BACHELOR OF SCIENCE IN MATERIALS SCIENCE AND NANOENGINEERING (BSMSNE) DEGREE

The program leading to the BS in Materials and NanoEngineering is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria and the Materials, Metallurgical, Ceramics and Similarly Named Engineering Program Criteria.

Program Learning Outcomes (Student Outcomes) for the BSMSNE Degree

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 BSMSNE Degree

The Bachelor of Science in Materials Science and NanoEngineering (BSMSNE) degree prepares graduates to succeed in professional careers by equipping them with the expertise sought by top graduate schools and corporations. Recognizing that graduates may embark on diverse educational and career paths, the Program Educational Objectives (PEOs) that graduates will achieve within a few years of obtaining their Bachelor of Science in Materials Science and NanoEngineering (BSMSNE) degree from Rice University are:

1. Graduates will demonstrate technical proficiency and professional achievement in their work which may include scientific inquiry as well as problem-solving, process optimization, and/or design in materials engineering and related fields.
2. Graduates will be accomplished at communicating and working collaboratively in diverse work environments.
3. Graduates seeking post-baccalaureate education will achieve appropriate levels of success in admission to and progression through those programs. Graduates entering professional careers will achieve appropriate career progression and success.

Requirements for the BSMSNE Degree

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

- A minimum of 33-36 courses (89-92 credit hours), depending on course selection, to satisfy major requirements.
- A minimum of 126-129 credit hours, depending on course selection, to satisfy degree requirements.
- A minimum of 17 courses (37 credit hours) taken at the 300-level or above.

Students seeking the BSMSNE must complete a minimum of 89 credit hours in general math and science, core, and specialization elective courses within the total minimum requirement of 126 credit hours.

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 Materials Science and NanoEngineering		89-92
Total Credit Hours Required for the BSMSNE Degree		126-129

Degree Requirements

Code	Title	Credit Hours
Required Math and Science Prerequisites		
MATH 101	SINGLE VARIABLE CALCULUS I	3
or MATH 105	AP/OTH CREDIT IN CALCULUS I	
MATH 102	SINGLE VARIABLE CALCULUS II	3
or MATH 106	AP/OTH CREDIT IN CALCULUS II	
Select 1 from the following: [1]		*4*
PHYS 101 & PHYS 103	MECHANICS (WITH LAB) and MECHANICS DISCUSSION	
PHYS 111	HONORS MECHANICS (WITH LAB)	
Select 1 from the following: [2]		*4*
PHYS 102 & PHYS 104	ELECTRICITY & MAGNETISM (WITH LAB) and ELECTRICITY AND MAGNETISM DISCUSSION	
PHYS 112	HONORS ELECTRICITY & MAGNETISM (WITH LAB)	
MATH 211	ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	3
MATH 212	MULTIVARIABLE CALCULUS	3
or MATH 232	HONORS MULTIVARIABLE CALCULUS	
CHEM 121	GENERAL CHEMISTRY I	3
or CHEM 111	AP/OTH CREDIT IN GENERAL CHEMISTRY I	

CHEM 123	GENERAL CHEMISTRY LABORATORY I	1
or CHEM 113	AP/OTH CREDIT IN GENERAL CHEMISTRY LAB I	
CHEM 122	GENERAL CHEMISTRY II	3
or CHEM 112	AP/OTH CREDIT IN GENERAL CHEMISTRY II	
CHEM 124	GENERAL CHEMISTRY LABORATORY II	1
or CHEM 114	AP/OTH CREDIT IN GENERAL CHEMISTRY LAB II	
CMOR 220	INTRODUCTION TO ENGINEERING COMPUTATION	3
Select 1 course from the following:		*3*
CMOR 302	MATRIX ANALYSIS	
or CMOR 303	MATRIX ANALYSIS FOR DATA SCIENCE	
or MATH 355	LINEAR ALGEBRA	
or MATH 354	HONORS LINEAR ALGEBRA	
Select 1 from the following:		*3*
PHYS 201	WAVES, LIGHT, AND HEAT	
CHEM 211 & CHEM 213	ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY DISCUSSION I	
CHEM 301	PHYSICAL CHEMISTRY I	
Core Requirements		
MECH 202	MECHANICS/STATICS [3]	3
MSNE 201	INTRODUCTION TO NANOTECHNOLOGY FOR ENGINEERS	3
or MSNE 222	MATERIALS IN NATURE AND BIOMIMETIC STRATEGIES	
MSNE 211	INTRODUCTION TO MATERIALS SCIENCE FOR ENGINEERS	3
MSNE 302	MATERIALS PROCESSING AND NANOMANUFACTURING	3
MSNE 304	MATERIALS SCIENCE JUNIOR LAB	3
MSNE 311	MATERIALS SELECTION AND DESIGN	3
MSNE 389	ETHICS & SAFETY FOR MATERIALS ENGINEERS	1
Select 4 courses from the following;		*12*
MSNE 401	THERMODYNAMICS IN MATERIALS SCIENCE	
MSNE 402	MECH PROPERTIES OF MATERIALS	
MSNE 406	PHYSICAL PROPERTIES OF SOLIDS	
MSNE 411	MATERIALS CHARACTERIZATION FROM NANO TO MACRO	
MSNE 415	CERAMICS AND GLASSES	
MSNE 407	CAPSTONE DESIGN PROJECT I	4
MSNE 408	CAPSTONE DESIGN PROJECT II	3
MSNE 435	CRYSTALLOGRAPHY & DIFFRACTION	3
MSNE 437	CRYSTALLOGRAPHY & DIFFRAC LAB	1
MSNE 450 & MSNE 451	MATERIALS SCIENCE SEMINAR and MATERIALS SCIENCE SEMINAR	1
Elective Requirements		
Select 1 elective course from the Engineering Cluster (see course list below)		*3-4*
Select 1 elective course from the Math and Science Cluster (see course list below)		*3-4*
Select 1 elective course from the Technical Cluster or select additional Engineering Cluster courses (see course lists below)		*3-4*
Total Credit Hours Required for the Major in Major in Materials Science and NanoEngineering		**89-92**
Additional Credit Hours to Complete Degree Requirements *		3-6
University Graduation Requirements (https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/) *		31
Total Credit Hours		**126-129**

