

ELECTRICAL AND COMPUTER ENGINEERING: POWER ENGINEERING, M.S.

This is a named option in the Electrical and Computer Engineering M.S. (<http://guide.wisc.edu/graduate/electrical-computer-engineering/electrical-computer-engineering-ms/>) that is offered in an online format.

The Master of Science Electrical and Computer Engineering: Power Engineering program will prepare you for leading-edge positions in industry in the areas of electric power, power electronics, motor drives, and electric machines.

UW–Madison’s Power Engineering master’s degree provides graduate students applicable and theoretical knowledge in power electronics, including alternative energy, through research and study of technological and conceptual innovations in electrical and computer engineering.

The education you receive at UW–Madison is directly applicable to a career in industry and is suitable for a new or recent graduate, as well as experienced professionals who seek the necessary (re)training to change or advance their careers.

UW–Madison’s Department of Electrical and Computer Engineering is recognized for excellence in research, instruction, and service to the profession. It ranks among the top electrical and computer engineering departments in national surveys, consistently producing talented graduates whose skills are highly respected throughout the nation and around the world.

The Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC) (<https://wempec.wisc.edu/>) is a UW–Madison technology focus center sponsored by companies holding an interest in electric machines and power electronics. With a mission to provide education, research and service, WEMPEC is a model program demonstrating strong interaction between university and industry.

UW–Madison’s online engineering graduate programs are world-class degree and consistently ranked in the Top 10 online engineering master’s programs by *U.S. News & World Report*.

Admittance into the Master of Science: Electrical and Computer Engineering program requires completion of the Capstone Certificate in Power Conversion and Control. (<http://guide.wisc.edu/nondegree/capstone/power-conversion-control-capstone-certificate/>)

M.S. Power Engineering students cannot be simultaneously enrolled in another graduate program at UW–Madison while completing this program.

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/>).

Requirements	Detail
Fall Deadline	June 1
Spring Deadline	November 1
Summer Deadline	The program does not admit in the summer.
GRE (Graduate Record Examinations)	Not required.
English Proficiency Test	Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (https://grad.wisc.edu/apply/requirements/#english-proficiency).
Other Test(s) (e.g., GMAT, MCAT)	n/a
Letters of Recommendation Required	3

ADMISSIONS DEADLINES

Applications are accepted for admission during the fall and spring terms.

Fall deadline is June 1.

Spring deadline is November 1.

ADMISSIONS PROCESS

Application steps are listed on the program’s admissions webpage (<https://interpro.wisc.edu/online-degree/electrical-engineering-power-engineering/#/apply>).

ADMISSIONS REQUIREMENTS

- Completion of the Capstone Certificate in Power Conversion and Control (<http://guide.wisc.edu/nondegree/capstone/power-conversion-control-capstone-certificate/>) with a GPA of 3.3
- A B.S. degree from a program accredited by ABET or the equivalent.* An electrical engineering major is preferred.
- A minimum undergraduate grade point average (GPA) of 3.00 on the equivalent of the last 60 semester hours (approximately two years of work) or a master’s degree with a minimum cumulative GPA of 3.00. Applicants from an international institution must have a strong academic performance comparable to a 3.00 for an undergraduate or master’s degree. All GPAs are based on a 4.00 scale. We use your institution’s grading scale; do not convert your grades to a 4.00 scale.
- Applicants whose native language is not English must provide scores from the Test of English as a Foreign Language (TOEFL). The minimum acceptable score on the TOEFL is 580 on the written version, 243 on the computer version, or 92 on the Internet version.
- International applicants must have a degree comparable to an approved U.S. bachelor’s degree.

We do **not** require applicants to submit scores from the Graduate Record Examination (GRE).

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 restrictions related to funding.

PROGRAM INFORMATION

Students enrolled in this program are not eligible to receive tuition remission from graduate assistantship appointments at this institution.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

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

NAMED OPTION REQUIREMENTS

MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
No	No	Yes	No	No

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students are able to complete a program with minimal disruptions to careers and other commitments.

Evening/Weekend: Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

Face-to-Face: Courses typically meet during weekdays on the UW–Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

Requirements Detail

Minimum Credit Requirement 30 credits

Minimum Residence Credit Requirement 16 credits

Minimum Graduate Coursework Requirement 15 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) policy (<https://policy.wisc.edu/library/UW-1244>).

