

# MASTER OF SCIENCE IN THE FIELD OF ELECTRICAL ENGINEERING (STEM, ON-CAMPUS)

Students pursuing this option gain a full on-campus and in-person experience inside and outside the classroom. As part of their program of study, students select an area-of-focus specialization, namely applied electromagnetics; communications and networks; electrical power and energy; MEMS, electronics, and photonics; signal and image processing, systems, and controls. This program provides the possibility of a research experience via a thesis option.

GW's location in Washington, DC, home to one of the nation's largest concentrations of high-technology enterprises, gives students and faculty access to new advances in technology through government agencies, private industry, and defense centers. International applicants may choose the on-campus program.

Visit the on-campus program website (<https://www.ece.seas.gwu.edu/master-science-electrical-engineering/>) for additional information.

## ADMISSIONS

Admission deadlines: Fall – January 15

Spring – September 1

Summer – March 1 (non-F1 visa seeking applicants)

**Standardized test scores:** The GRE General Test is optional for all applicants. For applicants who want to submit scores, they must be submitted officially from ETS using the institutional code 5246.

The Test of English as a Foreign Language (TOEFL), the Academic International English Language Testing System (IELTS), or the PTE Academic is required of all applicants except those who hold a bachelor's, master's, or doctoral degree from a college or university in the United States or from an institution located in a country in which English is the official language, provided English was the language of instruction. Minimum scores:

- Academic IELTS: an overall band score of 6.5 with no individual score below 6.0; or

- TOEFL: 550 on paper-based or 81 on Internet-based; or

- PTE Academic: 53; applicants requesting funding consideration must have 68.

**Recommendations:** Two (2) recommendations required. If possible, one recommendation should be from your advisor at the institution from which you earned your highest degree.

**Prior academic records:** Transcripts are required from all colleges and universities attended, whether or not credit was earned, the program was completed, or the credit appears as transfer credit on another transcript. Unofficial transcripts from all colleges and universities attended must be uploaded to your online application. Official transcripts are required only of applicants who are offered admission.

If academic records are in a language other than English, a copy in the original language and an English language translation must be uploaded. Transcript evaluations should not be uploaded. Applicants who have earned a degree from an Indian university are required to submit individual semester marksheets.

**Statement of purpose:** In an essay of 250 to 500 words, state your purpose in undertaking graduate study at The George Washington University; describe your academic objectives, research interests, and career plans; and discuss your related qualifications, including collegiate, professional, and community activities, and any other substantial accomplishments not already mentioned.

**Additional requirements:** Applicant must possess a B.S. in biomedical engineering, electrical engineering, computer engineering, or computer science with a grade point average of at least 3.0 (on a scale of 4.0) for the last 60 credits of undergraduate work. Students with a B.S. in another field may be admitted with a set of deficiency courses to be determined by the department. Applicants must choose an area of focus that most closely matches their interests and note this on the online application. All applicants must submit a resumé or CV.

**International applicants only:** International applicants are only allowed to choose the On-Campus program. Please review International Applicant Information carefully for details on required documents, earlier deadlines for applicants requiring an I-20 or DS-2019 from GW.

For additional information about the admissions process visit the SEAS Admissions Frequently Asked Questions (<https://graduate.engineering.gwu.edu/admissions-frequently-asked-questions/>) page.

Contact for questions:

[engineering@gwu.edu](mailto:engineering@gwu.edu)  
202-994-1802 (phone)  
202-994-1651 (fax)

Hours: 9:00 am to 5:00 pm, Monday through Friday

## REQUIREMENTS

The information on this page applies only to the on-campus version of this program. See requirements for the online program (p. ), below.

The following requirements must be fulfilled:

30 credits, all of which are completed in a single focus area. The program is offered in thesis and on-thesis options. For the thesis option, 6 of these credits are taken in ECE 6998 and ECE 6999.

Colloquium requirements

In addition to required coursework, students must attend five in-person, non-credit bearing colloquia as part of their program of study. At least two of the required five must be attended in the first two semesters. Each attended colloquium is verified by a faculty member in attendance. Upon the attendance of five colloquia, the student must submit to the department the colloquium attendance form signed by the faculty advisor prior to applying for graduation.

