branch out into the many other ECE courses we offer. When choosing major courses for the junior year, be sure to seek a balance between depth and breadth. On one hand, there is a wide selection of 3000-level courses from which to choose, extending the basic and advanced core into even more areas of ECE. These courses will allow you to explore more of the discipline, and gain even greater proficiency in any of the core areas you may have found interesting. On the other hand, if you are particularly interested in a single sub-discipline, you may be ready by the end of junior year to attempt a 4000-level course (depending of course on the specific class and its recommended background).

Despite the opportunities available to you in ECE, the most substantial component of your work junior year will most certainly be your Interactive Qualifying Project. If you are planning to complete your IQP off-campus, be sure to take additional care in planning your courses around the term that you will be away. Also, in the term before you leave, off-campus projects typically require 1/3 unit or more of preparatory work. You should take this extra burden into account as part of the workload for that term.

Yet another key undertaking of the junior year is your responsibility to find an MQP. If you are planning to do the project off-campus as a senior, you will need to follow an application procedure similar to that of off-campus IQPs. If you are planning to complete the project on-campus, then the efforts needed to find a project may vary greatly. You may need to apply to and interview for certain industry-sponsored MQP programs, or you might contact a professor in the department who has advertised a specific project he or she wants to advise. Consult with your academic advisor about what types of projects interest you, and what approach is best to secure an MQP for the next year.

Finally, do not forget about your Humanities and Arts Requirement, your Social Science Requirement, the ES requirement, and your physical education classes.
Senior Year

Depending on how well you have done in developing your degree program in the previous three years, planning for senior year can be a breeze—or a disaster. However, even if you are new to the idea of taking academic planning seriously, there is still plenty you can do to ensure that you will be walking across the stage on graduation day.

By far, the most important part of your senior year is your MQP. The ways of scheduling your project are quite varied, depending on the type of project, location, students, and advisors. Off-campus MQPs last for about 1 term, and are offered at various locations. A typical on-campus MQP usually requires 1/3 unit of work in three consecutive terms—commonly A-term through C-term of the senior year. From time to time senior projects may run longer, extending into D-term. Any student wishing to graduate on time, however, must remember two things: (1) all MQP students must be ready to give their final presentations on the annual Project Presentation Day in April, and (2) the final MQP report, with the proper accompanying paperwork, must be submitted by the registrar's specified deadline (prior to the final day of classes).

If your MQP is on the right track, the next step is to choose your remaining ECE courses, which can be accomplished in many different ways. Some students select courses that will directly help them in an upcoming job or graduate program. Other students choose courses to supplement the topics they are covering in their MQP. Some use the remaining courses to expand their breadth of knowledge into an area where they are weak, while others use senior year to take those one or two 4000-level courses in areas where they desire more expertise. All of these approaches are valid; the important thing is to think critically about your academic goals, and choose a path that best fits your current academic program, while allowing you to explore courses that appear interesting.

Besides your remaining major coursework, your plan for senior year must include everything else you need to complete to graduate. For example, some students choose to do their Humanities & Arts requirement senior year. Also, do not forget the many other degree requirements that we have repeatedly mentioned—you certainly do not want to graduate late because you forgot a 1/12-unit physical education class! Be sure to have your academic advisor check your course plan at the beginning of senior year, to verify that you have not overlooked anything.
Transfer Students

Since the ECE department's introductory curriculum is different from the traditional program offered at many other schools, transfer students must be sure to confer with their advisor to plan their WPI program. Transfer students with no previous ECE courses should begin the program in the same way as first-year students. Students with some transfer credit may be able to omit one or more of the introductory courses. Those with one or more courses in circuit theory and substantial laboratory experience should consider omitting ECE 2010, and possibly one or more of the other basic core courses, but this should only be done after consultation with an academic advisor.
Non ECE Majors

Students who wish to develop a background in electrical and computer engineering are advised to consult with a faculty member in the ECE Department. A basic foundation in electric circuits and electronics may be obtained by taking ECE 2010, ECE 2019, ECE 2201, and ECE 2311. A basic foundation in the elements of computer engineering may be obtained by taking ECE 2010, ECE 2029, ECE 2049, and ECE 3803 and/or ECE 3810. An overview of basic electric circuits can be obtained by taking ECE 2010.

Electrical and computer engineering may be coupled with other areas of study to define a unique interdisciplinary program. Students contemplating such an innovative program should contact the Interdisciplinary and Global Studies Division for guidance and approval, especially with regard to the selection of a suitable MQP and arrangements for program-specific distribution requirements.
Graduation and Beyond

As your senior year progresses, it is essential that you plan for the "next step"—life after graduation.

A common direction for students to choose upon graduation is full-time employment. The job-seeking process is not always easy, requiring mastery of many important life skills, such as writing a resume or participating in a job interview. Fortunately, there are many resources available to aid you in this process, including the Career Development Center, your academic advisor, other professors, and your peers. One of the best places to network with potential employers is at any of the regularly scheduled "career fairs", when companies send representatives to WPI to search for qualified applicants. Also, do not forget to utilize the internet as a tool for publishing resumes and investigating potential employers. Since a thorough and comprehensive job search can last several months, be sure to start early.

Another option is to continue with a program of academic study—typically a graduate degree. If you wish to begin study in the fall semester, realize that most graduate schools set their application deadlines in December or January, and the deadlines for many fellowship competitions may occur even earlier. In any case, if you are interested in beginning a graduate program directly after graduation, you should be investigating potential schools, the programs they offer, and any fellowships or scholarships that may be available by the end of your junior year and during the following summer. Once again, the Internet can provide invaluable assistance during this effort. Note that many graduate school and fellowship applications require you to take certain standardized tests, such as the Graduate Record Examinations (GRE's). Be sure to investigate thoroughly dates of preparation courses, test dates, and the delay time for receiving test results. You must allow time to prepare for and take all the necessary tests, and still receive the results in time to use with your graduate applications. Finally, do not forget that a degree in ECE is useful for far more than a future in engineering. The degrees we offer are excellent preparation for a wide array of graduate studies, including education, business, or law.

When choosing one of these routes, keep in mind that here in the ECE department, we expect from you a commitment to lifelong learning. In other words, even if you choose not to continue immediately with your formal studies, it does not mean the end of your education! First of all, there is always the chance to learn within a job in industry, through projects, training programs, and other learning opportunities. Furthermore, many students decide to return to graduate school after a few years of working, often finding that such "real-world" experience is a great advantage upon returning to academia. Regardless of the path you choose after leaving the ECE department, always remember that your WPI degree (while extremely valuable) is certainly not the end of your education—it is only a foundation for years of learning yet to come.