# COMPUTER ENGINEERING, MS

**Banner Code: EC-MS-CPE**

**Academic Advising**

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Computer Engineering involves knowledge of hardware and software development. The students learn how to design new generations of computers, as well as embedded computing systems, such as those found in smartphones, cars, appliances, computer networks, smart factories, and the internet-of-things. The program covers the entire digital integrated circuit design process targeting Field Programmable Gate Arrays (FPGAs) and Application Specific Integrated Circuits (ASICs), using various optimization criteria, such as speed, cost, power, energy, reliability, and security. It also encompasses the complete software development process targeting microcontrollers, microprocessors, multi-cores, and Graphics Processing Units (GPUs). It teaches students how to efficiently partition the system into software and hardware components, and develop high-performance interfaces between these two parts. Project-oriented courses and labs expose students to modern computer-aided design tools for hardware and software design. The students master the art of writing comprehensive technical reports and giving successful oral presentations. The computer engineering program offers the following concentrations: computer architecture and embedded systems, computer networks, digital signal processing, digital system design, hardware security and cryptographic engineering, internet of things and network security, machine learning and intelligent computing architectures, and space-based systems.

## Admissions & Policies

# Admissions

### Requirements

Applicants should have a baccalaureate degree preferably in computer engineering, computer science engineering, electrical engineering, electronics and communication engineering, or a closely-related discipline.

Students with BS or MS degrees in other science, technology, engineering, and mathematics (STEM) disciplines are encouraged to apply for admission as well. Such students may be advised to take some courses from the undergraduate computer engineering curriculum or a professional certificate offered by Mason, according to their intended concentration and specific backgrounds. Domestic students may be admitted provisionally and required to satisfy provisional requirements before taking advanced coursework.

Candidates must meet the general university graduate admission eligibility requirements, as defined in the catalog section Graduate Admission Policies (https://catalog.gmu.edu/admissions/graduate-policies/), under General Admission Requirements, including a minimum 3.00 GPA on a 4.00 scale.

All students are required to submit a resume. They are also encouraged to provide up to three choices for their preferred academic advisor (selected from the list available on the ECE Department website (https://ece.gmu.edu/people/faculty/)) and declare their preliminary concentration choice. The concentration can be changed during the entire time in the program.

For internationally educated applicants, a satisfactory score on any of the English proficiency examinations accepted by Mason is required. Satisfactory scores are specific to the College of Engineering and Computing. They are listed on the English Proficiency Requirements page (https://www.gmu.edu/admissions-aid/apply-now/how-apply/international/english-proficiency-requirements/) of the Mason website.

# Policies

### Student Advising

Students can select a concentration from those available in the MS degree program at the time of application to the program or later during their studies. In the former case, students are assigned an academic advisor from the selected concentration at the time of admission. In the latter case, students can petition for a change of an academic advisor to match their concentration choice.

### Plan of Study

Before completing 6 credit hours of coursework, each student must submit to the department a plan of study that has been approved by the academic advisor. This plan should be kept up to date by regular consultation with the academic advisor. A final, signed version of the plan must be turned in when the student submits a graduation application.

## Requirements

# Degree Requirements

Total credits: 30

Students must complete a minimum of 30 graduate credits beyond the bachelor's degree. The plan of study for the degree must fulfill the following requirements:

### Core Course Requirement

| Code | Title | Credits |
|---|---|---|
| Select 15 credits from the following: | | 15 |
| ECE 505 | Hardware Security | |
| ECE 508 | Internet of Things | |
| ECE 511 | Computer Architecture | |
| ECE 516 | Mobile Systems and Applications | |
| ECE 527 | Learning From Data | |
| ECE 528 | Introduction to Random Processes in Electrical and Computer Engineering | |
| ECE 531 | Introduction to Wireless Communications and Networks | |
| ECE 535 | Digital Signal Processing | |

| | | |
|---|---|---|
| ECE 542 | Computer Network Architectures and Protocols | |
| ECE 545 | Digital System Design with VHDL | |
| ECE 554 | Machine Learning for Embedded Systems | |
| ECE 556 | Neuromorphic Computing | |
| ECE 580 | Small Spacecraft Engineering | |
| ECE 611 | Advanced Computer Architecture | |
| ECE 646 | Applied Cryptography | |
| ECE 799 | Master's Thesis [1] | |
| Total Credits | | 15 |

[1] See Thesis/Scholarly Paper option.

