MASTER OF COMPUTATIONAL SCIENCE AND ENGINEERING (MCSE) DEGREE

Program Learning Outcomes for the MCSE Degree

Upon completing the MCSE degree, students will be able to:

1. Acquire broad, advanced knowledge in modern computational techniques.
2. Possess skills to identify, formulate, and solve advance technical problems related to one of the three focus areas.
3. Communicate technical ideas effectively.

Requirements for the MCSE Degree

The MCSE degree is a non-thesis master’s degree. For general university requirements, please see Non-Thesis Master's Degrees (ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-non-thesis-masters-degrees). For additional requirements, regulations, and procedures for all graduate programs, please see All Graduate Students (ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees). Students pursuing the MCSE degree must complete:

- A minimum of 30 credit hours to satisfy degree requirements.
- A minimum of 30 credit hours of graduate-level study (coursework at the 500-level or above).
- A minimum of 24 credit hours must be taken at Rice University.
- A minimum residency enrollment of one fall or spring semester of part-time graduate study at Rice University.
- A minimum overall GPA of 2.67.
- A minimum GPA of 2.67 in required coursework.

The Master in Computational Science and Engineering (MCSE) degree in the School of Engineering is a non-thesis degree program designed to provide training and expertise in computational science and engineering and in data analytics. The MCSE degree program is intended for students interested in technical and managerial positions such as computational scientist, computational engineering, and data analyst. The program offers students opportunities to specialize in areas such as high-performance computing, data analytics, data science, machine learning, software engineering, and distributed systems.

The departments of Computational and Applied Mathematics, Computer Science, Electrical and Computer Engineering, and Statistics jointly offer the MCSE degree program. Based on preferences indicated in their applications, MCSE students are admitted to one of the following home departments: Computational and Applied Mathematics (CAAM), Computer Science (COMP), Electrical and Computer Engineering (ELEC), or Statistics (STAT).

The courses listed below satisfy the requirements for this degree program. In certain instances, courses not on this official list may be substituted upon approval of the program's academic advisor, or where applicable, the department or program's Director of Graduate Studies. (Course substitutions must be formally applied and entered into Degree Works by the department or program's Official Certifier (https://registrar.rice.edu/facstaff/degreeworks/officialcertifier).) Students and their academic advisors should identify and clearly document the courses to be taken.

### Summary

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Credit Hours Required for the MCSE Degree</td>
<td>30</td>
</tr>
</tbody>
</table>

### Degree Requirements

#### Core Requirements

Select 1 course from 3 of the following 4 groups: 9-11

<table>
<thead>
<tr>
<th>Group 1 (CAAM)</th>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAAM 519</td>
<td></td>
<td>COMPUTATIONAL SCIENCE I</td>
<td></td>
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<tr>
<td>CAAM 520</td>
<td></td>
<td>COMPUTATIONAL SCIENCE II</td>
<td></td>
</tr>
<tr>
<td>CAAM 536 / CEVE 555</td>
<td></td>
<td>NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS</td>
<td></td>
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<tr>
<td>CAAM 550</td>
<td></td>
<td>NUMERICAL ANALYSIS I</td>
<td></td>
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<tr>
<td>CAAM 553</td>
<td></td>
<td>ADVANCED NUMERICAL ANALYSIS I</td>
<td></td>
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<tr>
<td>CAAM 564</td>
<td></td>
<td>NUMERICAL OPTIMIZATION</td>
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<tr>
<td>CAAM 571</td>
<td></td>
<td>LINEAR AND INTEGER PROGRAMMING</td>
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Group 2 (COMP) 2

Select 1 course from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>COMP 504</td>
<td>GRADUATE OBJECT-ORIENTED PROGRAMMING AND DESIGN</td>
<td></td>
</tr>
<tr>
<td>COMP 506</td>
<td>COMPILER CONSTRUCTION FOR GRADUATE STUDENTS</td>
<td></td>
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<tr>
<td>COMP 520 / ELEC 520</td>
<td>DISTRIBUTED SYSTEMS</td>
<td></td>
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<tr>
<td>COMP 521 / ELEC 552</td>
<td>OPERATING SYSTEMS AND CONCURRENT PROGRAMMING</td>
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<tr>
<td>COMP 522</td>
<td>MULTI-CORE COMPUTING</td>
<td></td>
</tr>
<tr>
<td>COMP 529 / ELEC 529</td>
<td>ADVANCED COMPUTER NETWORKS</td>
<td></td>
</tr>
<tr>
<td>COMP 530</td>
<td>DATABASE SYSTEM IMPLEMENTATION</td>
<td></td>
</tr>
<tr>
<td>COMP 533</td>
<td>INTRODUCTION TO DATABASE SYSTEMS</td>
<td></td>
</tr>
<tr>
<td>COMP 540</td>
<td>STATISTICAL MACHINE LEARNING</td>
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<tr>
<td>COMP 541</td>
<td>INTRODUCTION TO COMPUTER SECURITY</td>
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<tr>
<td>COMP 542</td>
<td>LARGE-SCALE MACHINE LEARNING</td>
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<tr>
<td>COMP 557 / ELEC 557</td>
<td>ARTIFICIAL INTELLIGENCE</td>
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</table>

