SYSTEMS ENGINEERING, BS

Banner Code: VS-BS-SYST

Academic Advising

2100 Nguyen Engineering Building
Fairfax Campus

Phone: 703-993-1670
Email: seor@gmu.edu
Website: http://seor.gmu.edu/undergrad.html

The program leading to the BS in Systems Engineering prepares students for a professional career in systems engineering. The program reflects the systems engineer's unique perspective, which considers all aspects of a system throughout its lifetime. Mason's systems engineering program is interdisciplinary, drawing from engineering, computer science, operations research, psychology, and economics. The core systems engineering courses tie these diverse threads to provide a global understanding of how individual engineering disciplines fit into the development of complex, large-scale systems. Students gain depth in a technical area by selecting a sequence of technical electives that constitute an emphasis. Students choose their own emphasis with the help of their advisor. A year-long senior design project provides hands-on experience in applying various systems engineering methods and tools. In the first two years, students obtain a basic foundation in mathematics, natural sciences, computing, writing, humanities, arts, and social sciences. The systems engineering program builds on this foundation, teaching theoretical knowledge, practical skills, and the ability to apply systems thinking to problems. Teamwork, collaborative learning, analytical skills, practical problem solving, and oral and written communication are strongly stressed.

Mission

The mission of the undergraduate program is to equip students with the ability to participate productively in the many professional activities associated with engineering a trustworthy system that satisfies client needs. The term "system" is interpreted broadly to include information, telecommunication, defense, health delivery, transportation, energy or manufacturing systems, as well as corporate processes.

Objectives

The program educational objectives of the Systems Engineering program are what we expect our students to attain within three to five years of graduation. Graduates earning the Bachelor of Science degree in Systems Engineering at George Mason University will:

- Use critical thinking, quantitative methods, and systems thinking to contribute to solutions for global societal challenges.
- Apply systems engineering methods, processes, models and tools to the engineering of complex systems.
- Advance the objectives of their organizations, profession, and society in a rapidly changing world.

Accreditation

The bachelor's program in Systems Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. The requirements for the degree may be satisfied through part-time enrollment.

Admissions & Policies

Policies

Change of Major

See Change of Major for more information.

Grade Requirements

Students in the Systems Engineering, BS program must complete all mathematics, science, and VSE courses with a grade of C or better.

Termination from the Major

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

In addition, students in the Volgenau School with evidence of continued failure to make adequate progress toward declaring or completing a Volgenau School major will also be terminated. Adequate progress is determined by the major program. For more information, see AP.5.2.4 Termination from the Major (https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-2-4).

Once a student has attempted one of these courses twice unsuccessfully, the third attempt must be no later than the next semester of enrollment, excluding summers. Failure to take the course at that time will result in termination from the major. A third attempt of a Volgenau School of Engineering course requires support by the student's major department as well as permission by the department offering the course. This permission is not guaranteed. If the student is unable to take the course when required, the student may request an extension to a future semester; extensions require approval of the student's advisor, their department, and the Associate Dean for Undergraduate Programs. The deadline for extension requests is the add deadline for the semester in which the course is required.

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

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

Requirements

Degree Requirements

Total credits: 123

Mathematics and Statistics

Code	Title	Credits
MATH 113	Analytic Geometry and Calculus I (Mason Core)	4
MATH 114	Analytic Geometry and Calculus II	4
MATH 203	Linear Algebra	3
MATH 213	Analytic Geometry and Calculus III	3
MATH 214	Elementary Differential Equations	3
STAT 344	Probability and Statistics for Engineers and Scientists I	3
STAT 354	Probability and Statistics for Engineers and Scientists II	3
Total Credits		23

Natural Science

Code	Title	Credits
PHYS 160 & PHYS 161	University Physics I (Mason Core) and University Physics I Laboratory (Mason Core)	4
PHYS 260 & PHYS 261	University Physics II (Mason Core) and University Physics II Laboratory (Mason Core)	4
Select 4 credits from the following: [1]		4
PHYS 262 & PHYS 263	University Physics III (Mason Core) and University Physics III Laboratory (Mason Core)	
BIOL 213	Cell Structure and Function (Mason Core)	
CHEM 211 & CHEM 213	General Chemistry I (Mason Core) and General Chemistry Laboratory I (Mason Core)	
CHEM 271 & CHEM 272	General Chemistry for Engineers Lecture (Mason Core) and General Chemistry for Engineers Lab (Mason Core)	
Total Credits		12