## Concentration Requirement

Accomplished by choosing one of the concentrations, and then meeting course requirements for this concentration with the grade B or better in each course. For each concentration, related ECE 590 Selected Topics in Engineering courses can be used in addition to all explicitly listed 500-level courses, and related ECE 699 Advanced Topics in Electrical and Computer Engineering courses can be used in addition to all explicitly listed 600 level or above courses, subject to approval by the student's academic advisor. With assistance from their advisors, students may petition the graduate program coordinator to approve a specialization area of their own design, not fulfilling the requirements of any concentration.

### Available Concentrations

- Concentration in Computer Architecture and Embedded Systems (CAES)
- Concentration in Computer Networks (CNWK)
- Concentration in Digital Signal Processing (DISP)
- Concentration in Digital System Design (DSYD)
- Concentration in Hardware Security and Cryptographic Engineering (HSCE)
- Concentration in Internet of Things and Network Security (INNS)
- Concentration in Machine Learning and Intelligent Computing Architectures (MLIC)
- Concentration in Space-Based Systems (SBSY)

### Concentration in Computer Architecture and Embedded Systems (CAES)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 511 | Computer Architecture | 3 |
| ECE 516 | Mobile Systems and Applications | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including two courses at the 600 level or above: | | 9 |
| CS 571 | Operating Systems | |
| CS 583 | Analysis of Algorithms | |
| ECE 508 | Internet of Things | |
| ECE 512 | Computer Architecture Security | |
| ECE 545 | Digital System Design with VHDL | |
| ECE 554 | Machine Learning for Embedded Systems | |
| ECE 555 | GPU Architecture and Programming | |
| ECE 611 | Advanced Computer Architecture | |
| ECE 612 | Real-Time Embedded Systems | |
| ECE 615 | Software/Hardware Codesign | |
| ECE 616 | Advanced Mobile Systems and Applications | |
| ECE 655 | Advanced GPU Programming and Deep Learning | |
| Total Credits | | 9 |

### Concentration in Computer Networks (CNWK)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 528 | Introduction to Random Processes in Electrical and Computer Engineering | 3 |
| ECE 542 | Computer Network Architectures and Protocols | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including two courses at the 600 level or above: | | 9 |
| ECE 508 | Internet of Things | |
| ECE 531 | Introduction to Wireless Communications and Networks | |
| ECE 532 | Secure Wireless Communications and Networks | |
| ECE 629 | Wireless Networks | |
| ECE 633 | Error Control Coding | |
| ECE 642 | Design and Analysis of Computer Networks | |
| ECE 643 | Network Switching and Routing | |
| ECE 646 | Applied Cryptography | |
| ECE 746 | Advanced Applied Cryptography | |
| Total Credits | | 9 |

### Concentration in Digital Signal Processing (DISP)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 535 | Digital Signal Processing | 3 |
| ECE 545 | Digital System Design with VHDL | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including two courses at the 600 level or above: | | 9 |
| ECE 527 | Learning From Data | |
| ECE 528 | Introduction to Random Processes in Electrical and Computer Engineering | |
| ECE 530 | Sensor Engineering | |
| ECE 531 | Introduction to Wireless Communications and Networks | |

| | | |
|---|---|---|
| ECE 537 | Introduction to Digital Image Processing (DIP) | |
| ECE 615 | Software/Hardware Codesign | |
| ECE 631 | Software-Defined Radio | |
| ECE 633 | Error Control Coding | |
| ECE 635 | Adaptive Signal Processing | |
| ECE 636 | Advanced Digital Signal Processing | |
| ECE 645 | Computer Arithmetic | |
| ECE 648 | Digital Signal Processing Hardware Architectures | |
| ECE 651 | Advanced Learning From Data | |
| Total Credits | | 9 |

### Concentration in Digital System Design (DSYD)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 511 | Computer Architecture | 3 |
| ECE 545 | Digital System Design with VHDL | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including two courses at the 600 level or above: | | 9 |
| ECE 505 | Hardware Security | |
| ECE 527 | Learning From Data | |
| ECE 554 | Machine Learning for Embedded Systems | |
| ECE 556 | Neuromorphic Computing | |
| ECE 586 | Digital Integrated Circuits | |
| ECE 615 | Software/Hardware Codesign | |
| ECE 618 | Hardware Accelerators for Machine Learning | |
| ECE 645 | Computer Arithmetic | |
| ECE 648 | Digital Signal Processing Hardware Architectures | |
| ECE 681 | VLSI Design for ASICs | |
| ECE 682 | VLSI Test Concepts | |
| Total Credits | | 9 |