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 The Materials Science and NanoEngineering department has determined that credit awarded for PHYS 141 *CONCEPTS IN PHYSICS I* is not eligible for meeting the requirements of the Materials Science and NanoEngineering major.

2 The Materials Science and NanoEngineering department has determined that credit awarded for PHYS 142 *CONCEPTS IN PHYSICS II* is not eligible for meeting the requirements of the Materials Science and NanoEngineering major.

3 MECH 202 is a required Engineering prerequisite to other Core Requirements and must be taken first.

Course Lists to Satisfy Requirements

Elective Requirements

To fulfill the remaining Materials Science and NanoEngineering major requirements for the BSMSNE degree, students must complete a total of 3 additional courses (a minimum of 9-12 credit hours, depending on course selection). 1 course (3-4 credit hours, depending on course selection) must come from the Engineering Cluster, 1 course (3-4 credit hours, depending on course selection) must come from the Math and Science Cluster. The remaining course (3-4 credit hours, depending on course selection) must come from the Technical Cluster or from additional Engineering Cluster coursework.

In general, courses at the 300-level or above offered by the George R. Brown School of Engineering can satisfy the Engineering Cluster, and courses at the 300-level or above offered by the Wiess School of Natural Sciences can satisfy the Math and Science Cluster. However, students need academic advisors' approval to apply courses not on this list to fulfill major requirements. The course lists below are pre-approved courses that fulfill Engineering Cluster or Math and Science Cluster requirements. **Please note:** some courses may not be offered every academic year, some courses may have additional pre-requisite requirements, and courses are subject to change by the lead department offering the course.

Engineering Cluster (no MSNE courses)

Code	Title	Credit Hours
Select at least 1 course from the following:		*3-4*
BIOE 370	BIOMATERIALS	

CEVE 310	PRINCIPLES OF ENVIRONMENTAL ENGINEERING
CEVE 311 / MECH 311	MECHANICS OF SOLIDS AND STRUCTURES
CEVE 427 / MECH 427	PHYSICS GUIDED MACHINE LEARNING & DATA DRIVEN MODELING FEM
CEVE 434	FATE AND TRANSPORT OF CONTAMINANTS IN THE ENVIRONMENT
CHBE 390	CHEMICAL KINETICS AND REACTOR DESIGN
CHBE 401	TRANSPORT PHENOMENA I
ELEC 241 & ELEC 240	FUNDAMENTALS OF ELECTRICAL ENGINEERING I and FUNDAMENTALS OF ELECTRICAL ENGINEERING I LABORATORY
ELEC 243	ELECTRONIC MEASUREMENT SYSTEMS
ELEC 261	INTRODUCTION TO PHYSICAL ELECTRONICS I
ELEC 361	QUANTUM MECHANICS FOR ENGINEERS
ELEC 462	OPTOELECTRONIC DEVICES
ENGI 302 / CEVE 302	SUSTAINABLE DESIGN
ENGI 303 / CEVE 322	ENGINEERING ECONOMICS
MECH 211 / CEVE 211	ENGINEERING MECHANICS
MECH 403	COMPUTER AIDED DESIGN
MECH 417 / CEVE 417	FINITE ELEMENT ANALYSIS
MECH 481	HEAT TRANSFER
Total Credit Hours	**3-4**

Math and Science Cluster (no MSNE or Engineering courses)