[1] Students who select the Bioengineering technical emphasis area are strongly encouraged to take BIOL 213 Cell Structure and Function (Mason Core). Students who select the Environmental Engineering technical emphasis area are strongly encouraged to take Chemistry. Both lecture and laboratory must belong to the same natural science subject. Students are not permitted to take PHYS 262 University Physics III (Mason Core) and CHEM 213 General Chemistry Laboratory I (Mason Core) or CHEM 211 General Chemistry I (Mason Core) and PHYS 263 University Physics III Laboratory (Mason Core). Both lecture and laboratory must belong to the same natural science subject.

Computing

Code	Title	Credits
Select from options below:		7
CDS 130 or CS 112	Computing for Scientists (Mason Core) Introduction to Computer Programming (Mason Core)	
and		
SYST 230	Object-oriented Modeling and Design	
or CS 211	Object-Oriented Programming	
Total Credits		7

Communication and Economics

Code	Title	Credits
COMM 100 or COMM 101	Public Speaking (Mason Core) Fundamentals of Communication (Mason Core)	3
ECON 103	Contemporary Microeconomic Principles (Mason Core)	3
Total Credits		6

Engineering

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

Systems Engineering

Students must complete each of these courses with a grade of C or better.

Code	Title	Credits
SYST 101	Understanding Systems Engineering	3
SYST 210	Systems Design	3
SYST 220	Dynamical Systems I	3
SYST 221	Systems Modeling Laboratory	1
SYST 320	Dynamical Systems II	3
SYST 330	Systems Methods	3
SYST 335	Discrete Systems Modeling and Simulation	3
SYST 371	Systems Engineering Management	3
SYST 395	Applied Systems Engineering	3
SYST 470	Human Factors Engineering	3
SYST 473	Decision and Risk Analysis	3
SYST 489	Senior Seminar	3
SYST 490	Senior Design Project I	3
SYST 495	Senior Design Project II (Mason Core)	3
OR 441	Deterministic Operations Research	3
OR 442	Stochastic Operations Research	3
Select 3 approved technical electives selected from one of the Technical Emphasis Areas below		9
Total Credits		55

Additional Mason Core

Students must complete all Mason Core requirements not fulfilled by major requirements.

Code	Title	Credits
English (6 credits)		6
ENGH 100 or ENGH 101	Composition for Multilingual Writers (Mason Core) Composition (Mason Core)	
ENGH 302	Advanced Composition (Mason Core) [1]	
Literature		3
Arts		3
Western Civilization/World History		3

Global Understanding	3
Total Credits	18

[1] Must complete natural science and technology section.

Technical Emphasis Areas

The systems engineering program requires 9 credits of technical electives. Students must select one of the following technical emphases, each containing three courses. Students must complete each of these courses with a grade of C oir better.

Aviation Systems

Code	Title	Credits
SYST 420	Network Analysis	3
SYST 460	Introduction to Air Traffic Control	3
SYST 461	Air Transportation System Engineering	3
Total Credits		9

Bioengineering

Code	Title	Credits
BENG 313	Physiology for Engineers	3
Select two from the following:		6
BENG 304	Modeling and Control of Physiological Systems	
BENG 406	Introduction to Biomechanics	
BENG 420	Biomedical Data Analytics	
Total Credits		9

Control Systems

Code	Title	Credits
ECE 201	Introduction to Signals and Systems	3
ECE 220	Continuous-Time Signals and Systems	3
SYST 421	Classical Systems and Control Theory	3
Total Credits		9

Computer Network Systems

Code	Title	Credits
SYST 420	Network Analysis	3
ECE 465	Computer Networking Protocols	3
TCOM 500	Modern Telecommunications	3
Total Credits		9

Data Analytics

Code	Title	Credits
SYST 468	Applied Predictive Analytics	3
IT 214	Database Fundamentals	3
STAT 463	Introduction to Exploratory Data Analysis	3
or SYST 438	Analytics for Financial Engineering and Econometrics	
Total Credits		9

