BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING (BSME) DEGREE

The program leading to the BSME degree is accredited by the Engineering Accreditation Commission (EAC) of ABET, https://www.abet.org (https://www.abet.org/).

Program Learning Outcomes (Student Outcomes) for the BSME Degree

Upon completing the BSME degree, students will be able to demonstrate:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives for the BSME Degree

Within 3 to 5 years of graduation, Bachelor of Science in Mechanical Engineering (BSME) degree alumni from Rice will be exceptional engineers who are:

1. Successful and on track to become leaders in the global workforce; and/or
2. Students in top-rated post-graduate programs.

Requirements for the BSME Degree

For general university requirements, see Graduation Requirements (https://ga.rice.edu/undergraduate-students/academic-opportunities/strategic-planning/procedures/graduation-requirements/). Students pursuing the BSME degree must complete:

- A minimum of 33 courses (87 credit hours) to satisfy major requirements.
- A minimum of 127 credit hours to satisfy degree requirements.
- A minimum of 21 courses (50 credit hours) taken at the 300-level or above.

- The requirements for one area of specialization (see below for areas of specialization). When students declare the major (https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/#text) in Mechanical Engineering (associated with the BSME degree), students must additionally identify and declare one of four areas of specialization, either in:
  - Computational Engineering (p. 2): covers the tools need to simulate and study a range of systems, both fluidic and solid, and to make predictions about behavior and performance of those systems; or
  - Mechanics/Dynamics (p. 3): provides a background in the fundamentals of solid interactions and control systems, and is highly relevant in areas such as robotics, solid mechanics, and tissue mechanics; or
  - Thermal Fluids (p. 3): integrates topics from thermodynamics, fluids, and heat transfer to study renewable and conventional energy systems, aerospace/aeronautics, and surface interactions; or
  - Breadth in Mechanical Engineering (p. 3): encompasses concepts from across the areas of specialization to prepare students for working in cross-cutting fields.

Because of the common core requirements, it is possible for students to change their area of specialization at any time, even after initially declaring the major. To do so, please contact the Office of the Registrar (registrar@rice.edu).

The BSME degree prepares students for the professional practice of engineering. The degree program's goals and objectives are available on the departmental website. Lists of representative undergraduate courses and the usual order in which they are taken are available from the department.

The courses listed below satisfy the requirements for this major. In certain instances, courses not on this official list may be substituted upon approval of the major's academic advisor, or where applicable, the department's Director of Undergraduate Studies. (Course substitutions must be formally applied and entered into Degree Works by the major'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>
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</thead>
<tbody>
<tr>
<td></td>
<td>Total Credit Hours Required for the Major in Mechanical Engineering</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Total Credit Hours Required for the BSME Degree</td>
<td>127</td>
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### Degree Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td></td>
<td>Core Requirements</td>
<td></td>
</tr>
<tr>
<td>CHEM 121</td>
<td>GENERAL CHEMISTRY I</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 111</td>
<td>AP/OTH CREDIT IN GENERAL CHEMISTRY I</td>
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<tr>
<td>CHEM 123</td>
<td>GENERAL CHEMISTRY LABORATORY I</td>
<td>1</td>
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<tr>
<td>or CHEM 113</td>
<td>AP/OTH CREDIT IN GENERAL CHEMISTRY LAB I</td>
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<td>MATH 101</td>
<td>SINGLE VARIABLE CALCULUS I</td>
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<tr>
<td>or MATH 105</td>
<td>AP/OTH CREDIT IN CALCULUS I</td>
<td></td>
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</table>
Bachelor of Science in Mechanical Engineering (BSME) Degree