### Concentration in Hardware Security and Cryptographic Engineering (HSCE)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 505 | Hardware Security | 3 |
| ECE 545 | Digital System Design with VHDL | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including two courses at the 600 level or above: | | 9 |
| ECE 511 | Computer Architecture | |
| ECE 512 | Computer Architecture Security | |
| ECE 527 | Learning From Data | |
| ECE 542 | Computer Network Architectures and Protocols | |
| ECE 586 | Digital Integrated Circuits | |
| ECE 615 | Software/Hardware Codesign | |
| ECE 633 | Error Control Coding | |
| ECE 645 | Computer Arithmetic | |
| ECE 646 | Applied Cryptography | |
| ECE 653 | Machine Learning Security and Privacy | |
| ECE 681 | VLSI Design for ASICs | |
| ECE 746 | Advanced Applied Cryptography | |
| ECE 747 | Cryptographic Engineering | |
| Total Credits | | 9 |

### Concentration in Internet of Things & Network Security (INNS)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 508 | Internet of Things | 3 |
| ECE 542 | Computer Network Architectures and Protocols | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including two courses at the 600 level or above: | | 9 |
| ECE 511 | Computer Architecture | |
| ECE 512 | Computer Architecture Security | |
| ECE 530 | Sensor Engineering | |
| ECE 532 | Secure Wireless Communications and Networks | |
| ECE 611 | Advanced Computer Architecture | |
| ECE 612 | Real-Time Embedded Systems | |
| ECE 633 | Error Control Coding | |
| ECE 642 | Design and Analysis of Computer Networks | |
| ECE 646 | Applied Cryptography | |
| ECE 653 | Machine Learning Security and Privacy | |
| ECE 746 | Advanced Applied Cryptography | |
| ECE 747 | Cryptographic Engineering | |
| SWE 619 | Object-Oriented Software Specification and Construction | |
| SWE 681 | Secure Software Design and Programming | |
| Total Credits | | 9 |

### Machine Learning and Intelligent Computing Architectures (MLIC)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 554 | Machine Learning for Embedded Systems | 3 |
| ECE 556 | Neuromorphic Computing | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including at least two courses at the 600 level or above: | | 9 |
| CS 580 | Introduction to Artificial Intelligence | |
| CS 584 | Theory and Applications of Data Mining | |
| ECE 527 | Learning From Data | |
| ECE 552 | Big Data Technologies | |
| ECE 616 | Advanced Mobile Systems and Applications | |
| ECE 617 | Distributed and Federated Learning | |
| ECE 618 | Hardware Accelerators for Machine Learning | |
| ECE 651 | Advanced Learning From Data | |
| ECE 653 | Machine Learning Security and Privacy | |
| ECE 655 | Advanced GPU Programming and Deep Learning | |
| ECE 681 | VLSI Design for ASICs | |

### Concentration in Space-Based Systems (SBSY)

| Code | Title | Credits |
|---|---|---|
| **Required Courses** | | |
| ECE 511 | Computer Architecture | 3 |
| ECE 580 | Small Spacecraft Engineering | 3 |
| Total Credits | | 6 |

| Code | Title | Credits |
|---|---|---|
| **Electives** | | |
| Select at least three courses from the following, including two courses at the 600 level or above: | | 9 |
| ECE 528 | Introduction to Random Processes in Electrical and Computer Engineering | |
| ECE 530 | Sensor Engineering | |
| ECE 535 | Digital Signal Processing | |
| ECE 545 | Digital System Design with VHDL | |
| ECE 611 | Advanced Computer Architecture | |
| ECE 612 | Real-Time Embedded Systems | |
| ECE 615 | Software/Hardware Codesign | |
| ECE 631 | Software-Defined Radio | |
| ECE 635 | Adaptive Signal Processing | |
| ECE 640 | Small Satellite Development | |
| ECE 646 | Applied Cryptography | |
| ECE 648 | Digital Signal Processing Hardware Architectures | |
| ECE 660 | Space Systems Engineering | |
| ECE 747 | Cryptographic Engineering | |
| Total Credits | | 9 |

## Upper-Level Course Requirement

A minimum of 9 credit hours of ECE (http://catalog.gmu.edu/courses/ece/) or CS (http://catalog.gmu.edu/courses/cs/) courses at the 600 level or above, other than ECE 799 (including, but not limited to, the selected concentration electives), with the grade B or better in each course. No more than 3 credit hours of either ECE 698 or ECE 798 may be used to fulfill this requirement.