Environmental Engineering

Code	Title	Credits
CEIE 240	Hydraulics	3
CEIE 355	Environmental Engineering and Science	3
CEIE 450	Environmental Engineering Systems	3
or CEIE 453	Water and Wastewater Treatment Processes	
Total Credits		9

Financial Engineering

Code	Title	Credits
SYST 438	Analytics for Financial Engineering and Econometrics	3
SYST 488	Financial Systems Engineering	3
And choose one of the following:		3
STAT 463	Introduction to Exploratory Data Analysis	
STAT 455	Experimental Design	
SYST 468	Applied Predictive Analytics	
MBUS 304	Entrepreneurship: Starting and Managing a New Enterprise	
Total Credits		9

Mechanical Engineering

Code	Title	Credits
Select one of the following options:		9
Option 1: Mechanical Design		
ME 211	Statics	
or CEIE 210	Statics	
ME 212	Solid Mechanics	
or CEIE 310	Mechanics of Materials	
ME 341	Design of Mechanical Elements	
or ME 231	Dynamics	
Option 2: Thermal Fluids		
ME 221	Thermodynamics	
ME 322	Fluid Mechanics	
ME 323	Heat Transfer	
or ME 342	Design of Thermal Systems	
Some of the courses listed above have additional prerequisites. Students should pay careful attention to prerequisites when selecting courses.		
Total Credits		9

Operations Research

Code	Title	Credits
OR 481	Numerical Methods in Engineering	3
SYST 420	Network Analysis	3
SYST 468	Applied Predictive Analytics	3
Total Credits		9

Software-Intensive Systems

Code	Title	Credits
CS 310	Data Structures	3
CS 321	Software Engineering	3
CS 332	Object-Oriented Software Design and Implementation	3
Total Credits		9

Synthesis Requirement

Mason's synthesis requirement for systems engineering majors is satisfied by successful completion of SYST 495 Senior Design Project II (Mason Core). Students who do not pass SYST 495 Senior Design Project

II (Mason Core) with a C or better must retake both SYST 490 Senior Design Project I and SYST 495 Senior Design Project II (Mason Core).

Writing-Intensive Requirement

Mason's writing-intensive requirement for systems engineering majors is satisfied by successful completion of SYST 489 Senior Seminar.

Advising and Plan of Study

All systems engineering students are assigned a faculty advisor. With the advisor's help and approval, each student is required to complete a plan of study. This plan of study, which is available from the SEOR office, constitutes a learning plan for the degree program and must be signed by the student's advisor and the Department Chair. The plan of study must be updated and signed by the advisor at least once per year.

Accelerated Master's

BS (selected)/Statistical Science, Accelerated MS

Overview

Highly-qualified students in BS programs have the option of applying to the accelerated Statistical Science, MS program.

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

Admission Requirements

No specific undergraduate BS degree is required. Students enrolled in any BS degree may apply to the accelerated Statistical Science, MS program **if such an accelerated Statistical Science, 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 if they have earned 90 undergraduate credits with an overall GPA of 3.00. Students must have successfully completed the following Mason courses each with a grade of C or better prior to admission to the accelerated program:

Code	Title	Credits
MATH 213	Analytic Geometry and Calculus III	3
MATH 203	Linear Algebra	3
or MATH 321	Abstract Algebra	
STAT 250	Introductory Statistics I (Mason Core)	3
or STAT 344	Probability and Statistics for Engineers and Scientists I	
STAT 346	Probability for Engineers	3
or MATH 351	Probability	
STAT 362	Introduction to Computer Statistical Packages	3

Accelerated Option Requirements

Students must complete all credits satisfying degree requirements for the BS and MS programs, with 6 credits overlap chosen from the following courses: STAT 515 Applied Statistics and Visualization for Analytics, STAT 544 Applied Probability, STAT 554 Applied Statistics I, STAT 560 Biostatistical Methods, and STAT 574 Survey Sampling I. (Credit may not be received for both STAT 474 and STAT 574; nor for both STAT 460 and STAT 560.) The graduate courses selected for overlap must be approved by the academic advisors of both the BS and MS programs. All

graduate course prerequisties must be completed prior to enrollment. Each graduate course must be completed with a grade of B or better to apply toward the MS degree.

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.

Degree Conferral

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

Systems Engineering, BS/Data Analytics Engineering, Accelerated MS

Overview

Qualified undergraduate students in the Systems Engineering, BS have the option of obtaining an accelerated Data Analytics Engineering, MS.

