Electrical engineering is a major field of modern technology. Electrical engineers are involved in research, development, design, production, and operation of a wide variety of devices and systems, including reliable, secure, and high-speed communication networks, autonomous vehicles, robots, multi-agent systems, nanoscale integrated circuits as well as sensors that are essential to the internet-of-things. Other technologies in electrical engineering include smartphones, tablets and other modern computing platforms, as well as wearable technology such as health-monitoring wristbands, biomedical systems such as prosthetic devices, and brain-machine interfaces.

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

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

Career Opportunities
Career opportunities exist in engineering research and development, system design, system integration, engineering management, engineering consultancy, technical sales, and patent law, among others. The program provides a strong preparation for graduate study.

Specializations
The curriculum provides a strong background in the fundamentals of electrical engineering and senior-level courses in the areas of electronics, networks, communications and signal processing, bioengineering, computer engineering, and controls and robotics. Further, the curriculum includes 12 credits of senior technical electives, 2 credits of advanced engineering labs, and 3 credits of senior advanced design project, which may be used for further specialization in one of these areas.

Additional Information
Degree requirements may be satisfied on a full-time or part-time basis. Cooperative education provides students with the opportunity to integrate paid career-related work experience with classroom learning. Academic credit towards the completion of major requirements is not given for co-op experience. In addition to the usual financial aid available through the Office of Student Financial Aid, electrical engineering majors are encouraged to apply for scholarships provided by various professional societies and industrial organizations in their field.
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: minimum 121

#### Electrical and Computer Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 101</td>
<td>Introduction to Electrical and Computer Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ECE 201</td>
<td>Introduction to Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 220</td>
<td>Continuous-Time Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 285</td>
<td>Electric Circuit Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 286</td>
<td>Electric Circuit Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>ECE 305</td>
<td>Electromagnetic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECE 331</td>
<td>Digital System Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 332</td>
<td>Digital Electronics and Logic Design Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 333</td>
<td>Linear Electronics I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 334</td>
<td>Linear Electronics Lab I</td>
<td>1</td>
</tr>
<tr>
<td>ECE 421</td>
<td>Classical Systems and Control Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECE 433</td>
<td>Linear Electronics II</td>
<td>3</td>
</tr>
<tr>
<td>ECE 445</td>
<td>Computer Organization</td>
<td>3</td>
</tr>
<tr>
<td>ECE 460</td>
<td>Communication and Information Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECE 491</td>
<td>Engineering Seminar</td>
<td>1</td>
</tr>
<tr>
<td>ECE 492</td>
<td>Senior Advanced Design Project I (Mason Core)</td>
<td>1</td>
</tr>
<tr>
<td>ECE 493</td>
<td>RS: Senior Advanced Design Project II (Mason Core)</td>
<td>2</td>
</tr>
</tbody>
</table>

Total Credits: 42

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

#### Advanced Engineering Labs

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 429</td>
<td>Control Systems Lab</td>
<td>2</td>
</tr>
<tr>
<td>ECE 434</td>
<td>Linear Electronics II Laboratory</td>
<td></td>
</tr>
<tr>
<td>ECE 447</td>
<td>Single-Chip Microcomputers ³</td>
<td></td>
</tr>
<tr>
<td>ECE 448</td>
<td>FPGA and ASIC Design with VHDL ¹</td>
<td></td>
</tr>
<tr>
<td>ECE 461</td>
<td>Communication Engineering Laboratory</td>
<td></td>
</tr>
<tr>
<td>ECE 467</td>
<td>Network Implementation Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 2

1. Fulfills 3 credits of technical electives and 1 credit of advanced lab.

#### Computer Science

<table>
<thead>
<tr>
<th>Code</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 222</td>
<td>Computer Programming for Engineers</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 7

#### Mathematics and Statistics

<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 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>
</tbody>
</table>

The decision to approve more than 3 credits of ECE 499 Special Topics in Electrical Engineering, non-ECE courses as well as graduate courses as technical electives is at the discretion of the department based on a review of the course content and the student's academic record.
### Electrical Engineering, BS

<table>
<thead>
<tr>
<th>STAT 346</th>
<th>Probability for Engineers</th>
<th>3</th>
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</thead>
</table>