## ECE Course Requirement

A maximum of 6 credits of non-ECE courses may be used to fulfill degree requirements, subject to prior approval by the student's academic advisor, in the form of a plan of study signed by the advisor and submitted to the ECE Office. Additional 6 credit hours of DFOR (http://catalog.gmu.edu/courses/dfor/), CS (http://catalog.gmu.edu/courses/cs/), ISA (http://catalog.gmu.edu/courses/isa/), or SWE (http://catalog.gmu.edu/courses/swe/) courses may be used to fulfill degree requirements, subject to the same approval process.

## Electives

Electives can be chosen from among all ECE graduate courses, as well as related graduate courses with other designations. The students are encouraged to discuss their choice of electives with their academic advisor prior to the registration.

## GPA Requirements

A maximum of 6 credits of courses with grades of C or B- may be applied toward the degree. The student must present a GPA of at least 3.00 for all courses submitted for degree conferral.

## Seminar Requirement

Graduate students are expected to participate actively in the exchange of knowledge and ideas in their discipline. Towards this objective, all degree candidates must attend a minimum of 6 graduate seminars approved for the degree program. Approved seminars are publicized on the departmental webpage.

To demonstrate completion of the seminar requirement, students must register for ECE 795 Engineering Seminar in their final semester. The department office will verify that the seminar requirement has been met and submit a grade of S (satisfactory) upon completion of the requirement. Students who have not met the seminar requirement in their final semester must continue to register for ECE 795 Engineering Seminar in subsequent semesters until the requirement is met.

## Thesis/Scholarly Paper Option

To complete the program, students may select one of the following options:

### Thesis Option

Students who select this option must complete:

| Code | Title | Credits |
|---|---|---|
| ECE 799 | Master's Thesis | 6 |
| Coursework | | 24 |
| Total Credits | | 30 |

The thesis is particularly recommended for those students who wish to develop and document their research skills or contemplate subsequent enrollment in a PhD program. The thesis involves a research effort, which is conducted under the guidance of a faculty advisor. Choosing the thesis option requires approval of a full-time faculty member willing to serve as a thesis advisor. The topic and scope of the thesis must be approved by the thesis advisor. In some cases, permission may be granted to complete a portion of the work at the student's place of employment. The final written thesis and oral defense are approved by the student's advisory committee.

This committee consists of at least three full-time faculty members, including two affiliated with the MS in Computer Engineering (http://catalog.gmu.edu/colleges-schools/engineering/electrical-computer/computer-engineering-ms/) Program, one of whom must be from the ECE Department. Thesis students may not register for ECE 798 Research Project. Students must register for at least 3 credits of ECE 799 Master's Thesis for their first thesis semester. Following their first thesis semester, they must register for at least 1 credit of ECE 799 Master's Thesis each fall and spring semester until graduation.

### Scholarly Paper Option

Students who select to complete their degree program with a scholarly paper must:

| Code | Title | Credits |
|---|---|---|
| Complete 30 credits of coursework | | 30 |
| ECE 797 | Scholarly Paper | 0 |
| Enroll in a 600-level or above course requiring a research project | | |
| Write a Scholarly Paper project report and present findings as part of the course requirements | | |
| Total Credits | | 30 |

An acceptable scholarly paper must be technically sound, adhere to accepted formatting standards for technical reports, and contain a significant literature review evidenced by a comprehensive list of cited references.

A list of courses requiring projects that can be used to satisfy the scholarly paper requirement will be published on the department website. Scholarly papers must be individual written project reports – not group projects. To qualify as a scholarly paper, an oral presentation of the project is required. A passing grade for the project, reflecting both the written report and the oral presentation, satisfies the scholarly paper requirement.

A successful scholarly paper will be recorded by awarding a satisfactory (S) grade for ECE 797 Scholarly Paper. Students are eligible to attempt the scholarly paper and register for ECE 797 Scholarly Paper after completion of 18 hours of coursework. Students choosing the scholarly paper option are not eligible for graduation until they have received a final, passing grade for ECE 797 Scholarly Paper.

