

# SYSTEMS ENGINEERING, MS

**Banner Code:** EC-MS-SYST

## Academic Advising

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Systems engineers are the visionaries who take a global perspective of the system. Whereas discipline-specific engineers deal with system components, the systems engineer is concerned with the integration of these components and the overall success of the system throughout its life cycle. Systems engineers focus on needs and requirements, design, production, deployment, operation, maintenance, refinement, and retirement of systems, considering multiple objectives and constraints from different stakeholder groups. Systems engineering comprises product, process, and resource management and focuses on architecture, human factors, decision support, performance and evaluation, and management. Our educational and research program reflects the systems engineer's unique perspective on the system life cycle.

Mason's graduate program in Systems Engineering recognizes the importance of balancing an education in quantitative models and engineering tools with a proper understanding of the systems perspective. Concentration areas include Advanced Transportation Systems, Command, Control, Communications, Computing, Intelligence & Cyber, Digital Engineering and System Architecture, Energy Systems, Financial Systems Engineering, Systems Engineering and Data Analytics, Systems Engineering of Software-Intensive Systems and Systems Management.

The graduate program leading to the Master of Science in Systems Engineering emphasizes both analytical and practical aspects of engineering complex systems. Students are expected to demonstrate proficiency in using qualitative and quantitative tools relevant to systems engineering practice. The program also prepares students for careers in research and development and for pursuing advanced graduate study leading to the PhD degree in Systems Engineering and Operations Research (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-operations-research-phd/>).

## Admissions & Policies

### Admissions

#### Foundation and Admission Requirements

Each applicant for the MS program should meet the following entrance requirements:

1. Have a baccalaureate degree from an accredited institution in engineering, mathematics, computer science, physical sciences, economics, or a related field.
2. Have completed courses in multivariate calculus, matrix algebra, differential equations, applied probability and statistics, and a computer language.

3. Provide evidence of satisfactory educational achievement in at least one of the following forms: a GPA of at least 3.00 as an undergraduate or an acceptable GPA in graduate courses. International students must also achieve satisfactory scores on the Graduate Record Examination (GRE).
4. Have achieved a satisfactory score on the TOEFL examination for non-native English speakers.
5. Have two letters of recommendation submitted by former professors or supervisors.

## Policies

### Advising & Plan of Study

All entering systems engineering students should attend an orientation meeting. Each student is assigned a faculty advisor upon acceptance. Students must meet with their advisors during their first semester and design an approved plan of study. Students are encouraged to seek out their advisor when questions arise and when their plan of study needs to be revised. Any changes to the plan of study must be approved by the faculty advisor and remain on file with the department. Selection of a concentration (if any) within the program must be submitted to the Registrar, with departmental approval, via formal paperwork. It is the student's responsibility to ensure that their intended concentration is reflected on their transcript prior to graduation.

## Requirements

### Degree Requirements

Total credits: 30-33

To obtain the Master of Science degree, students must complete a minimum of 30 semester hours of graduate level courses that consists of five core courses, three concentration courses, an elective, and a systems engineering project.

Students must have a working background in engineering mathematics and computer systems. A student lacking these foundations may be required to take one or more foundation courses. The department offers SYST 500 Quantitative Foundations for Systems Engineering as an intensive review of undergraduate engineering mathematics, including matrix algebra, calculus, differential equations, probability and statistics. Students who have not completed a two-semester calculus sequence and matrix algebra will be required to complete these courses prior to taking SYST 500.

Approved basic methods and concentration courses for the eight concentration areas are listed below. Students are expected to select a set of concentration courses that constitute a clearly defined focus. These courses must be approved by the student's advisor. Each student is required to have a current plan of study on file with the Systems Engineering and Operations Research Department.

Candidates for the MS must have a minimum GPA of 3.00 in coursework applied to the degree, which may include no more than 6 credits of C. The GPA calculation excludes all transfer courses and Mason nondegree studies credits not formally approved for the degree.

## Core Courses

Code	Title	Credits
Students must complete the following five courses:		15
SYST 505	Systems Engineering Principles <sup>1</sup>	
SYST 510	Systems Definition and Cost Modeling	
SYST 520	System Engineering Design	
SYST 530	Systems Engineering Management I	
SYST 611	System Methodology and Modeling	
Total Credits		15

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SYST 505 may be replaced by an approved elective for students who have work experience in systems engineering or who have been enrolled in the undergraduate BSSE program at Mason. SYST 505, if taken, must be taken in the first semester of enrollment in the MSSE program.

