Critical Infrastructure. Critical Education.

Online Master of Science in Electrical Engineering

engineering.gwu.edu

Department of Electrical and Computer Engineering
School of Engineering & Applied Science
The George Washington University’s online Master of Science in electrical engineering (M.S. in EE) engages students with a curriculum of the core engineering and advanced technical information they need to plan, design, implement, and manage sophisticated electrical systems.

Offered by the Department of Electrical and Computer Engineering, the online M.S. in EE includes two focus areas for students to develop expertise in the high-demand electrical engineering specialities of:

- Electrical Power and Energy
- Communications and Networks

Students gain hands-on experience leveraging state-of-the-art engineering techniques, skills, and tools.

Advance Your Career in Electrical Engineering

The blend of core and specialized electrical engineering knowledge makes GW’s M.S. in EE program an ideal fit for a range of professionals, including:

- Engineers in the early stages of their careers who want to advance
- Experienced engineers looking to keep their skills current
- Experienced engineers who want to develop specialized expertise in one of the M.S. in EE’s focus areas
Application Requirements

- Minimum grade point average of B (2.7 on a 4.0 scale) or higher. Applicants with less than a 2.7 GPA are welcome to apply and may be accepted conditionally based on a holistic review of application materials.
- Received a bachelor's degree in electrical engineering or closely related field from a regionally accredited institution

Application Materials

To speed our review of your application for admission, order your official transcripts and prepare all other materials to submit at the same time as your application. Prior to the application deadline, all supplemental application materials must be received by the admissions office. After that time, the file will be rejected as incomplete.

Complete application packets include:

- **Completed Application:** There is no application fee for these programs. When completing the application form, you will also need to upload your resume and statement of purpose.
- **Up-to-Date Resume or C.V.**
- **Statement of Purpose:** In an essay of 250 words or less, state your purpose in undertaking a 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

- **Official Transcripts:** Official transcripts are required from all institutions attended to complete the application packet. More information on transcript requirements can be found on our website’s transcript policy page.

- **Letters of Recommendation:** Three letters of recommendation are required for admission and at least one letter must come from a professional reference. Please download the letter of recommendation form, fill out the top portion, and email the form to the individual providing the recommendation. A letter of recommendation is only considered official when it is sent directly from the individual providing the recommendation to an Admissions Counselor via email at onlineeng@gwu.edu or via fax at (888) 245-5409. Submissions sent directly from applicants are not accepted.

- **GRE or GMAT Scores:** GRE or GMAT scores are recommended.
At GW, we’re committed to creating a diverse, global student community and advancing the disciplines of engineering around the world. We are pleased to admit candidates from outside the U.S. to our online graduate degree programs in engineering.

We encourage you to review our useful resources and applicant information for international students to determine the materials needed. International applicants should note that, because these programs are offered entirely online, GW cannot issue student visas. You are encouraged to attend synchronous class sessions, so consider time zone differences when you apply. Please contact an Admissions Counselor with any questions.

Scores from the Test of English as a Foreign Language (TOEFL), the academic International English Language Testing System (IELTS), or the PTE Academic are required of all applicants who are not citizens of countries where English is the official language, with the possible exception of those who hold a bachelor’s, master’s, or doctoral degree from an institution in which English is the language of instruction and the official language of the country in which the university is located, or who hold a bachelor’s, master’s, or doctoral degree from an institution that is accredited by a U.S. regional accrediting agency.

**Minimum Test Scores Required (submit one of the following):**

- TOEFL: 600 on paper-based or 100 on Internet-based
- IELTS: an overall band score of 7.0 with no individual score below 6.0
- PTE Academic: 68
The online Master of Science program in electrical engineering comprises 10 courses that vary by a student’s focus area. This blend of broad and specialized knowledge enables graduates to fulfill not only their own roles as electrical engineers, but also to understand how their expertise may interact with other engineering disciplines.

Each course in the curriculum awards 3 semester hours of graduate credit to yield the 30 credit hours required for the degree.

