

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING (BSME) DEGREE

The program leading to the Bachelor of Science in Mechanical Engineering (BSME) is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria and the Mechanical and Similarly Named Engineering Program Criteria.

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

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;
2. Engaged in lifelong learning by pursuing advanced study at top-rated post-graduate programs or new career opportunities in industry, academia, government or non-governmental organizations; and/or
3. Successfully tackling engineering and societal challenges for the betterment of humanity

Requirements for the BSME Degree

For general university requirements, see [Graduation Requirements \(https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/\)](https://ga.rice.edu/undergraduate-students/academic-policies-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 18 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 methods and tools for computational analysis in engineering applications, fluids and solids, to help with design and performance in such applications; **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. 4): 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

Code	Title	Credit Hours
Total Credit Hours Required for the Major in Mechanical Engineering		87
Total Credit Hours Required for the BSME Degree		127

Degree Requirements

Code	Title	Credit Hours
Core Requirements		
Basic Math and Science Courses (Required Pre-Requisites)		
CHEM 121 or CHEM 111	GENERAL CHEMISTRY I AP/OTH CREDIT IN GENERAL CHEMISTRY I	3
CHEM 123 or CHEM 113	GENERAL CHEMISTRY LABORATORY I AP/OTH CREDIT IN GENERAL CHEMISTRY LAB I	1

MATH 101 or MATH 105	SINGLE VARIABLE CALCULUS I AP/OTH CREDIT IN CALCULUS I	3
MATH 102 or MATH 106	SINGLE VARIABLE CALCULUS II 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 ¹	4
PHYS 102 & PHYS 104	ELECTRICITY & MAGNETISM (WITH LAB) and ELECTRICITY AND MAGNETISM DISCUSSION ²	4
Computational Applied Mathematics and Operations Research		
CMOR 220 or MECH 210	INTRODUCTION TO ENGINEERING COMPUTATION INTRODUCTION TO NUMERICAL METHODS	3
CMOR 302 or CMOR 303 or MATH 355 or MATH 354	MATRIX ANALYSIS MATRIX ANALYSIS FOR DATA SCIENCE LINEAR ALGEBRA HONORS LINEAR ALGEBRA	3
CMOR 304	DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING	3
Senior Design ³		
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 - LECTURE & LAB	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 ⁴		
Select 1 course from the following departmental course offerings at the 300-level or above: CMOR, DSCI, MATH, STAT.		3
Technical Electives ⁵		
Select 1 from the following Areas of Specialization (see Areas of Specialization below):		9
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/) [*]	31
Total Credit Hours	127

Footnotes and Additional Information

- ^{*} **Note:** University Graduation Requirements include 31 credit hours, comprised of Distribution Requirements (Groups I, II, and III), FWIS, and LPAP coursework. In some instances, courses satisfying FWIS or distribution requirements may additionally meet other requirements, such as the Analyzing Diversity (AD) requirement, or some of the student's declared major, minor, or certificate requirements. Additional Credit Hours to Complete Degree Requirements include general electives, coursework completed as upper-level, residency (hours taken at Rice), and/or any other additional academic program requirements.
- ¹ PHYS 111 may be substituted for PHYS 101 and PHYS 103. The Mechanical Engineering department has determined that credit awarded for PHYS 141 *CONCEPTS IN PHYSICS I* is not eligible for meeting the requirements of the MECH major.
- ² PHYS 112 may be substituted for PHYS 102 and PHYS 104. The Mechanical Engineering department has determined that credit awarded for PHYS 142 *CONCEPTS IN PHYSICS II* is not eligible for meeting the requirements of the MECH major.
- ³ During their senior year, mechanical engineering students in the BSME program complete these courses in design application while completing a major design project.
- ⁴ DSCI 305 may not be used to fulfill the Limited Elective requirement.
- ⁵ 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 / BIOE 454 / CEVE 454	COMPUTATIONAL FLUID MECHANICS	
Elective Requirements		
<i>Select 2 courses from the following:</i>		6
CMOR 360	INTRODUCTION TO OPERATIONS RESEARCH AND OPTIMIZATION	
CMOR 423 / CEVE 455	NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS	
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 466 / CEVE 496	SYSTEM IDENTIFICATION OF DYNAMIC SYSTEMS WITH MACHINE LEARNING	
MECH 474	ADVANCED COMPUTATIONAL MECHANICS	
MECH 497	NEUROMUSCULOSKELETAL MODELING AND SIMULATION	
MECH 505	NUMERICAL METHODS FOR ENGINEERS	
MECH 555	COMPUTATIONAL FLUID-STRUCTURE INTERACTION	
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