Total Credits 20

### Physics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 160</td>
<td>University Physics I (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 161</td>
<td>University Physics I Laboratory (Mason Core)</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 260</td>
<td>University Physics II (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 261</td>
<td>University Physics II Laboratory (Mason Core)</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 262</td>
<td>University Physics III (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 263</td>
<td>University Physics III Laboratory (Mason Core)</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Credits 12

### Engineering

<table>
<thead>
<tr>
<th>Code</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

### English, Communication, and Economics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGH 302</td>
<td>Advanced Composition (Mason Core) (Natural Sciences and Technology section)</td>
<td>3</td>
</tr>
<tr>
<td>COMM 100</td>
<td>Public Speaking (Mason Core)</td>
<td>3</td>
</tr>
<tr>
<td>or COMM 101</td>
<td>Fundamentals of Communication (Mason Core)</td>
<td></td>
</tr>
<tr>
<td>ECON 103</td>
<td>Contemporary Microeconomic Principles (Mason Core)</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 9

### Additional Mason Core

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Written Communication ¹</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Literature</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arts</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Western Civilization/World History</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Global Understanding</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 15

¹ Lower-level requirement.

### Concentrations

Concentrations are available in the electrical engineering baccalaureate program. Completion of specific science courses and senior-level courses leads to one of these designations on the student’s transcript on graduation. Concentration requirements may also meet some or all of the Advanced Engineering Lab and Technical Elective requirements.

### Available Concentrations

- Concentration in Bioengineering (BIOE)
- Concentration in Communications and Signal Processing (CSP)
- Concentration in Computer Engineering (CPE)
- Concentration in Control Systems (CON)
- Concentration in Electronics (ELE)

### Concentration in Bioengineering (BIOE)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BENG 301</td>
<td>Bioengineering Measurements</td>
<td>3</td>
</tr>
<tr>
<td>BENG 302</td>
<td>Bioengineering Measurements Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 434</td>
<td>Linear Electronics II Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>or ECE 429</td>
<td>Control Systems Lab</td>
<td></td>
</tr>
<tr>
<td>ECE 492</td>
<td>Senior Advanced Design Project I (Mason Core)</td>
<td>1</td>
</tr>
<tr>
<td>ECE 493</td>
<td>RS: Senior Advanced Design Project II (Mason Core)</td>
<td>2</td>
</tr>
</tbody>
</table>

Select two from the following:

- BENG 304 Modeling and Control of Physiological Systems
- BENG 313 Physiology for Engineers
- BENG 406 Introduction to Biomechanics
- BENG 420 Bioinformatics for Engineers
- BENG 525 Neural Engineering
- BENG 499 Special Topics in Bioengineering ²,³
- BENG 538 Medical Imaging
- BENG 590 Selected Topics in Bioengineering
- ECE 499 Special Topics in Electrical Engineering ¹,²,³

ECE 590 Selected Topics in Engineering ¹,²

Total Credits 14

¹ Bioengineering topic only.
² Must be pre-approved by department.
³ For a minimum of 3 credits.

### Concentration in Communications and Signal Processing (CSP)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 461</td>
<td>Communication Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ECE 492</td>
<td>Senior Advanced Design Project I (Mason Core)</td>
<td>1</td>
</tr>
<tr>
<td>ECE 493</td>
<td>RS: Senior Advanced Design Project II (Mason Core)</td>
<td>2</td>
</tr>
</tbody>
</table>

Select three from the following:

- ECE 410 Applications of Discrete-Time Signal Processing
- ECE 462 Data and Computer Communications
- ECE 463 Digital Communications Systems
- ECE 465 Computer Networking Protocols
- ECE 499 Special Topics in Electrical Engineering ¹,²,³
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 528</td>
<td>Introduction to Random Processes in Electrical and Computer Engineering</td>
<td></td>
</tr>
<tr>
<td>ECE 535</td>
<td>Digital Signal Processing</td>
<td></td>
</tr>
<tr>
<td>ECE 567</td>
<td>Optical Fiber Communications</td>
<td></td>
</tr>
<tr>
<td>ECE 590</td>
<td>Selected Topics in Engineering ¹,²</td>
<td></td>
</tr>
<tr>
<td>PHYS 306</td>
<td>Wave Motion and Electromagnetic Radiation</td>
<td></td>
</tr>
<tr>
<td>CYSE 476</td>
<td>Cryptography and Computer Network Security</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 13

¹ Communications and signal processing topic only.
² Must be pre-approved by department.
³ For a minimum of 3 credits.

