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 objectives of the Bachelor of Science in Systems Engineering program at George Mason University are to produce graduates who are able to:

- Apply critical thinking, quantitative methods, systems thinking, and principles of engineering to the engineering of contemporary and future systems.
- Apply systems engineering methods, processes, models and tools to the engineering of contemporary and future systems.
- Work successfully, professionally, and ethically as members and leaders of multi-disciplinary teams.

Accreditation
This program 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
All students in the Systems Engineering program must complete the following courses with a grade of C or better:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 203</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 214</td>
<td>Elementary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CS 211</td>
<td>Object-Oriented Programming</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 260</td>
<td>University Physics II (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>STAT 344</td>
<td>Probability and Statistics for Engineers and Scientists I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 354</td>
<td>Probability and Statistics for Engineers and Scientists II</td>
<td>3</td>
</tr>
</tbody>
</table>

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

Once a student has attempted one of these courses twice unsuccessfully, the third attempt must be no later than the next semester of enrollment, excluding summers. Failure to take the course at that time will result in termination from the major. If the student is unable to take the course when required, the student may request an extension to a future semester; extensions require approval of the student’s advisor, their department, and the Associate Dean for Undergraduate Programs. The deadline for extension requests is the add deadline for the semester in which the course is required.

Requirements

Degree Requirements
Total credits: 123
### Mathematics and Statistics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 113</td>
<td>Analytic Geometry and Calculus I (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 114</td>
<td>Analytic Geometry and Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 203</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 213</td>
<td>Analytic Geometry and Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 214</td>
<td>Elementary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>STAT 344</td>
<td>Probability and Statistics for Engineers and Scientists I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 354</td>
<td>Probability and Statistics for Engineers and Scientists II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 23

### Natural Science

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 160 &amp; PHYS 161</td>
<td>University Physics I (Mason Core) and University Physics I Laboratory (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 260 &amp; PHYS 261</td>
<td>University Physics II (Mason Core) and University Physics II Laboratory (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 251</td>
<td>General Chemistry for Engineers (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 211 &amp; CHEM 213</td>
<td>General Chemistry I (Mason Core) and General Chemistry Laboratory I (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 213</td>
<td>Cell Structure and Function (Mason Core)</td>
<td>3</td>
</tr>
</tbody>
</table>

**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 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.

### Computer Science

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 112</td>
<td>Introduction to Computer Programming (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>CS 211</td>
<td>Object-Oriented Programming</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 7

### Communication and Economics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM 100</td>
<td>Public Speaking (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>or COMM 101</td>
<td>Interpersonal and Group Interaction (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>ECON 103</td>
<td>Contemporary Microeconomic Principles (Mason Core)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 6

### Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 107</td>
<td>Introduction to Engineering (Mason Core)</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Credits:** 2

### Systems Engineering

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYST 101</td>
<td>Understanding Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYST 210</td>
<td>Systems Design</td>
<td>3</td>
</tr>
<tr>
<td>SYST 220</td>
<td>Dynamical Systems I</td>
<td>3</td>
</tr>
<tr>
<td>SYST 221</td>
<td>Systems Modeling Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>SYST 320</td>
<td>Dynamical Systems II</td>
<td>3</td>
</tr>
<tr>
<td>SYST 330</td>
<td>Systems Methods</td>
<td>3</td>
</tr>
<tr>
<td>SYST 335</td>
<td>Discrete Systems Modeling and Simulation</td>
<td>3</td>
</tr>
<tr>
<td>SYST 371</td>
<td>Systems Engineering Management</td>
<td>3</td>
</tr>
<tr>
<td>SYST 395</td>
<td>Applied Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYST 470</td>
<td>Human Factors Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYST 473</td>
<td>Decision and Risk Analysis</td>
<td>3</td>
</tr>
<tr>
<td>SYST 489</td>
<td>Senior Seminar</td>
<td>3</td>
</tr>
<tr>
<td>SYST 490</td>
<td>Senior Design Project I</td>
<td>3</td>
</tr>
<tr>
<td>SYST 495</td>
<td>Senior Design Project II (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>OR 441</td>
<td>Deterministic Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>OR 442</td>
<td>Stochastic Operations Research</td>
<td>3</td>
</tr>
</tbody>
</table>

Select 3 approved technical electives selected from one of the Technical Emphasis Areas below.

**Total Credits:** 55

### Additional Mason Core

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGH 101</td>
<td>Composition (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>ENGH 302</td>
<td>Advanced Composition (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>ENGH 303</td>
<td>Literature</td>
<td>3</td>
</tr>
<tr>
<td>Arts</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Western Civilization/World History</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Global Understanding</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**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 or better.

#### Aviation Systems

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYST 420</td>
<td>Network Analysis</td>
<td>3</td>
</tr>
<tr>
<td>SYST 460</td>
<td>Introduction to Air Traffic Control</td>
<td>3</td>
</tr>
<tr>
<td>SYST 461</td>
<td>Air Transportation System Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 9
Bioengineering
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 Bioinformatics for Engineers
Total Credits 9

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

Data Analytics
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

Financial Engineering
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
Total Credits 9

Mechanical Engineering
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
Total Credits 9

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

Software-Intensive Systems
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 a year.

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

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

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

• Civil and Infrastructure Engineering
• Computer Engineering
• Computer Science
• Electrical Engineering
• Systems Engineering
Accelerated Option Requirements

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

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

<table>
<thead>
<tr>
<th>Undergraduate</th>
<th>Graduate</th>
<th>Credit may not be received for both courses.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYST 420</td>
<td>SYST 521</td>
<td></td>
</tr>
<tr>
<td>SYST 473</td>
<td>SYST 573</td>
<td></td>
</tr>
<tr>
<td>OR 441</td>
<td>OR 541</td>
<td></td>
</tr>
<tr>
<td>OR 442</td>
<td>OR 542</td>
<td></td>
</tr>
</tbody>
</table>

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

Degree Conferral

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

BS (selected)/Systems Engineering, Accelerated MS

Overview

Highly-qualified students in selected BS programs (see below) have the option of obtaining an accelerated Systems Engineering, MS. For more detailed information, see AP.6.7 Bachelor’s/Accelerated Master’s Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

Admission Requirements

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

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

Accelerated Option Requirements

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

BS (selected)/Statistical Science, Accelerated MS

Overview

Highly-qualified students in selected BS programs (see below) have the option of obtaining an accelerated Statistical Science, MS. 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 civil and infrastructure engineering, computer engineering, computer science, electrical engineering, or 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 (6 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. These two courses may be chosen from the graduate courses in the following table.

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

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

BS (selected)/Data Analytics Engineering, Accelerated MS
Overview
Qualified undergraduate students have the option of obtaining an accelerated Data Analytics Engineering, MS with a concentration in predictive analytics.

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
While no specific undergraduate degree is required, Mason undergraduate students majoring in systems engineering or any other engineering, business, computer science, statistics, mathematics, or information technology 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.

<table>
<thead>
<tr>
<th>Undergraduate</th>
<th>Graduate</th>
<th>Credit may not be received for both courses.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYST 420</td>
<td>SYST 521</td>
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<tr>
<td>SYST 473</td>
<td>SYST 573</td>
<td></td>
</tr>
<tr>
<td>OR 441</td>
<td>OR 541</td>
<td></td>
</tr>
<tr>
<td>OR 442</td>
<td>OR 542</td>
<td></td>
</tr>
</tbody>
</table>

For the predictive analytics 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.

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/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:

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