## Project or Thesis

Students must complete three credit hours of SYST 699 Masters Project. Students in this course work in teams on an approved applied project. A project report is submitted at the end of the semester, and a final project presentation is made to the entire faculty of the SEOR Department.

Students with the consent of a faculty advisor and departmental approval, may be approved to complete a thesis.

Code	Title	Credits
SYST 699	Masters Project	3
Total Credits		3

## Concentrations

Students must complete 3 courses (9 credits) from their area of emphasis. Students may select one of the following eight areas of concentration, or may create their own emphasis area with the approval of their advisor and the Department Chair

- Advanced Transportation Systems (ATS)
- Command, Control, Communications, Computing, Intelligence & Cyber (C4I & Cyber)
- Digital Engineering and System Architecture (DESA)
- Energy Systems (NRGS)
- Financial Systems Engineering (FNSE)
- Systems Engineering and Data Analytics (SEDA)
- Systems Engineering of Software-Intensive Systems (SESI)
- Systems Management (SMG)

### Concentration in Advanced Transportation Systems (ATS)

The air transportation system is among the most complex networked systems. This concentration is designed to provide students with the skills to address the next generation of challenges of the air transportation system. Topics addressed include congestion and safety of the national air space, economic and human factors, impact of technology innovation, and public policy. The program emphasizes design, modeling, and analysis to support decision making for government and the aviation industry.

Code	Title	Credits
Required Coursework		
SYST 560	Introduction to Air Traffic Control	3
SYST 660	Air Transportation Systems Modeling	3
Select one of the following courses:		3
ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	
OR 531	Introduction to Analytics and Modeling	
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	
OR 568	Applied Predictive Analytics	
or SYST 568	Applied Predictive Analytics	
SYST 573	Decision and Risk Analysis	
SYST 584	Heterogeneous Data Fusion	
SYST 664	Bayesian Inference and Decision Theory	
One free elective, chosen under advisement:		3
Total Credits		12

### Concentration in Command, Control, Communications, Computing, Intelligence, and Cyber (C4I)

C4I & Cyber systems are concerned with gathering, retrieving, analyzing, and disseminating time-sensitive information to achieve mission-critical objectives. These systems support military operations across the spectrum of conflict, intelligence operations, transportation monitoring, emergency response, drug interdiction, and law enforcement, among others. C4I & Cyber systems include the equipment, people, and procedures necessary to accomplish the mission. The equipment may include a variety of sensors, communications systems, and information processing and decision-support systems.

The program focuses on the analysis, design, development, and management of C4I & Cyber systems. Topics addressed include C4I & Cyber architectures and software, communications, decision support, modeling and simulation, and sensor data fusion.

Code	Title	Credits
Select one of the following courses:		
SYST 680	Principles of Command, Control, Communications, Computing, and Intelligence (C4I)	3
or SYST 687	Cyber Security Systems Engineering	
Select one of the following courses:		
OR 542	Operations Research: Stochastic Models	3
or ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	
SYST 584	Heterogeneous Data Fusion	3
One free elective, chosen under advisement:		3
Total Credits		12

### Concentration in Digital Engineering and System Architecture (DESA)

There is much interest today in the engineering of systems that comprise other component systems, where each of the component systems serves organizational and human purposes. These systems families are often categorized as systems of systems, federations of systems, or coalitions of systems. The design of architectures is a major ingredient in the design of systems families. Furthermore, it provides the

conceptual basis for achieving system integration. This concentration covers the formulation of the system integration problem, definition of architecture frameworks, use of structured analysis and object-oriented methodologies for the design of architectures, modeling and simulation for the evaluation of architectures, and approaches to integration. Both defense and industrial applications are considered.

Code	Title	Credits
Required Coursework		
SYST 618	Model-based Systems Engineering	3
SYST 621	Systems Architecture Design	3
Select one of the following courses:		3
ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	
OR 531	Introduction to Analytics and Modeling	
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	
OR 568	Applied Predictive Analytics	
or SYST 568	Applied Predictive Analytics	
SYST 573	Decision and Risk Analysis	
SYST 584	Heterogeneous Data Fusion	
SYST 664	Bayesian Inference and Decision Theory	
One free elective, chosen under advisement:		3
Total Credits		12

### Concentration in Energy Systems (NRGS)

With the rising economic and environmental costs to power homes, businesses and the transportation systems that move people and goods from place to place, innovative solutions are required to meet the world's expanding energy needs. Students completing the energy systems concentration will build upon a foundation in systems engineering design by incorporating physical principles of thermal fluid energy transfer into system models. Students will develop the tools to model and analyze generation, transmission, and utilization systems in steady and dynamic operation. Students will optimize these systems by considering physical principles, economics, local policy and security concerns. Graduates will be able to apply their expertise to work with: traditional power generation facilities; renewable energy integration; national, local, and smart grids; mechanical and electrical energy storage systems; utilization of energy in building and transportation systems.

