

# COMPUTER ENGINEERING, BS

**Banner Code:** VS-BS-CPE

## Academic Advising

MSN 1G5  
4400 University Drive  
Fairfax, VA 22030

Phone: 703-993-1569  
Email: [ece@gmu.edu](mailto:ece@gmu.edu)  
Website: <https://ece.gmu.edu/undergraduate-studies/bachelors-programs/bs-computer-engineering>

The field of computer engineering can be described as an amalgam of hardware and software design. Computer engineers are involved in research, design, development, production, and operation of a wide variety of digital systems, from integrated circuits through microcontrollers, multi-core processors, FPGA-based accelerators, to big-data and cloud computing platforms. Reflecting the industry trend to integrate hardware and software development, the computer engineering program is built around computer-aided design tools that can simulate and assist in the design of new digital systems, such as those found in smartphones, tablets, robots, autonomous vehicles, drones, spacecraft, computer networks, smart factories, defense systems, and the internet-of-things. Advanced languages, such as VHDL and Python, and software tools, such as those used for FPGA- and ASIC-design and simulation, can be used to model hardware and software functionality from the system and architecture level down to the gate and transistor levels. Design, optimization, verification, and testing methodology involving these tools are taught in the program.

The Department of Electrical and Computer Engineering is staffed by 33 full-time professors and several part-time professors.

The bachelor's program in computer engineering is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>).

## Career Opportunities

Career opportunities exist in engineering design and development such as hardware/software co-design and integration, embedded system programming, mobile system and application development, robot and drone design, and cloud and big data computing. Other opportunities include engineering management, consultancy, technical sales, and patent law. The program provides a strong preparation for graduate study.

## Specializations

The curriculum provides a strong background in the fundamentals of computer engineering. A number of technical elective specializations are offered, ranging from primarily hardware-oriented to those that are more software-oriented. These include robotics and embedded systems, computer networks, signal processing, and integrated circuits. The curriculum includes 9 credits of senior technical electives, and 3 credits of senior advanced design project, which may be used for specialization in one of these technical areas.

## Additional Information

The requirements for the degree may be satisfied on a full-time or part-time basis. Cooperative education provides students the opportunity to integrate paid career-related work experience with classroom learning.

Academic credit towards the completion of major requirements cannot be given for co-op experience. In addition to the usual financial aid available through the Office of Student Financial Aid, computer engineering majors are encouraged to apply for scholarships provided by various professional societies and industrial organizations in their field.

## Admissions & Policies

### Policies

For policies governing all undergraduate degrees, see AP.5 Undergraduate Policies.

### Writing-Intensive Requirement

Mason's writing-intensive requirement is satisfied by the following two courses: ECE 333 Linear Electronics I and ECE 491 Engineering Seminar in which faculty provide writing instruction and feedback on student technical writing assignments. Drafts and revisions are required.

### Change of Major

See Change of Major for more information.

### Double Major and Minor Programs for Computer Engineering and Electrical Engineering

Computer Engineering majors and Electrical Engineering majors can earn degrees with double majors in a number of disciplines. Computer Engineering and Computer Science are frequently combined. Electrical Engineering has been combined with Computer Engineering, Mechanical Engineering, Computer Science, Physics, or Math. Details are available in the department brochures or at the Volgenau School website (<http://volgenau.gmu.edu>). There are several minors available for students in the ECE Department including the Mechanical Engineering minor, Bioengineering minor and others as listed in the catalog.

### Grade Requirements

All computer engineering students are strongly encouraged to see their major faculty advisor each semester before course registration.

Students must complete each ECE, ENGR, BENG, CS, MATH, PHYS and STAT course presented as part of the required 126 credits for the degree with a grade of C or better.

Students must also complete any course required by the program that is a prerequisite to another course applicable to the degree with a grade of C or better.

### Termination from the Major

No math, science, or Volgenau School of Engineering course that is required for the major may be attempted more than three times. Those students who do not successfully complete such a course within three attempts will be terminated from the major. Undeclared students in the Volgenau School who do not successfully complete a course required for a Volgenau School major within three attempts will also be terminated. For more information, see AP.5.2.4 Termination from the Major.

Once a student has attempted one of these courses twice unsuccessfully, the third attempt must be no later than the next semester of enrollment, excluding summers. Failure to take the course at that time will result in termination from the major. If the student is unable to take the

course when required, the student may request an extension to a future semester; extensions require approval of the student's advisor, their department, and the Associate Dean for Undergraduate Programs. The deadline for extension requests is the add deadline for the semester in which the course is required.

Students who have been terminated from a Volgenau School of Engineering major may not register for a Volgenau School course without permission of the department offering the course. This applies to all undergraduate courses offered by the Volgenau School except IT 104 Introduction to Computing (Mason Core) and STAT 250 Introductory Statistics I (Mason Core)

A student may not declare any major in the Volgenau School of Engineering if the student has previously met the termination criteria for that major at any time, regardless of what the student's major was at the time the courses were taken.