Overall Graduate GPA Requirement 3.00 GPA required.

Graduate GPA Requirement This program follows the Graduate School's GPA Requirement policy (<https://policy.wisc.edu/library/UW-1203> (<https://policy.wisc.edu/library/UW-1203/>)).

Other Grade Requirements In order for courses to count toward your master's degree, students must satisfy the following grade and GPA requirements:

E C E Courses

-Grades of B or better are always acceptable.

-BC grades are acceptable if the cumulative GPA for graduate E C E classroom courses is equal to or greater than 3.0.

-Grades of C or lower are not acceptable.

Non-E C E Courses

-Grades of B or better are always acceptable.

-BC and C grades are acceptable if approved by the E C E Graduate Committee by way of an appeal.

-Any grade lower than a C is not acceptable.

Research and Independent Study Credits

-S grades are acceptable, while U grades are not.

-If it is letter-graded, only grades of B or better are acceptable.

Assessments and Examinations A thesis, a project, or a specified course sequence must be completed, depending upon which degree plan the student follows.

Language Requirements n/a

REQUIRED COURSES

Of the 30 credits required, a minimum of 21 credits must be E C E courses 400-level and above. Of those 21 credits, at least 15 must come from the Power Engineering Course Options below, including at least 3 credits from 500-level courses, and 6 credits from 700+ level courses.

Course Path:

A maximum of 3 credits in E C E 699 Advanced Independent Study and 3 credits in E C E 999 Advanced Independent Study are allowed. E C E 790 Master's Research or similar research courses may not be used to satisfy the 30-credit requirement.

Thesis or Project Path:

Students must identify a faculty research advisor and complete a thesis or project paper under their direction. A minimum of 3 credits must be in E C E 790 Master's Research, and no more than 9 credits from any combination of E C E 699 Advanced Independent Study E C E 790 Master's Research or E C E 999 Advanced Independent Study may apply. A minimum of 15 credits of 700+ level courses are required.

Power Engineering Course Options

Code	Title	Credits
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Choose at least 15 credits from the following courses, including at least 3 credits from 500-level courses, and 6 credits from 700+ level courses.

E C E 411	Introduction to Electric Drive Systems (completed during Capstone) ¹	3
E C E 412	Power Electronic Circuits (completed during Capstone) ¹	3
E C E 427	Electric Power Systems	3
M E 446	Automatic Controls (completed during Capstone) ¹	3
M E 447	Computer Control of Machines and Processes	3
E C E 504	Electric Machine & Drive System Laboratory	3
E C E 511	Theory and Control of Synchronous Machines	3
E C E 512	Power Electronics Laboratory	3
E C E/COMP SCI/ M E 532	Matrix Methods in Machine Learning	3
E C E 711	Dynamics and Control of AC Drives	3
E C E 712	Solid State Power Conversion	3
E C E 713	Electromagnetic Design of AC Machines	3
E C E 714	Utility Application of Power Electronics	3
E C E/M E 739	Advanced Robotics	3
M E 746	Dynamics of Controlled Systems	3
M E 747	Advanced Computer Control of Machines and Processes	3
E C E/COMP SCI/ E M A/E P/M E 759	High Performance Computing for Applications in Engineering	3
E C E 901	Special Topics in Electrical and Computer Engineering	1-3

Research and Independent Study Courses

Course Path students may complete a maximum of 3 credits each of E C E 699 and E C E 999. They may not take E C E 790.

Thesis/Project Path students must take a minimum of 3 credits of E C E 790 and no more than 9 credits from any combination of E C E 699, E C E 790, or E C E 999.

E C E 699	Advanced Independent Study	1-6
E C E 790	Master's Research	3-9
E C E 999	Advanced Independent Study	1-6

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These courses are a required part of the master's program for students who completed the Capstone Certificate in Power Conversion and Control (<https://guide.wisc.edu/nondegree/capstone/power-conversion-control-capstone-certificate/>).

Students in this program may not take courses outside the prescribed curriculum without faculty advisor and program director approval. Students in this program cannot enroll concurrently in other undergraduate, graduate or certificate programs.