Code	Title	Credits
Required Coursework		
ME 521	Energy Transfer	3
ME 531	Energy Transmission	3
ME 541	Power Generation	3
One free elective, chosen under advisement:		3
Total Credits		12

### Concentration in Financial Systems Engineering (FNSE)

Financial engineering is a cross-disciplinary field which relies on mathematical finance, numerical methods, and computer simulations to make trading, hedging, and investment decisions, as well as facilitating the risk management of those decisions. While mathematics is indispensable in financial engineering, the concentration will try best to focus on the concepts and ideas of finance, while limiting the math within a scope acceptable to most students in engineering.

Code	Title	Credits
Required Coursework		
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	3
SYST 538	Analytics for Financial Engineering and Econometrics	3
Select one of the following:		3
SYST 548	Technologies and Security for Cryptocurrencies and Financial Transactions	
SYST 688	Financial Systems Engineering II: Derivative Products and Risk Management	
One free elective, chosen under advisement:		3
Total Credits		12

### Concentration in Systems Engineering and Data Analytics (SEDA)

Systems engineers must address a broad range of issues relevant to the design, implementation, analysis, and management of systems. This concentration provides methodological tools that can be applied to the systems engineering process. Areas of focus include decision support systems, distributed intelligent systems, knowledge-based planning systems, network systems, probabilistic reasoning systems, sensor fusion systems, and optimization methods.

Code	Title	Credits
Required Coursework		
OR 531	Introduction to Analytics and Modeling	3
SYST 568	Applied Predictive Analytics	3
SYST 573	Decision and Risk Analysis	3
One free elective, chosen under advisement:		3
Total Credits		12

### Concentration in Systems Engineering of Software-Intensive Systems (SESI)

This concentration addresses the software component of the systems engineering life cycle. It specifically covers the allocation of system requirements to software. Practitioners are concerned with the theoretical and practical aspects of technology, cost, and the social effect of computer systems that are reliable, maintainable, secure, efficient, and cost effective. The program emphasizes the integration of hardware, software, and firmware, and the management of these complex computer systems over their life cycle through systems engineering methods, tools, and processes.

Code	Title	Credits
Required Coursework		
SYST 542	Decision Support Systems Engineering	3
SYST 618	Model-based Systems Engineering	3
Select one from the following:		3
ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	
OR 531	Introduction to Analytics and Modeling	
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	
OR 568	Applied Predictive Analytics	

or SYST 568	Applied Predictive Analytics	
SYST 573	Decision and Risk Analysis	
SYST 584	Heterogeneous Data Fusion	
SYST 664	Bayesian Inference and Decision Theory	
One free elective, chosen under advisement:		3
Total Credits		12

### Concentration in Systems Management (SMG)

The management aspect of systems engineering involves tracking and control of system development through the major phases of the system lifecycle, identifying and resolving problems to minimize their effect on cost, schedule, or performance, and iteratively improving product and process. This concentration emphasizes the theory and practice of systems management and prepares students for careers in management.

Code	Title	Credits
Required Coursework		
SYST 514	Systems Thinking	3
SYST 618	Model-based Systems Engineering	3
SYST 630	Systems Engineering Management II	3
One free elective, chosen under advisement:		3
Total Credits		12

### Online MS in Systems Engineering

The graduate program leading to the Master of Science in Systems Engineering can be completed entirely online. The delivery mode for the online program is asynchronous, but many courses are also offered in synchronous mode. Students may also plan a program with some courses taken online and some in the classroom. The following courses are offered online at least once a year: SYST 500 Quantitative Foundations for Systems Engineering, SYST 505 Systems Engineering Principles, SYST 510 Systems Definition and Cost Modeling, SYST 520 System Engineering Design, SYST 530 Systems Engineering Management I, SYST 542 Decision Support Systems Engineering, SYST 573 Decision and Risk Analysis, SYST 611 System Methodology and Modeling, SYST 618 Model-based Systems Engineering, SYST 621 Systems Architecture Design, SYST 630 Systems Engineering Management II, SYST 699 Masters Project, OR 531 Introduction to Analytics and Modeling, OR 541 Operations Research: Deterministic Models and OR 542 Operations Research: Stochastic Models.