# Accelerated Master's

# Computer Engineering, BS/Computer Engineering, Accelerated MS

## Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a BS in Computer Engineering (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/computer-engineering-bs/) and an MS in Computer Engineering in an accelerated time-frame after satisfactory completion of a minimum of 144 credits.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

## BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of 3.0.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific prerequisites.

## Accelerated Master's Admission Requirements

Students already admitted in the BAM Pathway will be admitted to the MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form: 3.0 overall GPA, successfully meeting Mason's requirements for undergraduate degree conferral (graduation), and completing the application for graduation.

## Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced standing courses: Students may take up to 12 credits of graduate-level courses that will count as advanced standing (i.e., overlap between the BS/MS program) from the list below: Note that ECE 542 can be used to meet the ECE 465 requirement for the BS in Electrical Engineering program. An additional 9 credits of graduate-level courses from the list below may be selected to substitute in place of the 9 credits of technical electives required for the undergraduate degree:

| Code | Title | Credits |
|---|---|---|
| ECE 505 | Hardware Security | 3 |
| ECE 508 | Internet of Things | 3 |
| ECE 511 | Computer Architecture | 3 |
| ECE 512 | Computer Architecture Security | 3 |
| ECE 516 | Mobile Systems and Applications | 3 |
| ECE 521 | Linear Systems and Control | 3 |
| ECE 527 | Learning From Data | 3 |
| ECE 528 | Introduction to Random Processes in Electrical and Computer Engineering | 3 |
| ECE 530 | Sensor Engineering | 3 |
| ECE 531 | Introduction to Wireless Communications and Networks | 3 |
| ECE 532 | Secure Wireless Communications and Networks | 3 |
| ECE 535 | Digital Signal Processing | 3 |
| ECE 542 | Computer Network Architectures and Protocols | 3 |
| ECE 545 | Digital System Design with VHDL | 3 |
| ECE 552 | Big Data Technologies | 3 |
| ECE 554 | Machine Learning for Embedded Systems | 3 |

| | | |
|---|---|---|
| ECE 555 | GPU Architecture and Programming | 3 |
| ECE 556 | Neuromorphic Computing | 3 |
| ECE 567 | Optical Fiber Communications | 3 |
| ECE 580 | Small Spacecraft Engineering | 3 |
| ECE 590 | Selected Topics in Engineering | 3 |

Selected 600 level courses may be taken as well with permission of an advisor granted before registering for a given course.

Reserve credit courses: Additional courses (up to 6 credits) may be selected from the above list as credits to be put on reserve to be later applied to the graduate program. Students can take these courses while undergraduates but these reserve courses will only count for the graduate degree program.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

### 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. At the completion of MS requirements, a master's degree is conferred.

## Computer Science, BS/Computer Engineering, Accelerated MS

### Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a BS in Computer Science and an MS in Computer Engineering in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

See
AP.6.7 Bachelor's/Accelerated Master's Degrees for policies related to this program.

This accelerated option is offered jointly by the Computer Science Department and the Electrical and Computer Engineering Department.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see
AP.6 Graduate Policies.

### BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of 3.0.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific prerequisites.

### Accelerated Master's Admission Requirements

Students already admitted in the BAM Pathway will be admitted to the MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form: 3.0 overall GPA, successfully meeting Mason's requirements for undergraduate degree conferral (graduation), at least 3 credits of approved advanced standing graduate coursework, and completing the application for graduation.

### Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced standing courses: Students may take up to 12 credits of graduate-level courses that will count as advanced standing (i.e., overlap between the BS/MS program) from the list below:

| Code | Title | Credits |
|---|---|---|
| CS 571 | Operating Systems (to replace CS 471) | 3 |
| CS 580 | Introduction to Artificial Intelligence | 3 |
| CS 583 | Analysis of Algorithms | 3 |
| CS 584 | Theory and Applications of Data Mining | 3 |
| ECE 508 | Internet of Things | 3 |
| ECE 511 | Computer Architecture | 3 |
| ECE 512 | Computer Architecture Security | 3 |
| ECE 516 | Mobile Systems and Applications | 3 |
| ECE 527 | Learning From Data | 3 |
| ECE 542 | Computer Network Architectures and Protocols | 3 |

Reserve credit courses: Additional courses (up to 6 credits) may be selected from the above list as credits to be put on reserve to be later applied to the graduate program. Students can take these courses while undergraduates but these reserve courses will only count for the graduate degree program.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees.