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

PRIOR COURSEWORK

Graduate Work from Other Institutions

This program follows the Graduate School's policy for Satisfying Requirements with Prior Graduate Coursework from Other Institutions. (<https://policy.wisc.edu/library/UW-1216/>)

UW–Madison Undergraduate¹

With program approval, up to 7 credits from UW–Madison numbered 400 or above can be counted toward the minimum graduate degree credit requirement. Up to 7 credits of E C E 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.

With program approval, students may count up to 7 credits of undergraduate coursework from a bachelor of science degree in Electrical Engineering, Computer Engineering, Electrical and Computer Engineering, Electrical Engineering and Computer Science, or Computer Science from an ABET-accredited program at other institutions (not UW–Madison) toward fulfillment of minimum degree requirements.

Courses numbered 300 or above may be counted towards the minimum graduate degree credit requirement and courses numbered 700 or above may be counted towards 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.

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The department also accepts undergraduate credit from non-UW ABET-accredited institutions. See policy language above for details.

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

This program follows the Graduate School's Probation policy. (<https://policy.wisc.edu/library/UW-1217/>)

ADVISOR / COMMITTEE

An academic advisor will be assigned to newly-admitted students. Students who want to pursue research must secure a research advisor who matches their research area and agrees to supervise their research. A research advisor is not guaranteed.

CREDITS PER TERM ALLOWED

15 credits (most students take 3 credits per term)

TIME LIMITS

This program follows the Graduate School's Time Limits policy. (<https://policy.wisc.edu/library/UW-1221/>)

GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (<https://doso.students.wisc.edu/bias-or-hate-reporting/>)
- Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/#grievance-procedure>)
- Hostile and Intimidating Behavior Policies and Procedures (<https://hr.wisc.edu/hib/>)
 - Office of the Provost for Faculty and Staff Affairs (<https://facstaff.provost.wisc.edu/>)
- Dean of Students Office (<https://doso.students.wisc.edu/>) (for all students to seek grievance assistance and support)
- Employee Assistance (<http://www.eao.wisc.edu/>) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (<https://employee disabilities.wisc.edu/>) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (<https://grad.wisc.edu/>) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (<https://compliance.wisc.edu/>) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office of Student Conduct and Community Standards (<https://conduct.students.wisc.edu/>) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (<http://www.ombuds.wisc.edu/>) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (<https://compliance.wisc.edu/titleix/>) (for concerns about discrimination)

ECE Grievance Procedures

The ECE Department, College of Engineering, and University of Wisconsin offer multiple avenues to resolve unfair or inappropriate treatment by faculty, staff, or another student. This includes hostile and intimidating research group climate, authorship disputes, unreasonable expectations, and disrespectful behavior. The manner in which the grievance is handled depends on the nature of the issue and specific concerns of the aggrieved student. Graduate Assistants in TA, PA and/or RA appointments may utilize the Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/>) (GAPP) grievance process to resolve employment-related issues. Examples of matters appropriate for the GAPP grievance process include allegations of

excessive work hours, violations of sick days or vacation policies, or disputes regarding the assignment of duties.

In some cases the best approach is for the aggrieved student to discuss their concern directly with the person responsible for the objectionable action.

If the student is uncomfortable making direct contact with the other individual or desires a confidential consultation about their concern, they may contact the ECE Associate Chair for Graduate Studies, the ECE Grievance Advisor, or the College of Engineering Assistant Dean for Graduate Affairs. These individuals work to resolve the concern while being sensitive to student confidentiality.

Change of advisor

Students who believe they are in a research environment that fails to meet ECE and College of Engineering standards for climate and culture should contact the ECE Associate Chair for Graduate Studies, the ECE Grievance Advisor, or the College of Engineering Assistant Dean for Graduate Affairs for additional consultation. They will work with the student to explore alternate advising arrangements and ensure continuity of financial support should the student need to leave the research group. Note that immigration status is NOT tied to a specific research advisor.

Formal Written Complaint Process

Issues that are not resolved to the student's satisfaction may be pursued at the student's discretion by submitting a written complaint to the ECE Grievance Advisor. The steps described below are based on the Definition and Procedure section of the Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/>) (GAPP) Grievance Procedure.