**Focus Areas**

### Electrical Power and Energy
The Electrical Power and Energy area explores issues of electric power generation, transmission, and distribution. Students will gain hands-on experience with optimization techniques for solving some of the industry’s most complex challenges, such as how to optimize power generation and distribution with renewable energy. Graduates of this focus area will be able to design and develop reliable, efficient, secure, and sustainable electric power delivery systems.

**Core Courses:**
- ECE 6010 Linear Systems Theory
- ECE 6015 Stochastic Processes in Engineering
- ECE 6025 Signals and Transforms in Engineering
- ECE 6045 Special Topics: Foundations of Electrical Engineering
- ECE 6080 Computational Techniques in Electrical Engineering
- EMSE 6820 Program and Project Management

**Focus Area:**
- ECE 6610 Electrical Energy Conversion
- ECE 6620 Electrical Power Systems
- ECE 6662 Power Electronics
- ECE 6669 Smart Power Grids

### Communications and Networks
The Communications and Networks focus area examines the problem of efficient and safe transmission of information. Courses in information theory, stochastic processes, digital communication, networking, data encryption and compression, network protocols and technologies, and security can be applied in the construction and maintenance of local area networks, wide area networks, cellular and satellite communications, wireless networks, and the internet.

**Core Courses:**
- ECE 6010 Linear Systems Theory
- ECE 6015 Stochastic Processes in Engineering
- ECE 6025 Signals and Transforms in Engineering
- ECE 6045 Special Topics: Foundations of Electrical Engineering
- ECE 6080 Computational Techniques in Electrical Engineering
- EMSE 6820 Program and Project Management

**Focus Area:**
- ECE 6520 Mobile and Wireless Communications Systems
- ECE 6530 Introduction to Computer Networks

**Course Descriptions**

**ECE 6010 Linear Systems Theory**
Introduction to linear systems theory. Topics include linear vector spaces and linear operators, mathematical representation of dynamic linear systems, concept of state and solution of the state equation, controllability and observability, canonical forms of the state equation, state feedback, and state estimation.

**ECE 6015 Stochastic Processes in Engineering**
Axioms of probability; conditional probability; independent events; sequential experiments. Single and multiple random variables. Discrete-valued and continuous-valued stochastic processes; discrete-time and continuous-time stochastic processes; mean, auto-correlation and autocovariance functions; multiple random processes; stationary stochastic processes and linear time-invariant systems; ergodicity; Markov chains. Examples from engineering applications.

**ECE 6025 Signals and Transforms in Engineering**

**ECE 6035 Introduction to Computer Networks**

**ECE 6045 Special Topics: Foundations of Electrical Engineering**
Circuit elements and circuit analysis techniques. Circuit theorems for performing such fundamental computations for electrical engineering as sinusoidal steady-state analysis and maximum power or power dissipation calculations. Hands-on experience with CAD tools for designing circuits.

**ECE 6132 Secure Cloud Computing**
Security concerns and best practices for cloud computing and cloud services; cloud computing architectures, risk issues and legal topics; data security; internal and external clouds; information security frameworks and operations guidelines. Prerequisite: ECE 6035.

**ECE 6510 Communication Theory**
Principles of digital communications. Channels, digital modulation; optimum receivers and algorithms in the AWGN; coherent, non-coherent, and fading channels. Correlation detectors, matched filters; diversity. Bounds on performance of communications, comparison of communications systems and implementation issues. Prerequisite: ECE 6015.

**ECE 6520 Mobile and Wireless Communications Systems**
Course Descriptions (continued)

ECE 6610 Electrical Energy Conversion
Three-phase and single-phase AC rotating machines and transformers, DC machines, rotating machines as circuit elements, power semiconductor converters. Renewable generation, utility grid integration, smart grid applications. May be taken for graduate credit by students in fields other than electrical engineering.

ECE 6620 Electrical Power Systems
AC power grids, transmission line parameters, load flow, economic dispatch voltage, frequency, and power flow control. Voltage, current, and power limitations. Fault analysis and stability considerations. Effect of independent power producers and variable energy sources and energy storage.