Code	Title	Credit Hours
Core Requirement		
MECH 412	VIBRATIONS	3
Elective Requirements		
<i>Select 2 courses from the following:</i>		6
CEVE 476	STRUCTURAL DYNAMIC SYSTEMS	
COMP 462	FUNDAMENTALS OF ROBOTIC MANIPULATION ¹	
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 450 / COMP 450 / ELEC 450	ALGORITHMIC ROBOTICS	
MECH 474	ADVANCED COMPUTATIONAL MECHANICS	
MECH 488	DESIGN OF MECHATRONIC SYSTEMS	
MECH 497	NEUROMUSCULOSKELETAL MODELING AND SIMULATION	
MECH 498 / COMP 498 / ELEC 498	INTRODUCTION TO ROBOTICS ¹	
MECH 560	TRIBOLOGY: THE STUDY OF FRICTION, LUBRICATION, AND WEAR	
MECH 578	ORBITAL MECHANICS AND MISSION DESIGN	
MECH 596	INTRODUCTION TO FLIGHT MECHANICS	
MECH 678 / CEVE 678	APPLIED STOCHASTIC MECHANICS	
Total Credit Hours		9

Footnotes and Additional Information

¹ Either COMP 462 *Fundamentals of Robotic Manipulation* or MECH 498/COMP 498/ELEC 498 *Introduction to Robotics* may fulfill the Mechanics/Dynamics Area of Specialization, but not both courses.

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

Code	Title	Credit Hours
Core Requirement		
MECH 454 / BIOE 454 / CEVE 454 or MECH 472	COMPUTATIONAL FLUID MECHANICS THERMAL SYSTEMS DESIGN	3
Elective Requirements		
<i>Select 2 courses from the following:</i>		6
MECH 417 / CEVE 417	FINITE ELEMENT ANALYSIS	
MECH 454 / BIOE 454 / CEVE 454	COMPUTATIONAL FLUID MECHANICS ¹	
MECH 472	THERMAL SYSTEMS DESIGN ¹	
MECH 482	CONVECTIVE HEAT TRANSFER	

MECH 484	MICROSCOPIC THERMODYNAMICS AND TRANSPORT	
MECH 487	INTERFACIAL PHENOMENA, CAPILLARITY, AND WETTING	
MECH 555	COMPUTATIONAL FLUID-STRUCTURE INTERACTION	
MECH 560	TRIBOLOGY: THE STUDY OF FRICTION, LUBRICATION, AND WEAR	
MECH 575	INTRODUCTION TO HYDRODYNAMIC STABILITY	
MECH 589	MICROFLUIDICS: FUNDAMENTALS AND APPLICATIONS	
MECH 590	AEROSPACE PROPULSION	
MECH 591	GAS DYNAMICS	
MECH 594	INTRODUCTION TO AERONAUTICS	
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: 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

Code	Title	Credit Hours
Elective Requirements		
<i>Select 3 courses from the following:</i>		9
MECH 412	VIBRATIONS	
MECH 417 / CEVE 417	FINITE ELEMENT ANALYSIS	
MECH 454 / BIOE 454 / CEVE 454	COMPUTATIONAL FLUID MECHANICS	
MECH 472	THERMAL SYSTEMS DESIGN	
MECH 488	DESIGN OF MECHATRONIC SYSTEMS	
MECH 498 / COMP 498 / ELEC 498	INTRODUCTION TO ROBOTICS	
Total Credit Hours		9

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/) (<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/) (<https://ga.rice.edu/undergraduate-students/academic-policies-procedures/transfer-credit/>). Some departments and programs have additional restrictions on transfer credit. Requests for transfer credit must be approved for Rice equivalency by the designated transfer credit advisor for the appropriate academic department offering the Rice equivalent course (corresponding to the subject code of the course content). The Office of Academic Advising maintains the university's official list of [transfer credit advisors](https://oaa.rice.edu/advising-network/transfer-credit-advisors/) (<https://oaa.rice.edu/advising-network/transfer-credit-advisors/>) on their website: <https://oaa.rice.edu>. Students are encouraged to meet with the applicable transfer credit advisor as well as their academic program director when considering transfer credit possibilities.

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/) (<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/) (<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/) (<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/>.