Step One: The grievant must file a written statement with the ECE Grievance Advisor specifying the grievant's name, a clear and concise statement of the grievance and the issue(s) involved, the date(s) the incident or violation took place and the specific departmental, college, or university policies involved, and the relief sought. The grievance shall be signed and dated by the grievant(s) and representative (if any).

Within twenty (20) days of receipt of the written grievance, the ECE Grievance Advisor will meet with the grievant and their representative (if chosen) to hear the grievance and will return a written answer to the grievant and their representative (if chosen) no later than ten (10) days after this meeting. This answer will include a copy of the grievance procedure appeal process timeline, a list of resources and relevant contact information for future steps.

Step Two: If the decision in Step One is not accepted by the grievant, the grievant shall have 10 days from receipt of the answer in Step One to file an appeal with the College of Engineering Assistant Dean for Graduate Affairs. The Assistant Dean for Graduate Affairs will meet with the grievant and their representative (if chosen) within twenty (20) days from receipt of the appeal of Step One and attempt to resolve the grievance.

The Assistant Dean for Graduate Affairs will provide the grievant and their representative (if chosen) with a written response to the grievance no later than ten (10) days after this meeting.

Step Three: If the decision in Step Two is not accepted by the grievant, the grievant shall have 10 days from the receipt of the answer in Step Two to file an appeal with the Graduate School as described in Grievances and Appeals (<https://grad.wisc.edu/documents/grievances-and-appeals/>).

OTHER

Students are strongly discouraged to pursue positions as Project Assistants, Teaching Assistants or Research Assistants during their time in this program. Students in this program will not receive the tuition remission that is typically part of the compensation package for a graduate assistantship.

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.

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING RESOURCES

UW–Madison, the College of Engineering, and ECE have an abundance of professional development opportunities for students to take advantage of in order to better prepare themselves for internships and job positions during and following their education. First of all, the ECE Department strongly encourages students to utilize the Graduate School's professional development resources (<https://grad.wisc.edu/professional-development/>). Engineering Career Services (ECS) (<http://ecs.wisc.edu>) hosts multiple career fairs each semester where students can directly interact with prospective employers, schedule interviews, and find internships and full-time jobs. ECS also maintains job listings and hosts a variety of professional development workshops each semester. The ECE Department provides unique opportunities throughout the year for students to attend and participate in various lectures, workshops, and trainings. The ECE Graduate Student Association (GSA) organizes professional development opportunities for fellow students. Students are made aware of events and opportunities via email and other communications.

PEOPLE

PROFESSORS

Susan Hagness (Chair)
 David T. Anderson
 Nader Behdad
 John Booske
 Dan Botez
 Azadeh Davoodi
 John A. Gubner (Associate Chair for Operations)
 Yu Hen Hu
 Hongrui Jiang (Associate Chair for Graduate Studies)
 Irena Knezevic
 Bernard Lesieutre (Associate Chair for Undergraduate Studies)
 Mikko Lipasti
 Zhenqiang Ma
 Luke J. Mawst
 Robert Nowak
 Parameswaran Ramanathan
 Bulent Sarlioglu
 William A. Sethares
 Daniel van der Weide
 Barry Van Veen
 Giri Venkataramanan

Amy E. Wendt

ASSOCIATE PROFESSORS

Steven Fredette
 Mikhail Kats
 Daniel Ludois
 Paul H. Milenkovic
 Umit Ogras
 Dimitris Papailiopoulos
 Andreas Velten
 Zongfu Yu

ASSISTANT PROFESSORS

Joseph Andrews
 Kassem Fawaz
 Dominic Gross
 Chirag Gupta
 Robert Jacobberger
 Younghyun Kim
 Bhuvana Krishnaswamy
 Kangwook Lee
 Chu Ma
 Pedro Morgado
 Shubhra Pasayat
 Line Roald
 Joshua San Miguel
 Eric Severson
 Eric Tervo
 Ramya Korlakai Vinayak
 Ying Wang

TEACHING FACULTY

Mark C. Allie
 Eduardo Arvelo
 Setareh Behroozi
 Eric Hoffman
 Joe Krachey
 Srdjan Milicic

See also Electrical and Computer Engineering Faculty Directory (<https://directory.engr.wisc.edu/ece/faculty/>).