ECE 6662 Power Electronics
The application of electronics to energy conversion. Principles of operation, analysis, and control of circuits including solid-state electronic switches. Methods of solving power electronic circuits and finding the steady-state values of important quantities. Deriving the linear model of the studied power electronic circuits and designing controllers for these devices. A general knowledge of electric circuits and linear control theory is required.

ECE 6669 Smart Power Grids
Overview of probability theory. Overview of basic power market reliability modeling and evaluation. Generation supply reliability techniques, modeling and evaluation. Reliability of transmission system and delivery of supply. Loss of load probability evaluation.

Forced and maintenance outages and impact on system reliability. Load forecasting and probability of interconnected systems. Risk evaluation in power system operation. Operating reserve techniques and indices. Distribution system reliability including substations. Composite system reliability modeling. Reliability worth and value.

ECE 6800 Computational Techniques in Electrical Engineering

ECE 6830 System Optimization

ECE 6833 Nonlinear Systems

ECE 6850 Pattern Recognition
Random vectors, transformations, hypothesis testing, error probability, sequential methods. Bayes, other linear classifiers; discriminant functions, parameter estimation, learning, and dimensionality reduction; nonparametric methods; clustering; feature selection and ordering; computer applications and projects. Students should have completed at least one prior course in probability and statistics, such as ECE 6015 or equivalent, prior to enrollment. Contact the instructor if uncertain as to whether this requirement has been met. Prerequisite: ECE 6015.

ECE 6855 Digital Signal Processing Techniques
Signal and system representation, sampling and quantization, transform techniques. Recursive and nonrecursive digital filter design, recursive estimation, linear predictive filtering. Fast algorithms for signal processing. Current topics. Prerequisite: ECE 6015.

EMSE 6820 Program and Project Management
Problems in managing projects; project management as planning, organizing, directing, and monitoring; project and corporate organizations; duties and responsibilities; the project plan; schedule, cost, earned-value and situation analysis; leadership; team building; conflict management; meetings, presentations, and proposals.

At GW, providing world-class programs at an affordable tuition rate is one of our fundamental goals. Our online graduate degree programs in engineering require no additional fees, and required eBooks and software are included in the price of tuition, which is among the most competitively priced in the nation. This allows students to pursue a top-tier education and expand their career possibilities online, on their own schedule, confident that they are making a smart investment in their future.

Tuition per credit hour: $1,125
Registration fee (per semester): $35

Tuition is for the current academic year.
Tuition is subject to change after the current year.

Financial Aid
As a GW student you have several types of financial assistance programs available to you. The Office of Student Financial Assistance administers financial aid to graduate students. They will assist in the administration/certification of education loans to help meet the program’s tuition cost.

Contact Information
Phone: (877) 221-9868
Fax: (202) 994-0906
Email: finaid@gwu.edu

Prospective students can also contact an Admissions Counselor at (877) 221-9868 for more information about financial aid.
GW was founded in 1821 through an Act of Congress. Since then, we have been fulfilling George Washington’s vision of an institution in the nation’s capital dedicated to educating and preparing future leaders. GW responds to the growing needs of our own community and society at large through commitment to finding solutions to national and global problems.

Study, act, solve. This is our formula for moving the world forward.

The Department of Electrical and Computer Engineering prepares today’s undergraduate and graduate students to be tomorrow’s leaders and innovators, offering modern programs fueled by cutting-edge research. We strive to inspire our diverse students by providing rigorous and comprehensive electrical and computer engineering programs to inspire our students to pursue dynamic careers and global entrepreneurial partnerships in our rapidly developing technological society.

Students in GW’s online programs have access to the world-class faculty, pioneering research, and spirit of exploration that defines GW as a leading educational institution. We’re committed to welcoming online students to the GW academic community, and to supporting them throughout their time at the university.

Our heritage of innovation and excellence has earned us many accolades, including:

- U.S. News & World Report
  - #15 Best Online Master’s in Engineering Programs
  - #12 Best Online Master’s in Engineering Programs for Veterans

Advance your Engineering Career
Contact an Admissions Counselor to start your path to greater electrical engineering aptitude.

Email: onlineeng@gwu.edu
Phone: (877) 221-9868