Focus areas

All coursework in one of the following focus areas must be completed:

Code	Title	Credits
Communications and networks focus area		
Required		
ECE 6015	Stochastic Processes in Engineering	
ECE 6035	Introduction to Computer Networks	
ECE 6510	Communication Theory	
At least two courses selected from the following:		
ECE 6500	Information Theory	
ECE 6505	Error Control Coding	
ECE 6520	Mobile and Wireless Communication Systems	
ECE 6525	Satellite Communication Systems	
ECE 6530	Electronic Warfare	
ECE 6550	Network Architectures and Protocols	
ECE 6560	Network Performance Analysis	
ECE 6565	Network Security	
ECE 6570	Telecommunications Security Protocols	
ECE 6575	Optical Communication Networks	
ECE 6580	Wireless Networks	
ECE 6715	Antennas	
ECE 6720	Remote Sensing	
ECE 6725	Electromagnetic Radiation and Scattering	

ECE 6730	Waves in Random Media
ECE 6750	Modern Radar Systems
ECE 6760	Propagation Modeling in Wireless Communications
For the thesis option only:	
ECE 6998	Thesis Research I
ECE 6999	Thesis Research II
Electives*	
Non-thesis option—15 credits in elective courses; thesis option—9 credits in elective courses. For either option, at least 3 credits must come from outside the area of focus list.	

Code	Title	Credits
Cyber-physical security focus area		
Required		
ECE 6134	Cloud Computing and Security	
ECE 6565	Network Security	
ECE 6669	Smart Power Grids	
At least four courses selected from the following:		
ECE 6005	Computer Architecture and Design	
ECE 6035	Introduction to Computer Networks	
ECE 6070	Electrical Power Systems	
ECE 6130	Big Data and Cloud Computing	
ECE 6160	Secure Computing Systems	
ECE 6570	Telecommunications Security Protocols	
ECE 6666	Power System Transmission, Control, and Security	
ECE 6691	Power Systems Reliability	
For the thesis option only:		
ECE 6998	Thesis Research I	
ECE 6999	Thesis Research II	
Electives*		
Non-thesis option – 9 credits in elective courses.		
Thesis option – 3 credits in elective courses.		

For either option, at least 3 credits must come from outside of the area of focus list.

Code	Title	Credits
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Electrical power and energy focus area

Required

ECE 6070	Electrical Power Systems	
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At least two courses selected from the following:

ECE 6010	Linear Systems Theory	
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ECE 6020	Applied Electromagnetics	
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ECE 6025	Signals and Transforms in Engineering	
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At least three courses selected from the following:

ECE 6660	Electric Power Generation	
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ECE 6610	Electrical Energy Conversion	
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ECE 6662	Power Electronics	
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ECE 6666	Power System Transmission, Control, and Security	
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ECE 6667	Nuclear Power Generation	
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ECE 6668	Power Distribution Grids	
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ECE 6669	Smart Power Grids	
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ECE 6670	Power System Protection	
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ECE 6690	Power Systems Economics	
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ECE 6691	Power Systems Reliability	
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ECE 6699	Energy and Sustainability	
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For the thesis option only:

ECE 6998	Thesis Research I	
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ECE 6999	Thesis Research II	
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Electives\*

Non-thesis option—12 credits in elective courses; thesis option—6 credits in elective courses. For either option, at least 3 credits must come from outside of the area of focus list.

Code	Title	Credits
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Machine learning and intelligent systems focus area

Required

ECE 6210	Machine Intelligence	
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ECE 6217	Neural Networks and Hardware Implementations	
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ECE 6882	Reinforcement Learning	
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At least four courses selected from the following:

ECE 6010	Linear Systems Theory	
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ECE 6015	Stochastic Processes in Engineering **	
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ECE 6035	Introduction to Computer Networks	
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ECE 6255	Sensors, Networks, and Applications	
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ECE 6510	Communication Theory	
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ECE 6580	Wireless Networks	
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ECE 6761	Light and Information	
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ECE 6800	Computational Techniques in Electrical Engineering **	
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ECE 6845	Image Synthesis	
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ECE 6850	Pattern Recognition and Machine Learning	
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ECE 6880	Adaptive Signal Processing	
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ECE 6885	Computer Vision	
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For the thesis option only:

ECE 6998	Thesis Research I	
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ECE 6999	Thesis Research II	
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Electives\*

Non-thesis option—9 credits in elective courses; thesis option—3 credits in elective courses. For either option, at least 3 credits must come from outside of the area of focus list.