## Accelerated Master's

### Bioengineering, BS/Systems Engineering, Accelerated MS

#### Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Bioengineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/bioengineering/bioengineering-bs/>) and a Systems Engineering, MS in an accelerated time-frame after satisfactory completion of a minimum of 140 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory

performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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 (<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.

Bioengineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/bioengineering/bioengineering-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH and PHYS requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the Bioengineering courses given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Bioengineering course list and select the remaining courses from the Systems Engineering and Operations Research course list



given below. Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.

- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select from the following Bioengineering courses:

Code	Title	Credits
Required course:		
BENG 575	Intellectual Property, Regulatory Concepts and Product Development	
Select at most one from the following Bioengineering courses:		
BENG 501	Bioengineering Research Methods	
BENG 514	Pathophysiology and the Role of New Technologies in Human Diseases	
BENG 520	Biomedical Data Analytics	
BENG 521	Cell and Tissue Engineering	
or BENG 541	Biomaterials	
BENG 526	Neural Engineering	
BENG 537	Medical Image Processing	
or BENG 538	Medical Imaging	

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
SYST 510	Systems Definition and Cost Modeling (Core)	
SYST 514	Systems Thinking	
SYST 520	System Engineering Design (Core)	
SYST 530	Systems Engineering Management I (Core)	
SYST 542	Decision Support Systems Engineering	
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST 560	Introduction to Air Traffic Control	
SYST 563	Evidence-Based Systems Engineering	
SYST 568	Applied Predictive Analytics	
SYST 584	Heterogeneous Data Fusion	
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

## 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.

## Civil and Infrastructure Engineering, BS/ Systems Engineering, Accelerated MS Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Civil and Infrastructure Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/civil-environmental-infrastructure/civil-infrastructure-engineering-bs/>) and a Systems Engineering, MS in an accelerated time-frame after satisfactory completion of a minimum of 139 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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.

Civil and Infrastructure Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/civil-environmental-infrastructure/civil-infrastructure-engineering-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH and PHYS requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the

BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/ Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the Civil and Infrastructure Engineering courses given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Civil and Infrastructure Engineering course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.
- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Civil and Infrastructure Engineering courses:

Code	Title	Credits
CEIE 501	Sustainable Development	
CEIE 512	Structural Steel Design	
CEIE 532	Foundation Design	
CEIE 535	Engineering Geology	
CEIE 540	Water Supply and Distribution	
CEIE 542	Open Channel Flow	

CEIE 550	Environmental Engineering Systems
CEIE 553	Water and Wastewater Treatment Processes
CEIE 557	Remote Monitoring Techniques for Civil Engineering Applications
CEIE 561	Traffic Engineering
CEIE 562	Urban Transportation Planning
CEIE 571	Construction Administration
CEIE 572	Building Information Modeling
CEIE 573	Legal Aspects of the Construction Process
CEIE 574	Construction Computer Application and Informatics
CEIE 576	Construction Cost Estimating

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
SYST 510	Systems Definition and Cost Modeling (Core)	
SYST 514	Systems Thinking	
SYST 520	System Engineering Design (Core)	
SYST 530	Systems Engineering Management I (Core)	
SYST 542	Decision Support Systems Engineering	
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST 560	Introduction to Air Traffic Control	
SYST 563	Evidence-Based Systems Engineering	
SYST 568	Applied Predictive Analytics	
SYST 584	Heterogeneous Data Fusion	
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

## 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 Engineering, BS/Systems Engineering, Accelerated MS

## Overview

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

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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 (<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.

Computer Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/computer-engineering-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH, PHYS 160/161, and PHYS 260/261 requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four

courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the Electrical and Computer Engineering courses given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Electrical and Computer Engineering course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. Note that ECE 542 can be used to meet the ECE 465 requirement for the Computer Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/computer-engineering-bs/>) program. Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.
- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Electrical and Computer Engineering courses:

Code	Title	Credits
ECE 505	Hardware Security	
ECE 508	Internet of Things	
ECE 511	Computer Architecture	
ECE 512	Computer Architecture Security	
ECE 516	Mobile Systems and Applications	
ECE 521	Linear Systems and Control	
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 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 555	GPU Architecture and Programming	
ECE 556	Neuromorphic Computing	
ECE 567	Optical Fiber Communications	

ECE 580	Small Spacecraft Engineering
ECE 590	Selected Topics in Engineering

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
SYST 510	Systems Definition and Cost Modeling (Core)	
SYST 520	System Engineering Design (Core)	
SYST 530	Systems Engineering Management I (Core)	
SYST 542	Decision Support Systems Engineering	
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST 568	Applied Predictive Analytics	
SYST 584	Heterogeneous Data Fusion	
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

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/#text>).