MATH 102 or MATH 106
SINGLE VARIABLE CALCULUS II or AP/OTH CREDIT IN CALCULUS II 3

MATH 211
ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA 3

MATH 212
MULTIVARIABLE CALCULUS 3

PHYS 101 & PHYS 103
MECHANICS (WITH LAB) and MECHANICS DISCUSSION 4

PHYS 102 & PHYS 104
ELECTRICITY & MAGNETISM (WITH LAB) and ELECTRICITY AND MAGNETISM DISCUSSION 4

Computational and Applied Mathematics

CAAM 210
INTRODUCTION TO ENGINEERING COMPUTATION 3

or MECH 210
INTRODUCTION TO NUMERICAL METHODS 3

CAAM 335
MATRIX ANALYSIS 3

or MATH 354
HONORS LINEAR ALGEBRA 3

or MATH 355
LINEAR ALGEBRA 3

CAAM 336
DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING 3

Senior Design

MECH 407
CAPSTONE DESIGN PROJECT I 4

MECH 408
CAPSTONE DESIGN PROJECT II 3

Laboratory Courses

MECH 231
SOPHOMORE LAB 1

MECH 331
JUNIOR LABORATORY I 1

MECH 332
JUNIOR LABORATORY II 1

MECH 340
INDUSTRIAL PROCESS LAB 1

Mechanical Engineering

MECH 200
CLASSICAL THERMODYNAMICS 3

MECH 202
MECHANICS/STATICS 3

MECH 203
MECHANICAL ENGINEERING DESIGN TOOLS 3

MECH 310
RIGID BODY DYNAMICS 3

MECH 315
STRESS ANALYSIS 3

MECH 343
MODELING OF DYNAMIC SYSTEMS 4

MECH 350
MECHANICAL ELEMENTS 3

MECH 371
FLUID MECHANICS I 3

MECH 420 / ELEC 436
FUNDAMENTALS OF CONTROL SYSTEMS 3

MECH 481
HEAT TRANSFER 3

Elective Requirements

Limited Elective

Select 1 course from the following departmental course offerings at the 300-level or above: CAAM, DSCI, MATH, STAT. 3

Technical Electives

Select 1 from the following Areas of Specialization (see Areas of Specialization below): 2

- Computational Engineering
- Mechanics/Dynamics
- Thermal Fluids
- Breadth in Mechanical Engineering

Total Credit Hours Required for the Major in Mechanical Engineering 87

Additional Credit Hours to Complete Degree Requirements 9

University Graduation Requirements (https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/)

Total Credit Hours 127

Footnotes and Additional Information

1. During their senior year, mechanical engineering students in the BSME program complete these courses in design application while completing a major design project.

2. Students must complete a total of 3 technical electives (9 credit hours) in one area of specialization: Computational Engineering, Mechanics/Dynamics, Thermal Fluids, or Breadth in Mechanical Engineering.

Areas of Specialization

Students must complete the requirements as listed for one of the following areas of specialization for the BSME degree program. A minimum of 3 courses (minimum of 9 credit hours) must be taken in the area of specialization.

Area of Specialization: Computational Engineering

To fulfill the BSME degree requirements, students pursuing the Computational Engineering area of specialization must complete:

- 1 course (3 credit hours) from the area of specialization Core Requirement
- 2 courses (6 credit hours) from the area of specialization Elective Requirements

Code Title Credit Hours

Core Requirement

MECH 417 / CEVE 417 FINITE ELEMENT ANALYSIS 3

or MECH 454 COMPUTATIONAL FLUID MECHANICS

Elective Requirements

Select 2 from the following: 6

MECH 417 / CEVE 417 FINITE ELEMENT ANALYSIS 1

MECH 427 / CEVE 427 PHYSICS GUIDED MACHINE LEARNING & DATA DRIVEN MODELING FEM

MECH 454 / BIOE 454 / CEVE 454 COMPUTATIONAL FLUID MECHANICS 1

MECH 474 ADVANCED COMPUTATIONAL MECHANICS

MECH 505 NUMERICAL METHODS FOR ENGINEERS

MECH 555 COMPUTATIONAL FLUID-STRUCTURE INTERACTION

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MECH 679 / CEVE 679
APPLIED MONTE CARLO ANALYSIS

Total Credit Hours 9

Footnotes and Additional Information
1 MECH 417 or MECH 454 may fulfill the area of specialization Elective Requirements if they are not selected as the area of specialization Core Requirement.

Area of Specialization: Mechanics/Dynamics
To fulfill the BSME degree requirements, students pursuing the Mechanics/Dynamics area of specialization must complete:

- 1 course (3 credit hours) from the area of specialization Core Requirement
- 2 courses (6 credit hours) from the area of specialization Elective Requirements

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<td>MECH 417</td>
<td>VIBRATIONS</td>
<td>3</td>
</tr>
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</table>

Elective Requirements
Select 2 from the following:

- MECH 400 / CEVE 400 ADVANCED MECHANICS OF MATERIALS
- MECH 411 DYNAMICS AND CONTROL OF MECHANICAL SYSTEMS
- MECH 416 ADVANCED MACHINE DESIGN AND MECHANICAL SYSTEMS
- MECH 417 / CEVE 417 FINITE ELEMENT ANALYSIS
- MECH 427 / CEVE 427 PHYSICS GUIDED MACHINE LEARNING & DATA DRIVEN MODELING FEM
- MECH 430 TRIBOMECHADYNAMICS
- MECH 435 / ELEC 435 INTRODUCTION TO ENERGY-EFFICIENT MECHATRONICS
- MECH 450 / COMP 450 / ELEC 450 ALGORITHMIC ROBOTICS
- MECH 488 DESIGN OF MECHATRONIC SYSTEMS
- MECH 497 NEUROMUSCULOSKELETAL MODELING AND SIMULATION
- MECH 498 / COMP 498 / ELEC 498 INTRODUCTION TO ROBOTICS
- MECH 596 INTRODUCTION TO FLIGHT MECHANICS

Total Credit Hours 9

Footnotes and Additional Information
1 MECH 454 or MECH 472 may fulfill the area of specialization Elective Requirements if they are not selected as the area of specialization Core Requirement.

