BACHELOR OF SCIENCE WITH A MAJOR IN ELECTRICAL ENGINEERING (STEM)

Electrical engineering provides the technological foundation for the modern information society. Almost every modern technological advance made today can be traced to the work of electrical engineers. Students in George Washington University’s electrical engineering program discover the basics of electrical engineering design, allowing them to take their place alongside the engineers who make daily advances in sustainable energy, telecommunications, healthcare, defense, and other sectors. The program’s contemporary curriculum is complemented by well-staffed and well-equipped laboratories. Students can access real-world projects through internships and gain practical design sequence experiences by being prepared in a wide variety of technical fields. Graduates have gone on to have careers at Tesla, Intel, Google, AT&T, Qualcomm, NASA, and Cisco.

Double major

SEAS and non-SEAS students interested in pursuing the BS in electrical engineering as a double major should see the requirements under SEAS Regulations (http://bulletin.gwu.edu/engineering-applied-science/#seasregulationstext) in this Bulletin.

This is a STEM designated program.

Visit the program website (http://www.ece.seas.gwu.edu/bachelor-science-electrical-engineering/) for additional information.

ADMISSIONS

For more information on the admission process, please visit the Office of Undergraduate Admissions website. Applications may be submitted via the Common Application.

Supporting documents not submitted online should be mailed to:
The George Washington University
800 21st Street NW, Suite 100
Washington DC 20052

Contact for questions:
gwadm@gwu.edu or 202-994-6040

REQUIREMENTS

The following requirements must be fulfilled:

129 credits as outlined below in required and elective courses, including completion of a 3-course, 9-credit specialized track.

A minimum technical GPA of 2.2 and SEAS GPA of 2.0. A student’s technical GPA is calculated using all technical engineering courses outlined in the fifth, sixth, seventh, and eighth semesters of the curriculum.

Recommended program of study

The program of study lists all course requirements in the sequence for the degree. Students should review this information carefully and consult their advisor before changing the sequence of any courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 1111</td>
<td>General Chemistry 1</td>
<td>1</td>
</tr>
<tr>
<td>ECE 1010</td>
<td>Introduction to Electrical and Computer Engineering I</td>
<td></td>
</tr>
<tr>
<td>MATH 1231</td>
<td>Single-Variable Calculus 1</td>
<td></td>
</tr>
<tr>
<td>SEAS 1001</td>
<td>Engineering Orientation</td>
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</tr>
<tr>
<td>UW 1020</td>
<td>University Writing</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Humanities, social science, or non-technical elective</td>
<td>2</td>
</tr>
</tbody>
</table>

First semester

Second semester

ECE 1020  Introduction to Electrical and Computer Engineering II
ECE 1120  C Programming for Electrical and Computer Engineering
MATH 1232 Single-Variable Calculus II 1
PHIL 2135 Ethics in Business and the Professions
PHYS 1021 University Physics I 1
or PHYS 1025 University Physics I with Biological Applications

Humanities, social science, or non-technical elective 2

Third semester

APSC 2113 Engineering Analysis I
ECE 1125 Data Structures and Algorithms for ECE
ECE 2110 Circuit Theory
ECE 2120 Engineering Seminar
MATH 2233 Multivariable Calculus 1
PHYS 1022 University Physics II 1
or PHYS 1026 University Physics II with Biological Applications

Fourth semester

APSC 2114 Engineering Analysis II
ECE 2115 Engineering Electronics
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ECE 2140</td>
<td>Design of Logic Systems</td>
</tr>
<tr>
<td>ECE 2210</td>
<td>Circuits, Signals, and Systems</td>
</tr>
<tr>
<td>Humanities, social science, or non-technical elective</td>
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**Fifth semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>APSC 3115</td>
<td>Engineering Analysis III</td>
</tr>
<tr>
<td>ECE 3130</td>
<td>Digital Electronics and Design</td>
</tr>
<tr>
<td>ECE 3220</td>
<td>Introduction to Digital Signal Processing</td>
</tr>
<tr>
<td>ECE 3315</td>
<td>Fields and Waves I</td>
</tr>
<tr>
<td>ECE 3520</td>
<td>Microprocessors: Software, Hardware, and Interfacing</td>
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**Sixth semester**

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ECE 3125</td>
<td>Analog Electronics Design</td>
</tr>
<tr>
<td>ECE 3135</td>
<td>Digital Design with Field-Programmable Gate Arrays</td>
</tr>
<tr>
<td>ECE 3410</td>
<td>Communications Engineering</td>
</tr>
<tr>
<td>ECE 3915W</td>
<td>Electrical and Computer Engineering Capstone Project Lab I</td>
</tr>
<tr>
<td>ECE 4320</td>
<td>Fields and Waves II</td>
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</tbody>
</table>