## 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/Systems Engineering, Accelerated MS

### Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Computer Science, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/computer-science-bs/>) and a Systems Engineering, MS in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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.

Computer Science, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/computer-science-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH and Science requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course:** Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the combined Computer Science course list and Systems Engineering and Operations Research course list given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Computer Science course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.
- Any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.



- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Computer Science courses:

Code	Title	Credits
CS 540	Language Processors	
CS 550	Database Systems	
CS 551	Computer Graphics	
CS 555	Computer Communications and Networking	
CS 571	Operating Systems	
CS 580	Introduction to Artificial Intelligence	
CS 583	Analysis of Algorithms	
CS 584	Theory and Applications of Data Mining	

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

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/#text>).

## 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.

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

### Overview

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

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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.

Cyber Security Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/cyber-security-engineering/cyber-security-engineering-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH and PHYS requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the combined Cyber Security Engineering course list and Systems Engineering and Operations Research course list given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Cyber Security Engineering course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. Students are highly recommended

to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.

- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Cyber Security Engineering courses:

Code	Title	Credits
CYSE 570	Fundamentals of Operating Systems	
CYSE 580	Hardware and Cyber Physical Systems	

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
SYST 510	Systems Definition and Cost Modeling (Core)	
SYST 514	Systems Thinking	
SYST 520	System Engineering Design (Core)	
SYST 530	Systems Engineering Management I (Core)	
SYST 542	Decision Support Systems Engineering	
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST 548	Technologies and Security for Cryptocurrencies and Financial Transactions	
SYST 560	Introduction to Air Traffic Control	
SYST 563	Evidence-Based Systems Engineering	
SYST 568	Applied Predictive Analytics	
SYST 584	Heterogeneous Data Fusion	
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

## 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.

## Electrical Engineering, BS/Systems Engineering, Accelerated MS

### Overview

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

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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 AP6 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.

Electrical Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/electrical-engineering-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH, PHYS 160/161, and PHYS 260/261 requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the Electrical and Computer Engineering courses given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Electrical and Computer Engineering course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. Note that ECE 587 can be used to meet the ECE 433 requirement for the Electrical Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/electrical-engineering-bs/>) program. Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.
- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Electrical and Computer Engineering courses:

Code	Title	Credits
ECE 505	Hardware Security	
ECE 508	Internet of Things	
ECE 511	Computer Architecture	
ECE 513	Applied Electromagnetic Theory	
ECE 514	Grid Digitization and Automation	
ECE 516	Mobile Systems and Applications	
ECE 517	Cyber Infrastructure of the Smart Grid	
ECE 518	Power System Protection and Control	
ECE 519	Power Electronics for Modern Power Systems	
ECE 521	Linear Systems and Control	
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 532	Secure Wireless Communications and Networks
ECE 535	Digital Signal Processing
ECE 538	Medical Imaging
ECE 539	Neural Engineering
ECE 542	Computer Network Architectures and Protocols
ECE 550	System Engineering Design
ECE 552	Big Data Technologies
ECE 565	Introduction to Optical Electronics
ECE 567	Optical Fiber Communications
ECE 580	Small Spacecraft Engineering
ECE 584	Semiconductor Device Fundamentals
ECE 586	Digital Integrated Circuits
ECE 587	Design of Analog Integrated Circuits
ECE 590	Selected Topics in Engineering

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
SYST 510	Systems Definition and Cost Modeling (Core)	
SYST 520	System Engineering Design (Core)	
SYST 530	Systems Engineering Management I (Core)	
SYST 542	Decision Support Systems Engineering	
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST 568	Applied Predictive Analytics	
SYST 584	Heterogeneous Data Fusion	
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

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/#text>).

## 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.

## Mechanical Engineering, BS/Systems Engineering, Accelerated MS

### Overview

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

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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.