Area of Specialization: Thermal Fluids
To fulfill the BSME degree requirements, students pursuing the Thermal Fluids area of specialization must complete:

- 1 course (3 credit hours) from the area of specialization Core Requirement
- 2 courses (6 credit hours) from the area of specialization Elective Requirements

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<tr>
<td>MECH 454</td>
<td>COMPUTATIONAL FLUID MECHANICS</td>
<td>3</td>
</tr>
<tr>
<td>BIOE 454</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEVE 454</td>
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</table>

or MECH 472 THERMAL SYSTEMS DESIGN

Elective Requirements
Select 2 from the following:

- MECH 417 / CEVE 417 FINITE ELEMENT ANALYSIS
- MECH 454 / BIOE 454 / CEVE 454 COMPUTATIONAL FLUID MECHANICS

Total Credit Hours 9

Area of Specialization: Breadth in Mechanical Engineering
To fulfill the BSME degree requirements, students pursuing the Breadth in Mechanical Engineering area of specialization must complete:

3 courses (9 credit hours) from the area of specialization Elective Requirements

<table>
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<tbody>
<tr>
<td>MECH 412</td>
<td>VIBRATIONS</td>
<td>3</td>
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Elective Requirements
Select 3 from the following:

Total Credit Hours 9

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Policies for the BSME Degree

Program Restrictions and Exclusions

Students pursuing the BSME Degree should be aware of the following program restriction:

• As noted in Majors, Minors, and Certificates (https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/), under Declaring Majors, Minors and Certificates, students may not obtain both a BA and a BS in the same major. Students pursuing the Bachelor of Science in Mechanical Engineering (BSME) Degree may not additionally pursue the BA Degree with a Major in Mechanical Engineering.

Transfer Credit

For Rice University's policy regarding transfer credit, see Transfer Credit (https://ga.rice.edu/undergraduate-students/academic-policies-procedures/transfer-credit/). Some departments and programs have additional restrictions on transfer credit. The Office of Academic Advising maintains the university's official list of transfer credit advisors on their website: https://oaa.rice.edu. Students are encouraged to meet with their academic program's transfer credit advisor when considering transfer credit possibilities.

Departmental Transfer Credit Guidelines

Students pursuing the BSME degree should be aware of the following departmental transfer credit guidelines:

• Requests for transfer credit will be considered by the program director (and/or the program's official transfer credit advisor) on an individual case-by-case basis.

Additional Information

For additional information, please see the Mechanical Engineering website: https://mech.rice.edu/

Opportunities for the BSME Degree

Academic Honors

The university recognizes academic excellence achieved over an undergraduate's academic history at Rice. For information on university honors, please see Latin Honors (https://ga.rice.edu/undergraduate-students/honors-distinctions/university/) (summa cum laude, magna cum laude, and cum laude) and Distinction in Research and Creative Work (https://ga.rice.edu/undergraduate-students/honors-distinctions/university/). Some departments have department-specific Honors awards or designations.

Fifth-Year Master's Degree Option for Rice Undergraduate Students

In certain situations and with some terminal master's degree programs, Rice students have an option to pursue a master's degree by adding an additional fifth year to their four years of undergraduate studies.

Advanced Rice undergraduate students in good academic standing typically apply to the master's degree program during their junior or senior year. Upon acceptance, depending on course load, financial aid status, and other variables, they may then start taking some required courses of the master's degree program. A plan of study will need to be approved by the student's undergraduate major advisor and the master's degree program director.

As part of this option and opportunity, Rice undergraduate students:

• must complete the requirements for a bachelor's degree and the master's degree independently of each other (i.e. no course may be counted toward the fulfillment of both degrees).
• should be aware there could be financial aid implications if the conversion of undergraduate coursework to that of graduate level reduces their earned undergraduate credit for any semester below that of full-time status (12 credit hours).
• more information on this Undergraduate - Graduate Concurrent Enrollment opportunity, including specific information on the registration process can be found here (https://ga.rice.edu/undergraduate-students/academic-opportunities/undergraduate-graduate-concurrent-enrollment/).

Rice undergraduate students completing studies in science and engineering may have the option to pursue the Master of Mechanical Engineering (MME) degree. For additional information, students should contact their undergraduate major advisor and the MME program director.

Additional Information

For additional information, please see the Mechanical Engineering website: https://mech.rice.edu/