

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

Students in the master of science program in electrical engineering may choose between two program options, each with a different educational focus and mode of delivery.

**On-campus option**—Students in this program option gain a full on-campus and in-person experience inside and outside the classroom. The program enables the opportunity to select a specialized focus area from the following: communications and networks; electrical power and energy; electronics, photonics and mems; machine learning and intelligent systems; and signal and image processing, systems, and controls. An optional thesis provides the possibility of a research experience. GW's location in Washington, DC, home to one of the nation's largest concentrations of high-tech 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.

**Online, cohort option**—The completely online program option provides a focused experience based on a cohort model.

- Visit the online program website (<https://online.engineering.gwu.edu/online-master-science-electrical-engineering/>) for additional information
- Download a free brochure ([https://online.engineering.gwu.edu/sites/g/files/zaxdzs5816/files/2024-03/ms.ee\\_.2024.pdf](https://online.engineering.gwu.edu/sites/g/files/zaxdzs5816/files/2024-03/ms.ee_.2024.pdf))
- Begin your application (<https://online.engineering.gwu.edu/apply/>)

This is a STEM designated program.

## ADMISSIONS

**Please note:** The admission requirements below are for the on-campus program. Admission requirements for the online, cohort option program are available here (<https://engineeringmasters.online.gwu.edu/online-programs/ms-in-electrical-engineering/>).

**Admission deadlines:** Fall – January 15  
Spring – September 1  
Summer – March 1 (non-F1 visa seeking applicants)

### Standardized test scores:

The Graduate Record Examination (GRE) is required of all applicants. (Institution 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 6.0 with no individual score below 5.0; applicants requesting funding consideration must have an overall band score of 7.0 with no individual score below 6.0; or
- TOEFL: 550 on paper-based or 80 on Internet-based; applicants requesting funding consideration must have 600 on paper-based; or 100 on Internet-based; or
- PTE Academic: 53; applicants requesting funding consideration must have 68.

**Recommendations required:** 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 (<http://www.ece.seas.gwu.edu/master-science-electrical-engineering/>) 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 (<http://graduate.admissions.gwu.edu/international-applicants/>) 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. 6), 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 requirement—In addition to required coursework, students must attend five in-person non-credit bearing colloquia as part of their program of study. Each colloquium attended is verified by a faculty member also in attendance. After attending five colloquia, the student must submit to the department prior to applying for graduation a colloquium attendance form signed by the faculty advisor.

### 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	
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 6520	Mobile and Wireless Communication Systems	
ECE 6570	Telecommunications Security Protocols	
ECE 6666	Power System Transmission, Control, and Security	
ECE 6691	Power Systems Reliability	
For the thesis option		
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.		
Electrical power and energy focus area		
Required		

ECE 6070	Electrical Power Systems
At least two courses selected from the following:	
ECE 6010	Linear Systems Theory
ECE 6020	Applied Electromagnetics
ECE 6025	Signals and Transforms in Engineering
At least three courses selected from the following:	
ECE 6660	Electric Power Generation
ECE 6610	Electrical Energy Conversion
ECE 6662	Power Electronics
ECE 6666	Power System Transmission, Control, and Security
ECE 6667	Nuclear Power Generation
ECE 6668	Power Distribution Grids
ECE 6669	Smart Power Grids
ECE 6670	Power System Protection
ECE 6690	Power Systems Economics
ECE 6691	Power Systems Reliability
ECE 6699	Energy and Sustainability
For the thesis option	
ECE 6998	Thesis Research I
ECE 6999	Thesis Research II
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
Machine learning and intelligent systems focus area		
Required		
ECE 6210	Machine Intelligence	
ECE 6217	Neural Networks and Hardware Implementations	
ECE 6850	Pattern Recognition and Machine Learning	
ECE 6882	Reinforcement Learning	
At least three courses selected from the following:		

ECE 6010	Linear Systems Theory
ECE 6015	Stochastic Processes in Engineering **
ECE 6035	Introduction to Computer Networks
ECE 6255	Sensors, Networks, and Applications
ECE 6510	Communication Theory
ECE 6580	Wireless Networks
ECE 6761	Light and Information
ECE 6800	Computational Techniques in Electrical Engineering **
ECE 6845	Image Synthesis
ECE 6880	Adaptive Signal Processing
ECE 6885	Computer Vision
For the thesis option	
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
MEMS, electronics, and photonics focus area		
Required		
ECE 6030	Device Electronics	
At least four courses selected from the following:		
ECE 6020	Applied Electromagnetics	
ECE 6210	Machine Intelligence	
ECE 6213	Design of VLSI Circuits	
ECE 6214	High-Level VLSI Design Methodology	
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	
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 6842	Image Engineering
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	
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 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.

Visit the program website (<https://www.ece.seas.gwu.edu/graduate-programs/>) for additional information.

### Online program requirements

Code	Title	Credits
<b>Required</b>		
The following requirements must be fulfilled: 30 credits, including 18 credits in required courses and 12 credits in elective courses.		
Core courses		
ECE 6010	Linear Systems Theory	
ECE 6015	Stochastic Processes in Engineering	
ECE 6025	Signals and Transforms in Engineering	
ECE 6045	Special Topics	
ECE 6800	Computational Techniques in Electrical Engineering	
ECE 6820	Real-Time Digital Signal Processing	
All courses in one of the following areas:		
Electrical power and energy		
ECE 6070	Electrical Power Systems	
ECE 6610	Electrical Energy Conversion	
ECE 6662	Power Electronics	
ECE 6669	Smart Power Grids	
Communications and networks		
ECE 6035	Introduction to Computer Networks	
ECE 6132	Secure Cloud Computing	
ECE 6510	Communication Theory	
ECE 6520	Mobile and Wireless Communication Systems	

### 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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