## Requirements

### Degree Requirements

Total credits: 126

#### Electrical and Computer Engineering

Code	Title	Credits
ECE 101	Introduction to Electrical and Computer Engineering	3
ECE 201	Introduction to Signals and Systems	3
ECE 220	Continuous-Time Signals and Systems	3
ECE 285	Electric Circuit Analysis I	3
ECE 286	Electric Circuit Analysis II	3
ECE 331	Digital System Design	3
ECE 332	Digital Electronics and Logic Design Lab	1
ECE 333	Linear Electronics I	3
ECE 334	Linear Electronics Lab I	1
ECE 445	Computer Organization	3
ECE 447	Single-Chip Microcomputers	4
ECE 448	FPGA and ASIC Design with VHDL	4
ECE 465	Computer Networking Protocols	3
ECE 491	Engineering Seminar	1
ECE 492	Senior Advanced Design Project I (Mason Core) <sup>1</sup>	1
ECE 493	RS: Senior Advanced Design Project II (Mason Core)	2
Total Credits		41

<sup>1</sup> Students who would like to complete a more challenging senior design project have the option of enrolling in ECE 392 Engineering Design Studio to gain a semester head start in the design process.

#### Computer Science

Code	Title	Credits
CS 112	Introduction to Computer Programming (Mason Core)	4
CS 211	Object-Oriented Programming	3
CS 222	Computer Programming for Engineers	3

CS 310	Data Structures	3
CS 471	Operating Systems	3
Total Credits		16

#### Mathematics and Statistics

Code	Title	Credits
MATH 113	Analytic Geometry and Calculus I (Mason Core)	4
MATH 114	Analytic Geometry and Calculus II	4
MATH 125	Discrete Mathematics I (Mason Core)	3
MATH 203	Linear Algebra	3
MATH 213	Analytic Geometry and Calculus III	3
MATH 214	Elementary Differential Equations	3
STAT 346	Probability for Engineers	3
Total Credits		23

#### Physics

Code	Title	Credits
PHYS 160	University Physics I (Mason Core)	3
PHYS 161	University Physics I Laboratory (Mason Core)	1
PHYS 260	University Physics II (Mason Core)	3
PHYS 261	University Physics II Laboratory (Mason Core)	1
PHYS 262	University Physics III (Mason Core)	3
Total Credits		11

#### Engineering

Code	Title	Credits
ENGR 107	Introduction to Engineering (Mason Core)	2
Total Credits		2

#### Technical Electives

Students must choose one of the four technical specialization areas listed below. All three of the technical electives totaling 9 credit hours must be selected from within the chosen specialization area. With the prior approval of the ECE department, students may also create a custom specialization area and select a set of technical electives, including non-ECE courses, to apply to the custom specialization area. Graduate courses listed within the specialization areas can only be taken with prior approval of the department. The decision to approve taking graduate courses listed within the specialization areas is based on a review of the student's academic record.

#### Specialization Areas

##### Robotics and Embedded Systems

Code	Title	Credits
Select three from the following:		9
ECE 350	Embedded Systems and Hardware Interfaces	
ECE 370	Robot Design	
ECE 421	Classical Systems and Control Theory	
ECE 446	Device Driver Development	
ECE 450	Mobile Robots	
ECE 470	Introduction to Humanoid Robotics	
ECE 510	Real-Time Concepts	

ECE 530	Sensor Engineering	
Total Credits		9

**Computer Networks**

Code	Title	Credits
Select three from the following:		
ECE 460	Communication and Information Theory	
ECE 462	Data and Computer Communications	
ECE 463	Digital Communications Systems	
CYSE 476	Cryptography and Computer Network Security	
Total Credits		9

**Signal Processing**

Code	Title	Credits
Select these three courses:		
ECE 410	Applications of Discrete-Time Signal Processing	
ECE 460	Communication and Information Theory	
ECE 535	Digital Signal Processing	
Total Credits		9

**Integrated Circuits**

Code	Title	Credits
Select three from the following:		
ECE 430	Principles of Semiconductor Devices	
ECE 431	Digital Circuit Design	
ECE 433	Linear Electronics II	
ECE 565	Introduction to Optical Electronics	
Total Credits		9

**English, Communication, and Economics**

Code	Title	Credits
ENGH 302	Advanced Composition (Mason Core) (Natural Sciences and Technology section)	3
COMM 100 or COMM 101	Public Speaking (Mason Core) Fundamentals of Communication (Mason Core)	3
ECON 103	Contemporary Microeconomic Principles (Mason Core)	3
Total Credits		9

**Additional Mason Core**

Students must complete all Mason Core requirements not fulfilled by major requirements. Mason Core courses should be selected from the department's list of approved courses. The Synthesis Mason Core requirement is satisfied by ECE 492 Senior Advanced Design Project I (Mason Core) plus ECE 493 RS: Senior Advanced Design Project II (Mason Core). All students must submit at least 24 credits of social science and humanities coursework, which is normally satisfied by the 24 credits of Mason Core social science and humanities courses listed here and in previous sections.

