ELECTRICAL ENGINEERING: RESEARCH, M.S.

This is a named option in the Electrical Engineering M.S. (http://guide.wisc.edu/graduate/electrical-computer-engineering/electrical-engineering-ms/#text)

The M.S.–EE Research named option in ECE emphasizes the enhancement of professional knowledge and research techniques within electrical and computer engineering. After completing the program, students will earn a diploma stating “Master of Science in Electrical Engineering,” and, effective fall 2020, the transcript will include the indication “Named Option: Research.”

The Electrical Engineering Research Master’s program is intended for students who seek training in research and advanced concept development, and who want to pursue an in-depth research project with a faculty member. Students desiring the highest level of research training should apply to the Ph.D. program; often a Research M.S. degree is awarded along the way to a Ph.D. degree.

A distinguishing feature of the Research program, in comparison to ECE’s other master’s degree programs, is the preparation of a thesis or a project report based on a research problem. Overall, the Research program requires 30 credit hours, of which at minimum three credits must be research (ECE 790 Master’s Research or Thesis). The Research program typically takes 24 months to complete.

When applying for the ECE Research program, students are required to choose a specific area of interest from one of the four sub-disciplines of research in the department, although the decision is not binding: applied physics, computing, information systems, and power.

For more information on this specific degree plan, please visit the ECE website (https://www.engr.wisc.edu/department/electrical-computer-engineering/academics/master-of-science-electrical-engineering).

ADMISSIONS

Please consult the table below for key information about this degree program’s admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program’s website. Graduate admissions is a two-step process between academic programs and the Graduate School. Applicants must meet the minimum requirements (https://grad.wisc.edu/apply/requirements) of the Graduate School as well as the program(s).

Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/apply).

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Deadline</td>
<td>December 15</td>
</tr>
<tr>
<td>Spring Deadline</td>
<td>The program does not admit in the spring.</td>
</tr>
<tr>
<td>Summer Deadline</td>
<td>This program does not admit in the summer.</td>
</tr>
<tr>
<td>GRE (Graduate Record Examinations)</td>
<td>Required*</td>
</tr>
</tbody>
</table>

Please consult the table below for key information about this degree program’s admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program’s website. Graduate admissions is a two-step process between academic programs and the Graduate School. Applicants must meet the minimum requirements (https://grad.wisc.edu/apply/requirements) of the Graduate School as well as the program(s).

Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/apply).

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further
funding information (https://grad.wisc.edu/funding) is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

**PROGRAM RESOURCES**

Students in the ECE research-based M.S. degree plan are eligible for financial support from the program.

**RESEARCH ASSISTANTSHIPS**

Students should contact professors in their area of interest. Professors decide whom they will appoint on their research grants.

**TEACHING ASSISTANTSHIPS AND GRADER POSITIONS**

Current graduate students may apply for teaching assistantships or hourly grader positions via the ECE TA/Grader Portal (https://apps.aims.wisc.edu/tagrader/default.aspx). Students currently holding a research assistant or fellowship position that are interested in teaching assistant positions should discuss options with their research advisor before applying.

Non-native English speakers are required to pass the SPEAK Test (http://wwwenglish.wisc.edu/esl/speak.htm) through the English as a Second Language Program on campus. Students wishing to take the SPEAK Test should contact the ECE TA Coordinator via e-mail to register for the exam.

**PROJECT ASSISTANTSHIPS**

There are project assistant opportunities on campus. Announcements of openings are posted on TA/PA bulletin boards in Engineering Hall and on the UW Job Center webpage (http://www.jobcenter.wisc.edu).

**FELLOWSHIPS**

Information concerning fellowships is sent to graduate students through email from the department, faculty, and/or the Graduate School.

**REQUIREMENTS**

**MINIMUM GRADUATE SCHOOL REQUIREMENTS**

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

**NAMED OPTION REQUIREMENTS**

**MODE OF INSTRUCTION**

<table>
<thead>
<tr>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Mode of Instruction Definitions**

- **Evening/Weekend:** These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.
- **Online:** These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules.