**Seventh semester**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ECE 4710</td>
<td>Control Systems Design</td>
</tr>
<tr>
<td>ECE 4920W</td>
<td>Electrical and Computer Engineering Capstone Project Lab II</td>
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</tbody>
</table>

One technical elective

Two ECE restricted electives

**Eighth semester**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ECE 4610</td>
<td>Electrical Energy Conversion</td>
</tr>
<tr>
<td>ECE 4925W</td>
<td>Electrical and Computer Engineering Capstone Project Lab III</td>
</tr>
</tbody>
</table>

Humanities, social science, or non-technical elective

Two technical electives

**Track requirement**

Students complete one specialized track of three courses (for a minimum of 9 credits) from the options listed below. Requirements for the track can be completed using technical elective courses or ECE restricted elective courses.

1. **Track 1: Electronics, nanotechnology, and chip design**
   - ECE 4140: VLSI Design and Simulation
   - ECE 4145: Microfabrication and Nanofabrication Technology
   - ECE 4150: ASIC Design and Testing of VLSI Circuits
   - ECE 4160: Introduction to Nanoelectronics
   - ECE 4435: Photonics and Fiber Optics
   - ECE 4535: Computer Architecture and Design
   - ECE 6221: Introduction to Physical Electronics

2. **Track 2: Artificial intelligence and robotics**
   - ECE 4210: Machine Intelligence
   - And two technical elective courses selected from the following with the advisor’s approval:
     - ECE 4730: Robotic Systems
     - ECE 4535: Computer Architecture and Design
     - ECE 6217: Neural Networks and Hardware Implementations
     - ECE 6850: Pattern Recognition and Machine Learning
     - ECE 6882: Reinforcement Learning
     - BME 4835: Introduction to Assistive Robotics

3. **Track 3: Telecommunication and network security**
   - And two technical elective courses selected from the following with the advisor’s approval:
     - ECE 3525: Introduction to Embedded Systems
     - ECE 4415: Introduction to Computer Networks
     - ECE 4425: Data Communications Laboratory
     - ECE 4555: Computer Security
     - ECE 6160: Network Security
     - ECE 6575: Optical Communication Networks
     - ECE 6580: Wireless Networks

4. **Track 4: Sustainable energy and power systems**
   - ECE 4620: Electrical Power Systems
   - And two technical elective courses selected from the following with the advisor’s approval:
     - ECE 4610: Electrical Power Systems
     - ECE 4615: Introduction to Power Systems
ECE 4662  Power Electronics
ECE 6699  Energy and Sustainability
MAE 2131  Thermodynamics

Track 5: Electrical engineering general track
Three technical elective courses selected with the advisor’s approval to align with track’s overall academic goals.

1 Course satisfies the University general education requirement (http://bulletin.gwu.edu/university-regulations/general-education/) in math, science, and writing.

2 All electrical and computer engineering students take five courses to satisfy the ECE humanities and social science/non-technical requirement. Three of these courses—one in humanities and two in social sciences—must be on the University general education requirement list; one course must be PHIL 2135 (or NSC 4176 for students in the NROTC Program); and one course can be in the humanities/social sciences, or a non-technical course related to public health, safety, and welfare; global cultural, social, environmental, and economic factors; or innovation, entrepreneurship, and creativity. For the last category, students can consider taking DNSC 1051, DNSC 4404, EMSE 4410, ISTM 4223 MGT 3300, MGT 3301, MGT 3302, MGT 3303, or MGT 4003. The non-technical course cannot focus on scientific/mathematical approaches or technology. All courses selected to satisfy this requirement must be taken for a minimum of 3 credits and approved by the advisor.

3 Three 3-credit technical elective courses must be selected with the approval of the advisor from upper-division undergraduate (2000 to 4000 level) or graduate courses in engineering, computer science, mathematics, physical sciences, or biological sciences. Exceptions must be approved by the advisor. Technical elective courses can be used to fulfill the track requirement. See above.

4 The two ECE restricted electives must be selected with the approval of the advisor from ECE courses at the 3000 level or above. Exceptions must be approved by the advisor. ECE elective courses can be used to fulfill the track requirement. See above.

COMBINED PROGRAMS

Combined programs
• Dual Bachelor of Science with a major in electrical engineering and Master of Science in the field of computer engineering (http://bulletin.gwu.edu/engineering-applied-science/electrical-computer-engineering/combined-bs-electrical-engineering-ms-computer-engineering/)
• Dual Bachelor of Science with a major in electrical engineering and Master of Science in the field of electrical engineering (http://bulletin.gwu.edu/engineering-applied-science/electrical-computer-engineering/combined-bs-ms-electrical-engineering/)