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

Admission Requirements

Mason undergraduate students majoring in systems engineering may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30.

For the predictive analytics concentration, students must submit evidence of:

- Satisfactory completion of courses in calculus, applied probability and statistics, and a scientific programming language.
- Familiarity with analytical modeling software, such as spreadsheets or math packages.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with six credits overlap chosen from the courses in the following table. For BS candidates, these graduate courses replace the corresponding undergraduate courses listed. The undergraduate version of these courses may not be applied toward the MS degree.

Undergraduate	Graduate	
SYST 473	SYST 573	Credit may not be received for both courses.
OR 441	OR 541	Credit may not be received for both courses.
SYST 438	SYST 538	This course applies to only certain concentrations; Credit may not be received for both courses

SYST 468	SYST 568	This course applies to only certain concentrations; Credit may not be received for both courses
SYST 488	SYST 588	This course applies to only certain concentrations; Credit may not be received for both courses

For the predictive analytics and financial engineering concentration, any other 500-level course may be applied to both the undergraduate and graduate degrees with approval of the advisor and SEOR department chair.

OR 541 Operations Research: Deterministic Models will substitute for the OR 531 Analytics and Decision Analysis core requirement in the MS DAE program. Students are not permitted to take OR 531 Analytics and Decision Analysis.

Degree Conferral

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

Systems Engineering BS/Operations Research, Accelerated MS

Overview

Qualified undergraduate students may apply for a five-year accelerated BS/MS program leading to a Bachelor of Science in Systems Engineering and an MS degree in Operations Research.

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

Admission Requirements

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

Accelerated Option Requirements

Up to two courses (six credit hours) of master's level courses may be applied to both the undergraduate and the graduate degrees. These two courses may be chosen from the list of graduate courses in the following table. For Systems 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 Operations Research, MS.

Undergraduate	Graduate	
SYST 420	SYST 521/OR 643	Credit may not be received for both courses.
SYST 473	SYST 573	Credit may not be received for both courses.
OR 441	OR 541	Credit may not be received for both courses.
OR 442	OR 542	Credit may not be received for both courses.
SYST 438	SYST 538	These courses apply only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 468	SYST 568	These courses apply only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 488	SYST 588	These courses apply only to certain concentrations in the graduate program; credit may not be received for both courses.

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

Degree Conferral

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

Systems Engineering BS/Systems Engineering, Accelerated MS

Overview

Qualified undergraduate students may apply for a five-year accelerated BS/MS program leading to a Bachelor of Science in Systems Engineering and an MS degree in Systems Engineering.

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

Admission Requirements

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

Accelerated Option Requirements

Up to two courses (six credit hours) of master's level courses may be applied to both the undergraduate and the graduate degrees. These two courses may be chosen from the list of graduate courses in the following table. For Systems 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	
SYST 420	SYST 521/OR 643	Credit may not be received for both courses.
SYST 473	SYST 573	Credit may not be received for both courses.
OR 441	OR 541	Credit may not be received for both courses.
OR 442	OR 542	Credit may not be received for both courses.
SYST 438	SYST 538	These courses apply only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 468	SYST 568	These courses apply only to certain concentrations in the graduate program; credit may not be received for both courses.
SYST 488	SYST 588	These courses apply only to certain concentrations in the graduate program; credit may not be received for both courses.

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

Degree Conferral

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

Systems Engineering, BS/ Telecommunications, Accelerated MS

Overview

Highly-qualified students in the Systems Engineering, BS have the option of obtaining an accelerated Telecommunications, MS.

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

Admission Requirements

Students in the Systems Engineering, BS program who preferably have chosen to take the systems engineering of telecommunications elective sequence may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30 and completed all MATH and PHYS requirements. Other students will be considered on their individual merit. Criteria for admission are identical to criteria for admission to the Telecommunications, MS program.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with 6 credits overlap selected from the following courses:

Code	Title	Credits
TCOM 500	Modern Telecommunications	3
TCOM 530	Data Communications Fundamentals	3
OR 541	Operations Research: Deterministic Models	3
SYST 530	Systems Engineering Management I	3
SYST 573	Decision and Risk Analysis (if taken, replaces TCOM 521 in the telecommunications core requirements)	3

Degree Conferral

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