Group 3 (ELEC) 3

Select 1 course from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>ELEC 513 / COMP 513</td>
<td>COMPLEXITY IN MODERN SYSTEMS</td>
<td></td>
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<tr>
<td>ELEC 525 / COMP 525</td>
<td>VIRTUALIZATION AND CLOUD RESOURCE MANAGEMENT</td>
<td></td>
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<tr>
<td>ELEC 526 / COMP 526</td>
<td>HIGH PERFORMANCE COMPUTER ARCHITECTURE</td>
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<tr>
<td>ELEC 531</td>
<td>STATISTICAL SIGNAL PROCESSING</td>
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ELEC 533 / CAAM 583 / STAT 583  INTRODUCTION TO RANDOM PROCESSES AND APPLICATIONS
ELEC 546 / COMP 546  INTRODUCTION TO COMPUTER VISION
ELEC 547  COMPUTER VISION
ELEC 549  COMPUTATIONAL PHOTOGRAPHY
ELEC 553  MOBILE AND EMBEDDED SYSTEM DESIGN AND APPLICATION
ELEC 554 / COMP 554  COMPUTER SYSTEMS ARCHITECTURE
ELEC 558  DIGITAL SIGNAL PROCESSING
ELEC 575  LEARNING FROM SENSOR DATA
ELEC 576 / COMP 576  A PRACTICAL INTRODUCTION TO DEEP LEARNING
Group 4 (STAT)  
Select 1 course from the following:  
STAT 502 / COMP 502 / ELEC 502  NEURAL MACHINE LEARNING I
STAT 518  PROBABILITY
STAT 519  STATISTICAL INFERENCE
STAT 541  MULTIVARIATE ANALYSIS
STAT 602 / COMP 602 / ELEC 602  NEURAL MACHINE LEARNING AND DATA MINING II
STAT 605  R FOR DATA SCIENCE
STAT 613  STATISTICAL MACHINE LEARNING
STAT 615  REGRESSION AND LINEAR MODELS
STAT 616  ADVANCED STATISTICAL METHODS
STAT 648  GRAPHICAL MODELS AND NETWORKS

Elective Requirements
Communication, Leadership, Management and Ethics  
Select up to 6 credit hours from the following:  
ENGI 510  TECHNICAL AND MANAGERIAL COMMUNICATIONS
ENGI 515  LEADING TEAMS AND INNOVATION
ENGI 528 / CEVE 528  ENGINEERING ECONOMICS
ENGI 529 / CEVE 529  ETHICS AND ENGINEERING LEADERSHIP
ENGI 542  COMMUNICATION FOR ENGINEERS: BUILDING A PRACTICAL TOOLBOX
ENGI 545 / LEAD 545  STRATEGIC THINKING FOR COMPLEX PROBLEM SOLVING
ENGI 610 / NSCI 610  MANAGEMENT FOR SCIENCE AND ENGINEERING
ENGI 614  LEARNING HOW TO INNOVATE?
ENGI 615  LEADERSHIP COACHING FOR ENGINEERS

Additional Electives
Select additional courses from departmental CAAM, COMP, ELEC, or STAT course offerings at the 500-level or above to reach 30 total credit hours.

Total Credit Hours 30

Footnotes and Additional Information
1 A student whose home department is COMP, ELEC, or STAT has the option of satisfying Group 1 requirements by completing exactly one course from the following: CAAM 453, CAAM 454, or CAAM 471.
2 A student whose home department is CAAM, ELEC, or STAT has the option of satisfying Group 2 requirements by completing exactly one course from the following: COMP 322 / ELEC 323, or COMP 430.
3 A student whose home department is CAAM, COMP, or STAT has the option of satisfying Group 3 requirements by completing exactly one course from the following: ELEC 425 / COMP 425.
4 A student whose home department is CAAM, COMP, or ELEC has the option of satisfying Group 4 requirements by completing exactly one course from the following: STAT 310 / ECON 307, STAT 405, or STAT 410.
5 Other courses may satisfy the Communication, Leadership, Management, and Ethics group requirement. See advisor for more details.
6 Credit hours earned for ENGI 530 Engineering Practicum may not be applied toward MCSE degree requirements.

Policies for the MCSE Degree
Departments of Computational and Applied Mathematics, Computer Science, Electrical and Computer Engineering, and Statistics Graduate Program Handbook
The General Announcements (GA) is the official Rice curriculum. As an additional resource for students, the departments of Computational and Applied Mathematics, Computer Science, Electrical and Computer Engineering, and Statistics, which jointly offer the MCSE degree program, publish a graduate program handbook, which can be found here: https://gradhandbooks.rice.edu/2018-19/Computer_Science_Graduate_Handbook.pdf

Application Information
Students must have completed a BA or BS degree in an engineering or science discipline, with training in engineering mathematics, statistical foundations, and programming methodology to be admitted to the program.

• Fall admission deadline —February 1
• To apply to the program go to MSCE application (mcsegradapps.rice.edu)
• For additional information about the program contact mcse@rice.edu
• Enrollments and degrees awarded for degree programs in the Engineering School are available at: https://engineering.rice.edu/about/enrollment-degrees-awarded.

Transfer Credit
For Rice University’s policy regarding transfer credit, see Transfer Credit (ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/#transfer). Some departments and programs have additional restrictions on transfer credit. Students are encouraged to meet with their academic program’s advisor when considering transfer credit possibilities.
Additional Information
For additional information, please see the Computational Science and Engineering website: https://engrprofmasters.rice.edu/

Opportunities for the MCSE Degree
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