**CURRICULAR REQUIREMENTS**

**Requirements Detail**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Credit Requirement</td>
<td>30 credits</td>
</tr>
<tr>
<td>Minimum Residence Credit Requirement</td>
<td>16 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>At least 50% of credits applied toward the graduate degree credit requirement must be completed in graduate-level coursework.</td>
</tr>
<tr>
<td>Overall Graduate GPA Requirement</td>
<td>3.00 GPA required.</td>
</tr>
<tr>
<td>Other Grade Requirements</td>
<td>The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.</td>
</tr>
<tr>
<td>Assessments and Examinations</td>
<td>Students must complete either a thesis or project. Details about these two paths can be found below.</td>
</tr>
<tr>
<td>Language Requirements Speakers</td>
<td>See &quot;English Competency for Non-Native English Requirements Speakers&quot;, below.</td>
</tr>
</tbody>
</table>

**REQUIRED COURSES**

**Degree Credit Requirement:**

UW-Madison Graduate School policy states that the M.S. degree requires at least 30 credits of courses (300 level or above, no audits or pass-fail) completed as a graduate student at UW-Madison: https://grad.wisc.edu/documents/minimum-graduate-degree-credit-requirement/.

The E C E department requires 30 credits for an M.S. degree and does not count E C E 300-level courses toward M.S. or Ph.D. requirements.

**Research Option MS Degree Plans**

There are two distinct plans of study, from which students must choose in order to fulfill the requirements for the research option E C E M.S. degree: Thesis and Project.

**Thesis Plan**

To fulfill the requirements of the Thesis Plan, the student must earn 30 graduate credits, attained with acceptable grades as defined on the
Policies tab. Of these 30 credits, at least 15 must be in ECE Courses 400-level or higher, and at least 15 must be in courses numbered 700 or higher. Only graduate courses, namely those courses listed or approved for listing in the Graduate School Bulletin are applicable for graduate credit, with the exceptions that 300-level ECE courses and ECE 702 Graduate Cooperative Education Program are not acceptable. ECE 890 Pre-Dissertation's Research and ECE 990 Research or Thesis are not applicable to the M.S. degree.

Of the 30 credits, a minimum of 3 and a maximum of 9 credits must be in ECE 790 Master's Research or Thesis. These ECE 790 credits are applicable toward both the 15 ECE credit requirement and the 700-level requirement. The combined number of credits in ECE 790, ECE 699 Advanced Independent Study, and ECE 999 Advanced Independent Study applied toward the degree may not exceed 9.

Each student who elects the Thesis Plan is required to perform research in consultation with a master's thesis committee. Master's thesis committees must have at least 3 members, 2 of whom must be graduate faculty or former graduate faculty up to one year after resignation or retirement. At the conclusion of the research program, a thesis must be prepared. The thesis must: 1) conform to Graduate School and library formats; 2) be approved by the master's thesis committee; 3) be filed with the Memorial Library where it is cataloged and stacked for future reference (if required by the master's thesis committee); and 4) an electronic copy must be sent to the ECE Graduate Student Services Coordinator, who will deposit it into Minds@UW, Department of Electrical and Computer Engineering Thesis Collection. The Minds@UW system will provide a permanent URL, safe long-term archiving and is indexed by Google, Google Scholar and other specialty academic search engines.

At the conclusion of the thesis, all grades of P (Progress) and I (Incomplete) in ECE 790 Master's Research or Thesis are changed to either S (Satisfactory) or U (Unsatisfactory) by the advisor. In the final semester the student is required to check in at the ECE Graduate Student Services Office to apply for a degree warrant by the announced deadline.

Project Plan

The Project Plan consists of the same credit and course requirements as the Thesis Plan. Under this plan, the student must perform a research project in consultation with a faculty advisor. At the conclusion of the project, a report is prepared. The research project is generally more limited in scope than a thesis and is typically not awarded as many credits. The report need not conform to Graduate School and library formats, but it must be typewritten. The student's advisor must approve the report. No library or Minds@UW copy is required, but may be requested by the faculty. In the final semester, the student is required to check in at the ECE Graduate Student Services Office to apply for a degree warrant by the announced deadline.