### Concentration in Computer Engineering (CPE)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 447</td>
<td>Single-Chip Microcomputers</td>
<td>4</td>
</tr>
<tr>
<td>ECE 492</td>
<td>Senior Advanced Design Project I (Mason Core)</td>
<td>1</td>
</tr>
<tr>
<td>ECE 493</td>
<td>RS: Senior Advanced Design Project II (Mason Core) ¹</td>
<td>2</td>
</tr>
</tbody>
</table>

Select two from the following: 6-7

- ECE 350   Embedded Systems and Hardware Interfaces
- ECE 431   Digital Circuit Design
- ECE 446   Device Driver Development
- ECE 448   FPGA and ASIC Design with VHDL
- ECE 450   Mobile Robots
- ECE 499   Special Topics in Electrical Engineering ¹,²,³
- ECE 510   Real-Time Concepts
- ECE 548   Sequential Machine Theory
- ECE 590   Selected Topics in Engineering ¹,²
- CS 471   Operating Systems

Total Credits: 13-14

¹ Computer engineering topic only.
² Must be pre-approved by department.
³ For a minimum of 3 credits.

### Concentration in Control Systems (CON)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 429</td>
<td>Control Systems Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 492</td>
<td>Senior Advanced Design Project I (Mason Core)</td>
<td>1</td>
</tr>
<tr>
<td>ECE 493</td>
<td>RS: Senior Advanced Design Project II (Mason Core) ¹</td>
<td>2</td>
</tr>
</tbody>
</table>

Select three from the following: 9-10

- ECE 370   Robot Design
- ECE 422   Digital Control Systems
- ECE 447   Single-Chip Microcomputers
- ECE 450   Mobile Robots
- ECE 470   Introduction to Humanoid Robotics
- ECE 499   Special Topics in Electrical Engineering ¹,²,³
- ECE 513   Applied Electromagnetic Theory
- ECE 565   Introduction to Optical Electronics
- ECE 567   Optical Fiber Communications
- ECE 584   Semiconductor Device Fundamentals
- ECE 586   Digital Integrated Circuits
- ECE 587   Design of Analog Integrated Circuits
- ECE 590   Selected Topics in Engineering ¹,²
- PHYS 306  Wave Motion and Electromagnetic Radiation
- PHYS 308  Modern Physics with Applications

Total Credits: 13-14

¹ Electronics topic only.
² Must be pre-approved by department.
³ For a minimum of 3 credits.

### 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.
Admission Requirements

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

- Computer Engineering
- Computer Science
- Electrical Engineering

Accelerated Option Requirements

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

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

<table>
<thead>
<tr>
<th>Undergraduate</th>
<th>Graduate</th>
<th>Credits</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 Graduate Recruitment and Enrollment Services. At the completion of MS requirements, a master’s degree is conferred.

BS (selected)/Statistical Science, Accelerated MS

Overview

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

<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 Admissions Office. At the completion of MS requirements, a master’s degree is conferred.

Electrical Engineering, BS/Electrical Engineering, Accelerated MS Overview
Highly-qualified students in the Electrical Engineering, BS have the option of obtaining an accelerated Electrical Engineering, MS.

For more detailed information, see AP6.7 Bachelor’s/Accelerated Master’s Degrees. For policies governing all graduate degrees, see AP6 Graduate Policies.

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

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

Select 6 credits from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCOM 535</td>
<td>The TCP/IP Suite of Internet Protocols</td>
<td>6</td>
</tr>
</tbody>
</table>
TCOM 551  Digital Communication Systems

<table>
<thead>
<tr>
<th>Or approved substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Total Credits 6

**Degree Conferral**

Students must apply to have the BS conferred the semester before they expect to complete the BS requirements. At the completion of the MS requirements, the MS degree will be awarded.