Mechanical Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/mechanical-engineering-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH and PHYS requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of

the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the combined Mechanical Engineering course list and Systems Engineering and Operations Research course list given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Mechanical Engineering course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.
- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Mechanical Engineering courses:

Code	Title	Credits
ME 521	Energy Transfer	
ME 531	Energy Transmission	
ME 541	Power Generation	
ME 542	Energy Utilization	

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
SYST 510	Systems Definition and Cost Modeling (Core)	
SYST 514	Systems Thinking	
SYST 520	System Engineering Design (Core)	
SYST 530	Systems Engineering Management I (Core)	
SYST 542	Decision Support Systems Engineering	
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST 560	Introduction to Air Traffic Control	
SYST 563	Evidence-Based Systems Engineering	
SYST 568	Applied Predictive Analytics	



SYST 584	Heterogeneous Data Fusion
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

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/#text>).

## 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.

## Statistics, BS/Systems Engineering, Accelerated MS

### Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Statistics, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/statistics/statistics-bs/>) and a Systems Engineering, MS in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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.

Statistics, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/statistics/statistics-bs/>) students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course:** Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the combined Statistics course list and Systems Engineering and Operations Research course list given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Statistics course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.
- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select from the following Statistics courses:

Code	Title	Credits
STAT 544	Applied Probability	
STAT 554	Applied Statistics I	

Select the remaining from the following Systems Engineering and Operations Research courses:

Code	Title	Credits
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST/OR 568	Applied Predictive Analytics	
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

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/#text>).

## 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.

## Systems and Industrial Engineering BS/ Systems Engineering, Accelerated MS Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Systems and Industrial Engineering, BS and a Systems Engineering, MS in an accelerated time-frame after satisfactory completion of a minimum of 141 credits.

Admitted students are able to use up to 12 credits of approved advanced standing graduate courses in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the advanced standing graduate courses, the courses are applied to partial satisfaction of requirements for the master's program.

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.

Systems and Industrial Engineering, BS students will be considered for admission into the BAM Pathway after completion of a minimum of 60

credits with an overall GPA of at least 3.3, and completion of all MATH and PHYS requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course:** Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree.

These courses may be chosen from the list of graduate courses in the following table. For Systems and Industrial Engineering, BS students, these graduate courses replace the corresponding undergraduate courses listed in the table. The undergraduate version of these courses may *not* be applied toward the Systems Engineering, MS.

Undergraduate	Graduate	
OR 441	OR 541	Credit may not be received for both courses.
OR 442	OR 542	Credit may not be received for both courses.
SYST 414	SYST 514	The course applies only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 420	SYST 521/OR 643	Credit may not be received for both courses.
SYST 438	SYST 538	The course applies only to certain concentrations in the graduate program; credit may not be received for both courses.

SYST 448	SYST 548	The course applies only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 460	SYST 560	The course applies only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 461	SYST 660	The course applies only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 468	SYST/OR 568	The course applies only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 473	SYST 573	Credit may not be received for both courses.
SYST 488	SYST 588	The course applies only to certain concentrations in the graduate program; credit may not be received for both courses.

Any course chosen from the above course list may be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program. Any other 500-level course may be applied to both the undergraduate and graduate degrees with approval of the advisor and SEOR department chair. Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

## 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.

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

### Overview

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

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) 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.

Mason undergraduate students majoring in both engineering and non-engineering disciplines will be considered for admission into the BAM Pathway if 1) such an accelerated Systems Engineering, MS pathway is allowable from the student's BS program, which will be determined by the academic advisors of both the BS and MS programs and by the SEOR department chair, 2) they have completed of a minimum of 60 credits with an overall GPA of at least 3.3, and 3) they have completed all MATH and PHYS requirements.

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

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/systems-operations-research/systems-engineering-ms/>) program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- 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 course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS. Credit may not be received for both the undergraduate and graduate version of these courses.
- Except for the courses marked as core, any course chosen from the course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS program.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

The courses may be chosen from the list of Systems Engineering and Operations Research graduate courses in the following table.

Code	Title	Credits
SYST 510	Systems Definition and Cost Modeling (Core)	
SYST 514	Systems Thinking	
SYST 520	System Engineering Design (Core)	
SYST 530	Systems Engineering Management I (Core)	
SYST 542	Decision Support Systems Engineering	
SYST 573	Decision and Risk Analysis	
SYST 538	Analytics for Financial Engineering and Econometrics	
SYST 560	Introduction to Air Traffic Control	
SYST 563	Evidence-Based Systems Engineering	
SYST 568	Applied Predictive Analytics	
SYST 584	Heterogeneous Data Fusion	
SYST 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	

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

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

## 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.