ECE 610 Seminar Requirement

All on-campus ECE graduate students must register for ECE 610 Seminar in Electrical and Computer Engineering during their first Fall semester of graduate studies. MS-degree seeking students must take 1 credit of ECE 610 in the Fall semester of which they are entering the program. Students with a course conflict with ECE 610 can defer taking the seminar by one year provided their faculty advisor agrees.

The purpose of ECE 610 is to expose students in their first semester of graduate school to various areas within ECE and to areas outside of ECE to which ECE has or could have connections, e.g., biotechnology, physics, mathematics, business, software. Electrical and Computer Engineering is very interdisciplinary in nature, and so it is important that students be aware of state-of-the-art research in areas other than their own.

English Competency for Non-Native English Speakers

Effective written and oral communication is vital for a successful academic career. International students whose native language is not English will be required to take the English as Second Language Assessment Test (ESLAT), offered by the English as a Second Language (ESL) Program.

The ESLAT must be taken as soon as the student arrives at the university. The test is offered in the Fall and Spring during the week before the beginning of instruction. For more information, see the ESL home page at https://esl.wisc.edu/international-students/placement/.

Based on ESLAT performance, specific ESL courses may be recommended. These courses must be taken and passed within 12 months of the ESLAT. Otherwise, the student will not be permitted to register during the third semester after entering the graduate program. Any ESL courses numbered 300 or above can be counted towards graduate degree requirements but not toward ECE course requirements. Completion of ESLAT and recommended courses is also a requirement for graduation of an international student whose native language is not English.

Students are exempt from taking the ESLAT if:

- English is the exclusive language of instruction at the undergraduate institution;
- they have earned a degree from a regionally accredited U.S. college or university not more than 5 years prior to the anticipated semester of enrollment; or
- they have completed at least two full-time semesters of graded course work, exclusive of ESL courses, in a U.S. college or university, or at an institution outside the U.S. where English is the exclusive language of instruction, not more than 5 years prior to the anticipated semester of enrollment.

Policies

Graduate School Policies

The Graduate School's Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

Named Option-Specific Policies

Graduate Program Handbook

The Graduate Program Handbook (https://www.engr.wisc.edu/department/electrical-computer-engineering/academics/ece-graduate-student-handbooks) is the repository for all of the program's policies and requirements.
PRIOR COURSEWORK

Graduate Work from Other Institutions
With program approval, students are allowed to count graduate coursework from other institutions toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. No credits from other institutions can be counted toward the minimum graduate residence credit requirement. Coursework earned five or more years prior to admission to a master's degree is not allowed to satisfy requirements.

UW–Madison Undergraduate
With program approval, up to 7 credits numbered 400 or above can be counted toward the minimum graduate degree credit requirement. Up to 7 credits of ECE courses numbered 700 or above can be counted toward the minimum graduate coursework (50%) requirement. No credits can be counted toward the minimum graduate residence credit requirement.

UW–Madison University Special
With program approval, students are allowed to count up to 9 credits of coursework numbered 400 or above taken as a UW–Madison University Special student toward the minimum graduate residence credit requirement, and the minimum graduate degree credit requirement. Courses numbered 700 or above taken as a UW–Madison Special student toward the minimum graduate coursework (50%) requirement. Coursework earned five or more years prior to admission is not allowed to satisfy requirements.

PROBATION

Students must be in good academic standing with the Graduate School, their program, and their advisor. The Graduate School regularly reviews the record of any student who received grades of BC, D, F, or I in graduate-level courses (300 or above), or grades of U in research and thesis. This review could result in academic probation with a hold on future enrollment, and the student may be suspended from graduate studies.

The Graduate School may also put students on probation for incompletes not cleared within one term. All incomplete grades must be resolved before a degree is granted.

The status of a student can be one of three options:

1. Good standing (progressing according to standards; any funding guarantee remains in place).
2. Probation (not progressing according to standards but permitted to enroll; loss of funding guarantee; specific plan with dates and deadlines in place in regard to removal of probationary status).
3. Unsatisfactory progress (not progressing according to standards; not permitted to enroll, dismissal, leave of absence or change of advisor or program).