Code	Title	Credits
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MEMS, electronics, and photonics focus area

Required

ECE 6030	Device Electronics	
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At least four courses selected from the following:

ECE 6020	Applied Electromagnetics	
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ECE 6210	Machine Intelligence	
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ECE 6213	Design of VLSI Circuits	
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ECE 6214	High-Level VLSI Design Methodology	
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ECE 6215	Microsystems Design, Simulation, and Fabrication for Sensor Applications
ECE 6216	RF/VLSI Circuit Design
ECE 6217	Neural Networks and Hardware Implementations
ECE 6218	Advanced Analog VLSI Circuit Design
ECE 6221	Introduction to Physical Electronics
ECE 6240	VLSI Design and Simulation
ECE 6245	Microfabrication and Nanofabrication Technology
ECE 6250	ASIC Design and Testing of VLSI Circuits
ECE 6255	Sensors, Networks, and Applications
ECE 6260	Introduction to Nanoelectronics
ECE 6710	Microwave Engineering
ECE 6715	Antennas
ECE 6735	Numerical Electromagnetics
ECE 6745	Analysis of Nonlinear and Multivalued Devices
ECE 6761	Light and Information
ECE 6765	Photonics and Fiber Optics
ECE 6770	Applied Magnetism
For the thesis option only:	
ECE 6998	Thesis Research I
ECE 6999	Thesis Research II
Electives*	
Non-thesis option—15 credits in elective courses; thesis option—9 credits in elective courses. For either option, at least 3 credits must come from outside of the area of focus list.	

Code	Title	Credits
Signal and image processing, systems, and controls focus area		
Required		
ECE 6015	Stochastic Processes in Engineering	
At least four courses selected from the following:		
ECE 6005	Computer Architecture and Design	
ECE 6010	Linear Systems Theory	

ECE 6025	Signals and Transforms in Engineering
ECE 6666	Power System Transmission, Control, and Security
ECE 6800	Computational Techniques in Electrical Engineering
ECE 6810	Speech and Audio Processing by Computer
ECE 6815	Multimedia Processing
ECE 6820	Real-Time Digital Signal Processing
ECE 6825	Computer Control Systems
ECE 6830	System Optimization
ECE 6835	Nonlinear Systems
ECE 6840	Digital Image Processing
ECE 6845	Image Synthesis
ECE 6850	Pattern Recognition and Machine Learning
ECE 6855	Computer Vision
ECE 6860	Compression Techniques for Data, Speech, and Video
ECE 6865	Statistical Signal Estimation
ECE 6875	Wavelets and Their Applications
ECE 6880	Adaptive Signal Processing
ECE 6885	Computer Vision
For the thesis option only:	
ECE 6998	Thesis Research I
ECE 6999	Thesis Research II
Electives*	
Non-thesis option—15 credits in elective courses; thesis option—9 credits in elective courses. For either option, at least 3 credits must come from outside of the area of focus list.	

\*Normally, no more than two courses taken outside of the Department of Electrical and Computer Engineering can be counted toward the requirements for the degree. Courses taken outside the department must have prior approval from the student's faculty advisor. In addition, no more than three 3000- or 4000-level ECE courses that have been approved for graduate credit may be counted toward the requirements for the degree.

\*\*Required for students who have not taken courses in linear algebra, probability, and random processes at the undergraduate level or higher.

### **Educational Planner**

In consultation with an academic advisor, each student must develop an Educational Planner through DegreeMAP that governs the student's plan of study. The Educational Planner should be established soon after matriculation and must be completed before the end of the student's first semester. The Educational Planner must be approved by the advisor.

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