

# BACHELOR OF SCIENCE WITH A MAJOR IN COMPUTER ENGINEERING (STEM)

George Washington University's computer engineering program prepares students to specialize in computer systems architecture, computer communications networking, and very-large-scale integrated (VLSI) systems. The classroom experience is enhanced by opportunities for students to be involved in cutting-edge, high-profile research projects and internships at federal laboratories and high-tech companies, all made possible by GW's location in the nation's capital. The computer engineering community at the University is a close-knit family of faculty and students and, as part of this community, students benefit from smaller class sizes and have access to state-of-the-art, high-performance computers. Program graduates have gone on to careers in companies such as Intel, Qualcomm, Google, Microsoft, and Apple, or have continued their education at the top graduate and doctoral programs in the country.

## Double major

SEAS and non-SEAS students interested in pursuing the BS in computer engineering as a double major should see Double Major 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:  
Office of Undergraduate Admissions  
The George Washington University  
800 21st Street NW, Suite 100  
Washington DC 20052

Contact for questions:  
[gwadm@gwu.edu](mailto: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 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 below in the fifth, sixth, seventh, and eighth semesters of the curriculum.

## Recommended program of study

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

Code	Title	Credits
<b>First semester</b>		
CHEM 1111	General Chemistry I <sup>1,5</sup>	
ECE 1010	Introduction to Electrical and Computer Engineering I	
MATH 1231	Single-Variable Calculus I <sup>1</sup>	
SEAS 1001	Engineering Orientation	
UW 1020	University Writing <sup>1</sup>	
One humanities, social science, or non-technical elective <sup>2</sup>		
<b>Second semester</b>		
CSCI 1311	Discrete Structures I	
ECE 1020	Introduction to Electrical and Computer Engineering II	
ECE 1120	C Programming for Electrical and Computer Engineering	
MATH 1232	Single-Variable Calculus II <sup>1</sup>	
PHIL 2135	Ethics in Business and the Professions	
PHYS 1021	University Physics I <sup>1</sup>	
or PHYS 1025	University Physics I with Biological Applications	
<b>Third semester</b>		
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 <sup>1</sup>	
PHYS 1022	University Physics II <sup>1</sup>	
or PHYS 1026	University Physics II with Biological Applications	
<b>Fourth semester</b>		
APSC 3115	Engineering Analysis III	
ECE 2115	Engineering Electronics	

ECE 2140	Design of Logic Systems
ECE 2210	Circuits, Signals, and Systems
One humanities, social science, or non-technical elective <sup>2</sup>	
<b>Fifth semester</b>	
ECE 3130	Digital Electronics and Design
ECE 3220	Introduction to Digital Signal Processing
ECE 3515	Computer Organization
ECE 3520	Microprocessors: Software, Hardware, and Interfacing
One technical elective <sup>3</sup>	
<b>Sixth semester</b>	
ECE 3135	Digital Design with Field-Programmable Gate Arrays
ECE 3525	Introduction to Embedded Systems
ECE 3915W	Electrical and Computer Engineering Capstone Project Lab I
ECE 4415	Introduction to Computer Networks
ECE 4425	Data Communications Laboratory
One technical elective <sup>3</sup>	
<b>Seventh semester</b>	
ECE 4140	VLSI Design and Simulation
ECE 4535	Computer Architecture and Design
ECE 4920W	Electrical and Computer Engineering Capstone Project Lab II
One humanities, social science, or non-technical elective <sup>2</sup>	
One ECE restricted elective <sup>4</sup>	
<b>Eighth semester</b>	
ECE 4150	ASIC Design and Testing of VLSI Circuits
ECE 4925W	Electrical and Computer Engineering Capstone Project Lab III
One humanities, social science, or non-technical elective <sup>2</sup>	
One ECE restricted elective <sup>4</sup>	
One technical elective <sup>3</sup>	

Code	Title	Credits
<b>Track requirement</b>		
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. <sup>3,4</sup>		
Track 1: Electronics, nanotechnology, and chip design		
Three technical elective courses selected from the following with the advisor's approval:		
ECE 3125	Analog Electronics Design	
ECE 4145	Microfabrication and Nanofabrication Technology	
ECE 4160	Introduction to Nanoelectronics	
ECE 4435	Photonics and Fiber Optics	
ECE 6221	Introduction to Physical Electronics	
Track 2: Artificial Intelligence and Robotics		
ECE 4810	Machine Intelligence	
And two technical elective courses selected from the following with the advisor's approval:		
ECE 4710	Control Systems Design	
ECE 4730	Robotic Systems	
ECE 6217	Neural Networks and Hardware Implementations	
ECE 6850	Pattern Recognition and Machine Learning_	
ECE 6882	Reinforcement Learning	
BME 4835	Introduction to Assistive Robotics	
Track 3: Computer hardware and systems		
Three technical elective courses selected from the following with the advisor's approval:		
ECE 6105	Introduction to High-Performance Computing	
ECE 6125	Parallel Computer Architecture	
ECE 6130	Big Data and Cloud Computing	
ECE 6140	Embedded Systems	
ECE 6150	Design of Interconnection Networks for Parallel Computer Architectures	

#### Track 4: Cybersecurity

ECE 6160                      Secure Computing Systems

And two technical elective courses selected from the following with the advisor's approval:

ECE 6130                      Big Data and Cloud Computing

ECE 6132                      Secure Cloud Computing

ECE 6565                      Network Security

ECE 6570                      Telecommunications Security Protocols

#### Track 5: Computer engineering general track

Three technical elective courses selected with the advisor's approval to align with the track's overall academic goals.

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

<sup>2</sup>All electrical and computer engineering students take five courses to satisfy the ECE humanities, social science, and 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 Ethics in Business and the Professions (or NSC 4176 Leadership and Ethics 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; or global cultural, social, environmental, and economic factors; or innovation, entrepreneurship, and creativity. For the non-technical course, students can consider taking DNSC 1051 Introduction to Business Analytics, DNSC 4404 Essentials of Project Management, EMSE 4410 Engineering Economic Analysis, ISTM 4223 Technology Entrepreneurship MGT 3300 Entrepreneurship, MGT 3301 Small Business Management, MGT 3302 e-Entrepreneurship, MGT 3303 Women's Entrepreneurial Leadership, or MGT 4003 Management of the Growing Entrepreneurial Venture. 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.

<sup>3</sup>Five 3-credit technical elective courses must be chosen 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. At least one of the technical electives must be a math or science course at the 2000-level or above. Exceptions must be approved by the advisor. Technical elective courses can be used to fulfill the track requirement. See above.

<sup>4</sup>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.

<sup>5</sup>Students can take CHEM 1113 General Chemistry for Engineers instead of CHEM 1111 General Chemistry I with consultation from ECE advisors.

## COMBINED PROGRAMS

### Combined programs

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