A semester GPA below 3.0 will result in the student being placed on academic probation. If a semester GPA of 3.0 is not attained during the subsequent semester of full-time enrollment, the student may be dismissed from the program or allowed to continue for 1 additional semester based on advisor appeal to the Graduate School.

ADVISOR / COMMITTEE
New students must declare an advisor by the end of the second week of classes in the first semester.

CREDITS PER TERM ALLOWED
15 credits

TIME CONSTRAINTS
Master's degree students who have been absent for five or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.

OTHER
Funding is not guaranteed and applicants should be prepared to fund their degree. The department awards a small number of research assistantships, teaching assistantships, project assistantships, and fellowships each year. All applications are automatically considered for department funding. Students in the online Power Engineering program are not permitted to accept assistantships.

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES
Take advantage of the Graduate School's professional development resources [https://grad.wisc.edu/pd] to build skills, thrive academically, and launch your career.

PEOPLE

PROFESSORS, ASSISTANT PROFESSORS, AND ASSOCIATE PROFESSORS
Anderson, David T. [https://directory.engr.wisc.edu/ece/Faculty/Anderson_David]
Behdad, Nader [https://directory.engr.wisc.edu/ece/Faculty/Behdad_Nader]
Booske, John H. [https://directory.engr.wisc.edu/ece/Faculty/Booske_John]
Boston, Nigel [https://directory.engr.wisc.edu/ece/Faculty/Boston_Nigel]
Botez, Dan [https://directory.engr.wisc.edu/ece/Faculty/Botez_Dan]
Davoodi, Azadeh [https://directory.engr.wisc.edu/ece/Faculty/Davoodi_Azadeh]
Farrell, Robert M. [https://directory.engr.wisc.edu/ece/Faculty/Farrell_Robert]
Fawaz, Kassem [https://directory.engr.wisc.edu/ece/Faculty/Fawaz_Kassem]
Gubner, John [https://directory.engr.wisc.edu/ece/Faculty/Gubner_John]
Hagness, Susan [https://directory.engr.wisc.edu/ece/Faculty/Hagness_Susan] (department chair)
Hitchon, William N. [https://directory.engr.wisc.edu/ece/Faculty/Hitchon_William]
Hu, Yu Hen [https://directory.engr.wisc.edu/ece/Faculty/Hu_Yu-hen]
Jahns, Thomas M. [https://directory.engr.wisc.edu/ece/Faculty/Jahns_Thomas]
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Arpaci-Dusseau, Remzi (https://directory.engr.wisc.edu/ece/Faculty/Arpaci-dusseau_Remzi) (Computer Sciences)
Banerjee, Suman (https://directory.engr.wisc.edu/ece/Faculty/Banerjee_Suman) (Computer Sciences)
Brace, Chris (Biomedical Engineering)
Brar, Victor (Physics)
Gupta, Mohit (Computer Sciences)
Hernando, Diego (Radiology)
Hill, Mark (https://directory.engr.wisc.edu/ece/Faculty/Hill_Mark) (Computer Sciences)
Miller, Barton (Computer Sciences)
Negrut, Dan (https://directory.engr.wisc.edu/me/Faculty/Negrut_Dan) (Mechanical Engineering)
Raskutti, Garvesh (Statistics)
Rohe, Karl (https://directory.engr.wisc.edu/ece/Faculty/Rohe_Karl) (Statistics)
Sanders, Scott T. (https://directory.engr.wisc.edu/me/Faculty/SandersScott) (Mechanical Engineering)
Sankaralingam, Karthikeyan (https://directory.engr.wisc.edu/ece/Faculty/Sankaralingam_Karthikeyan) (Computer Sciences)
Sarlioglu, Bulent (https://directory.engr.wisc.edu/epd/Faculty/Sarlioglu_Bulent) (Engineering Professional Development)
Sinclair, Matt (https://directory.engr.wisc.edu/ece/Faculty/SinclairMatt) (Computer Sciences)
Varghese, Tomy (https://directory.engr.wisc.edu/bme/Faculty/Varghese_Tomy) (Medical Physics)

STAFF

For a listing of current staff members in the Department of Electrical and Computer Engineering, please visit the ECE website (https://directory.engr.wisc.edu/ece/staff).