Code	Title	Credit Hours
Select at least 1 course from the following:		*3-4*
BIOS 201	INTRODUCTORY BIOLOGY I	
BIOS 301	BIOCHEMISTRY I	
BIOS 385	CELLULAR AND MOLECULAR MECHANISMS OF THE NEURON	
CMOR 304	DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING	
CMOR 360	INTRODUCTION TO OPERATIONS RESEARCH AND OPTIMIZATION	
CMOR 415 / ELEC 488 / NEUR 415	THEORETICAL NEUROSCIENCE: FROM CELLS TO LEARNING SYSTEMS	
CMOR 422	NUMERICAL ANALYSIS	
CMOR 435 / MATH 435	DYNAMICAL SYSTEMS	
CMOR 500	ANALYSIS	
CMOR 520	COMPUTATIONAL SCIENCE	
CHEM 211 & CHEM 213	ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY DISCUSSION I	
CHEM 301	PHYSICAL CHEMISTRY I	
CHEM 302	PHYSICAL CHEMISTRY II	
CHEM 330	ANALYTICAL CHEMISTRY	
CHEM 360	INORGANIC CHEMISTRY	
EEPS 307 / CEVE 307 / ENST 307	ENERGY AND THE ENVIRONMENT	
EEPS 321	EARTH AND PLANETARY SURFACE ENVIRONMENTS	
MATH 302	ELEMENTS OF ANALYSIS	
MATH 354	HONORS LINEAR ALGEBRA	
MATH 355	LINEAR ALGEBRA	
PHYS 201	WAVES, LIGHT, AND HEAT	
PHYS 202	MODERN PHYSICS	
PHYS 301	INTERMEDIATE MECHANICS	
PHYS 302	INTERMEDIATE ELECTRODYNAMICS	
PHYS 355	INTRODUCTION TO BIOLOGICAL PHYSICS	
STAT 280	ELEMENTARY APPLIED STATISTICS [1]	
STAT 305	INTRODUCTION TO STATISTICS FOR BIOSCIENCES	
Total Credit Hours		**3-4**

Technical Cluster (MSNE or Engineering courses) [2]

Code	Title	Credit Hours
Select 1 course from the following (or select additional coursework from the Engineering Cluster):		*3*
MSNE 413	3D PRINTING AND ADDITIVE MANUFACTURING: THEORY AND APPLICATIONS	
MSNE 417	ELECTRONIC, OPTICAL AND MAGNETIC PROPERTIES OF POLYMERS	
MSNE 433	COMPUTATIONAL MATERIALS MODELING	
MSNE 505	MICROSTRUCTURE AND NANOSTRUCTURE EVOLUTION	
MSNE 512	QUANTUM MATERIALS ENGINEERING	
MSNE 523	PROPERTIES, SYNTHESIS AND DESIGN OF COMPOSITE MATERIALS	
MSNE 538 / CEVE 538	COMPUATIONAL NANOSCIENCE FOR GREEN INFRASTRUCTURE	
MSNE 555	MATERIALS IN NATURE AND BIO-MIMETIC STRATEGIES	
MSNE 560 / CHBE 560	COLLOIDAL AND INTERFACIAL PHENOMENA	
MSNE 569	SCIENCE AND APPLICATIONS OF CORROSION SCIENCE AND ENGINEERING	
MSNE 580 / CHEM 580	MICROSCOPY METHODS IN MATERIALS SCIENCE	
MSNE 581 / MECH 581	MICRO AND NANO HEAT TRANSPORT METHODOLOGIES AND DESIGN	
MSNE 593 / CHBE 593	INTRODUCTION TO POLYMER PHYSICS AND ENGINEERING	
MSNE 594 / CHBE 594	PROPERTIES OF POLYMERS	
MSNE 650	NANOMATERIALS AND NANOMECHANICS	
Total Credit Hours		**3**

Footnotes and Additional Information

1 The MSNE department has determined that credit awarded for STAT 180 *AP/OTH CREDIT IN STATISTICS* is not eligible for meeting the requirements of the MSNE major.

2 The Technical Cluster requirement can also be met with a course listed within the Engineering Cluster above.

Policies for the BSMSNE Degree

Program Restrictions and Exclusions

Students pursuing the BSMSNE 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 Materials Science and NanoEngineering (BSMSNE) Degree may not additionally pursue the BA Degree with a Major in Materials Science and NanoEngineering.

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 (https://oaa.rice.edu/advising-network/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 BSMSNE 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 Materials Science and NanoEngineering website: https://msne.rice.edu/

Opportunities for the BSMSNE 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 Materials Science and NanoEngineering (MMSNE) degree. For additional information, students should contact their undergraduate major advisor and the MMSNE program director.

Research Opportunities

Many MSNE majors participate in undergraduate research; some even start during their freshman year. To get involved, speak to a MSNE undergraduate advisor or directly to a MSNE faculty member.

Additional Information

For additional information, please see the Materials Science and NanoEngineering website: https://msne.rice.edu/