Code	Title	Credits
	Written Communication <sup>1</sup>	3
	Literature	3

Arts	3	
Western Civilization/World History	3	
Global Understanding	3	
Total Credits		15

<sup>1</sup> Lower-level.

**Accelerated Master's****BS (selected)/Operations Research, Accelerated MS****Overview**

Highly-qualified students in selected BS programs (see below) have the option of obtaining an accelerated Operations Research, MS.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

**Admission Requirements**

Mason undergraduate students majoring in the following disciplines may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30 and completed all MATH and PHYS requirements. Criteria for admission are identical to criteria for admission to the Operations Research, MS program.

- Computer Engineering
- Computer Science
- Electrical Engineering

**Accelerated Option Requirements**

Up to two courses (6 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. These two courses may be chosen from the graduate courses in the following table.

For BS candidates, these graduate courses replace the corresponding undergraduate courses. The undergraduate version of these courses may not be applied to the MS degree.

Undergraduate	Graduate	
SYST 420	SYST 521	Credit may not be received for both courses.
SYST 473	SYST 573	Credit may not be received for both courses.
OR 441	OR 541	Credit may not be received for both courses.
OR 442	OR 542	Credit may not be received for both courses.

Any other 500-level course may be applied to both the undergraduate and graduate degrees with approval of the advisor and SEOR department chair.

## Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

## BS (selected)/Statistical Science, Accelerated MS

### Overview

Highly-qualified students in selected BS programs (see below) have the option of obtaining an accelerated Statistical Science, MS. Students in an accelerated degree program must fulfill all university requirements for the master's degree.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

### Admission Requirements

Students enrolled in a BS degree in any one of the Volgenau School major areas, in the Mathematics, BS program from the College of Science, or in the Economics, BS program from the College of Humanities and Social Sciences may apply to this option if they have earned 90 undergraduate credits with an overall GPA of 3.00. Criteria for admission are identical to criteria for admission to the Statistical Science, MS program, which include successful completion of the following Mason courses each with a grade of C or better:

Code	Title	Credits
MATH 113	Analytic Geometry and Calculus I (Mason Core)	4
MATH 114	Analytic Geometry and Calculus II	4
MATH 213	Analytic Geometry and Calculus III	3
MATH 203	Linear Algebra	3
or MATH 321	Abstract Algebra	
STAT 250	Introductory Statistics I (Mason Core)	3
or STAT 344	Probability and Statistics for Engineers and Scientists I	
STAT 346	Probability for Engineers	3
or MATH 351	Probability	

### Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with 6 credits overlapping with grades of B or better in two 500-level STAT courses selected from STAT 544 Applied Probability, STAT 554 Applied Statistics I, and STAT 574 Survey Sampling I.

### Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and Graduate

Recruitment and Enrollment Services. At the completion of MS requirements, a master's degree is conferred.

## BS (selected)/Systems Engineering, Accelerated MS

### Overview

Highly-qualified students in selected BS programs (see below) have the option of obtaining an accelerated Systems Engineering, MS.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

### Admission Requirements

Mason undergraduate students majoring in computer engineering, computer science, or electrical engineering may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30 and completed all MATH and PHYS requirements. Criteria for admission are identical to criteria for admission to the Systems Engineering, MS program.

### Accelerated Option Requirements

Up to two courses (6 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. These two courses may be chosen from the graduate courses in the following table.

For BS candidates, these graduate courses replace the corresponding undergraduate courses listed. The undergraduate version of these courses may not be applied toward the MS degree.

Undergraduate	Graduate	
SYST 420	SYST 521	Credit may not be received for both courses.
SYST 473	SYST 573	Credit may not be received for both courses.
OR 441	OR 541	Credit may not be received for both courses.
OR 442	OR 542	Credit may not be received for both courses.

Any other 500-level course may be applied to both the undergraduate and graduate degrees with approval of the advisor and SEOR department chair.

### Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

# Computer Engineering, BS/Computer Engineering, Accelerated MS

## Overview

The university offers highly-qualified students in the Computer Engineering, BS the option of obtaining an accelerated Computer Engineering, MS.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

## Admission Requirements

Students in the Computer Engineering, BS program may apply to this option if they have earned 90 undergraduate credits with an overall GPA of 3.25. Criteria for admission are identical to criteria for admission to the Computer Engineering, MS program.

## Accelerated Option Requirements

Students must complete all credits that satisfy the requirements for the BS and MS programs, with 6 credits overlap.

Students take 6 credits of 500-level courses as part of their technical electives or substitutes for required courses as part of their 126-credit undergraduate program. The specific courses that may be taken and applied to the accelerated program will be specified by the ECE Department.

Students admitted to the accelerated program must maintain an overall GPA of at least 3.25 during the entire BS/MS program and present a GPA of at least 3.25 for the 24 credits of graduate work submitted for the MS degree.

Students may take additional graduate-level courses as part of their BS technical electives with advisor approval. These additional graduate-level courses will not count toward the MS degree.

## Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.