## Cyber Security Engineering, BS/Computer Engineering, Accelerated MS

### Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a BS in Cyber Security Engineering (http://catalog.gmu.edu/colleges-schools/engineering/cyber-security-engineering/cyber-security-engineering-bs/) and an MS in Computer Engineering (http://catalog.gmu.edu/colleges-schools/engineering/electrical-computer/computer-engineering-ms/) in an accelerated time-frame after satisfactory completion of a minimum of 150 credits.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program.

This accelerated option is offered jointly by the Cyber Security Engineering Department and the Electrical and Computer Engineering Department.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).

## BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of 3.0.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

## Accelerated Master's Admission Requirements

Students already admitted in the BAM Pathway will be admitted to the MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form: 3.0 overall GPA, successfully meeting Mason's requirements for undergraduate degree conferral (graduation), and completing the application for graduation.

## Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced standing courses: Students may take up to 6 credits of graduate-level courses that will count as advanced standing (i.e., overlap between the BS/MS program) from the list below:

| Code | Title | Credits |
|---|---|---|
| ECE 505 | Hardware Security | 3 |
| ECE 508 | Internet of Things | 3 |
| ECE 511 | Computer Architecture | 3 |
| ECE 512 | Computer Architecture Security | 3 |
| ECE 542 | Computer Network Architectures and Protocols | 3 |

These courses may be used as technical electives in the Cyber Security Engineering, BS program.

Reserve credit courses: Additional courses (up to 6 credits) may be selected from the above list as credits to be put on reserve to be later applied to the graduate program. Students can take these courses while undergraduates but these reserve courses will only count for the graduate degree program.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

# Electrical Engineering, BS/Computer Engineering, Accelerated MS

## Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a BS in Electrical Engineering (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/electrical-engineering-bs/) and an MS in Computer Engineering in an accelerated time-frame after satisfactory completion of a minimum of 139 credits.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

## BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of 3.0.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

## Accelerated Master's Admission Requirements

Students already admitted in the BAM Pathway will be admitted to the MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form: 3.0 overall GPA, successfully meeting Mason's requirements for undergraduate degree conferral (graduation), and completing the application for graduation.

## Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced standing courses: Students may take up to 12 credits of graduate-level courses that will count as advanced standing (i.e., overlap between the BS/MS program) from the list below. Note that ECE 587 can be used to meet the ECE 433 requirement for the BS in Electrical Engineering program. An additional 9 credits of graduate-level courses from the list below may be selected to substitute in place of the 9 credits of technical electives required for the undergraduate degree.

| Code | Title | Credits |
|---|---|---|
| ECE 505 | Hardware Security | 3 |
| ECE 508 | Internet of Things | 3 |
| ECE 511 | Computer Architecture | 3 |
| ECE 512 | Computer Architecture Security | 3 |
| ECE 516 | Mobile Systems and Applications | 3 |
| ECE 521 | Linear Systems and Control | 3 |
| ECE 527 | Learning From Data | 3 |
| ECE 528 | Introduction to Random Processes in Electrical and Computer Engineering | 3 |
| ECE 530 | Sensor Engineering | 3 |
| ECE 531 | Introduction to Wireless Communications and Networks | 3 |
| ECE 532 | Secure Wireless Communications and Networks | 3 |

| | | |
|---|---|---|
| ECE 535 | Digital Signal Processing | 3 |
| ECE 542 | Computer Network Architectures and Protocols | 3 |
| ECE 545 | Digital System Design with VHDL | 3 |
| ECE 552 | Big Data Technologies | 3 |
| ECE 554 | Machine Learning for Embedded Systems | 3 |
| ECE 555 | GPU Architecture and Programming | 3 |
| ECE 556 | Neuromorphic Computing | 3 |
| ECE 567 | Optical Fiber Communications | 3 |
| ECE 580 | Small Spacecraft Engineering | 3 |
| ECE 590 | Selected Topics in Engineering | 3 |

Selected 600 level courses may be taken as well with permission of an advisor granted before registering for a given course.

Reserve credit courses: Additional courses (up to 6 credits) may be selected from the above list as credits to be put on reserve to be later applied to the graduate program. Students can take these courses while undergraduates but these reserve courses will only count for the graduate degree program.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

## 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. At the completion of MS requirements, a master's degree is conferred.