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

Program Learning Outcomes (Student Outcomes) for the BSMSNE Degree

Upon completing the BSMSNE degree, students will 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 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 (PEO) 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 (ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements). Students pursuing the BSMSNE degree must complete:

- A minimum of 30 or 34 courses (90-94 credit hours) depending on course selection to satisfy major requirements.
- A minimum of 130-134 credit hours depending on course selection to satisfy degree requirements.
- A minimum of 15 courses (38 credit hours) taken at the 300-level or above.

Students seeking the BSMSNE must complete at least 90 semester hours in general math and science, core, and specialization elective courses within the total requirements of 130 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/officialcertified].) 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 Materials Science and NanoEngineering</td>
<td>90-94</td>
</tr>
<tr>
<td></td>
<td>Total Credit Hours Required for the BSMSNE Degree</td>
<td>130-134</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>Required Math and Science Prerequisites</td>
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<tr>
<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>
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<td>MATH 102</td>
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<td>or MATH 106</td>
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<td>Select 1 from the following:</td>
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<tr>
<td>PHYS 101</td>
<td>MECHANICS (WITH LAB)</td>
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<tr>
<td>&amp; PHYS 103</td>
<td>and MECHANICS DISCUSSION</td>
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<tr>
<td>PHYS 111</td>
<td>HONORS MECHANICS (WITH LAB)</td>
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<tr>
<td>PHYS 102</td>
<td>ELECTRICITY &amp; MAGNETISM (WITH LAB)</td>
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<tr>
<td>&amp; PHYS 104</td>
<td>and ELECTRICITY AND MAGNETISM DISCUSSION</td>
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<tr>
<td>PHYS 112</td>
<td>HONORS ELECTRICITY &amp; MAGNETISM (WITH LAB)</td>
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<tr>
<td>MATH 211</td>
<td>ORDINARY DIFFERENTIAL EQUATIONS</td>
<td>3</td>
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<tr>
<td></td>
<td>AND LINEAR ALGEBRA</td>
<td></td>
</tr>
<tr>
<td>MATH 212</td>
<td>MULTIVARIABLE CALCULUS</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 121</td>
<td>GENERAL CHEMISTRY I</td>
<td>4</td>
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<tr>
<td>&amp; CHEM 123</td>
<td>and GENERAL CHEMISTRY LABORATORY I</td>
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<tr>
<td>CHEM 122</td>
<td>GENERAL CHEMISTRY II</td>
<td>4</td>
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<tr>
<td>&amp; CHEM 124</td>
<td>and GENERAL CHEMISTRY LABORATORY II</td>
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Bachelor of Science in Materials Science and NanoEngineering (BSMSNE) Degree

CAAM 210  INTRODUCTION TO ENGINEERING COMPUTATION  3
CAAM 335  MATRIX ANALYSIS  3

Select 1 from the following:  3

PHYS 201  WAVES, LIGHT, AND HEAT
CHEM 211 & CHEM 213  ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY DISCUSSION
CHEM 301  PHYSICAL CHEMISTRY I

Core Requirements

MSNE 201  INTRODUCTION TO NANOENGINEERING  3
MSNE 301  MATERIALS SCIENCE  3
MSNE 302  MATERIALS PROCESSING AND NANOUFACTURING  3
MSNE 303  MATERIALS SCIENCE JUNIOR LAB  1
MSNE 311  MATERIALS SELECTION AND DESIGN  4
MSNE 401  THERMODYNAMICS IN MATERIALS SCIENCE  3
MSNE 402  MECH PROPERTIES OF MATERIALS  3
MSNE 406  PHYSICAL PROPERTIES OF SOLIDS  3
MSNE 407  CAPSTONE DESIGN PROJECT I  4
MSNE 408  CAPSTONE DESIGN PROJECT II  3
MSNE 411  METALLOGRAPHY AND PHASE RELATIONS  3
MSNE 415  CERAMICS AND GLASSES  3
MSNE 435  CRYSTALLOGRAPHY & DIFFRACTION  3
MSNE 437  CRYSTALLOGRAPHY & DIFFRACTOMETERS  1
MSNE 450  MATERIALS SCIENCE SEMINAR  1
& MSNE 451  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 2 elective courses from the Technical Cluster or select additional Engineering Cluster courses (see course lists below)  6-8

Total Credit Hours Required for the Major in Major in Materials Science and NanoEngineering  90-94

University Graduation Requirements (ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements)  40

Total Credit Hours  130-134

Footnotes and Additional Information

* Includes coursework completed as distribution credit, FWIS, LPAP, upper-level, residency (hours taken at Rice), 60 hours outside of the major (if applicable), and any additional academic program requirements. The "hours outside of the major" requirement may include all of the above university requirements.

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 4 additional courses (a minimum of 12 credit hours). 1 course (3-4 credit hours) must come from the Engineering Cluster, 1 course (3-4 credit hours) must come from the Math and Science Cluster. The 2 remaining courses (6-8 credit hours) must come from the Technical Cluster or from additional Engineering Cluster coursework.

Engineering Cluster (no MSNE courses)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tr>
<td>BIOE 370</td>
<td>BIOMATERIALS</td>
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<tr>
<td>CEVE 310</td>
<td>PRINCIPLES OF ENVIRONMENTAL ENGINEERING</td>
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<tr>
<td>MECH 311 &amp; MECH 311</td>
<td>MECHANICS OF SOLIDS AND STRUCTURES</td>
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<tr>
<td>MECH 427 &amp; MECH 427</td>
<td>COMPUTATIONAL STRUCTURAL MECHANICS</td>
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<tr>
<td>FEM 434</td>
<td>FATE AND TRANSPORT OF CONTAMINANTS IN THE ENVIRONMENT</td>
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<td>CHBE 390</td>
<td>CHEMICAL KINETICS AND REACTOR DESIGN</td>
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<td>CHBE 401</td>
<td>TRANSPORT PHENOMENA I</td>
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<tr>
<td>ELEC 241 &amp; ELEC 240</td>
<td>FUNDAMENTALS OF ELECTRICAL ENGINEERING I</td>
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<tr>
<td>ELEC 243</td>
<td>ELECTRONIC MEASUREMENT SYSTEMS</td>
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<td>ELEC 261</td>
<td>ELECTRONIC MATERIALS AND QUANTUM DEVICES</td>
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<td>ELEC 361</td>
<td>QUANTUM MECHANICS FOR ENGINEERS</td>
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<td>ELEC 462</td>
<td>OPTOELECTRONIC DEVICES</td>
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<td>ENGI 302 &amp; CEVE 302</td>
<td>SUSTAINABLE DESIGN</td>
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<td>ENGI 303 &amp; CEVE 322</td>
<td>ENGINEERING ECONOMICS</td>
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<td>MECH 211 &amp; CEVE 211</td>
<td>ENGINEERING MECHANICS</td>
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<td>MECH 403</td>
<td>COMPUTER AIDED DESIGN</td>
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<td>MECH 417 &amp; CEVE 417</td>
<td>FINITE ELEMENT ANALYSIS</td>
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<td>MECH 481</td>
<td>HEAT TRANSFER</td>
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Total Credit Hours  3-4

Math and Science Cluster (no MSNE or Engineering courses)

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<thead>
<tr>
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<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>ASTR 201</td>
<td>STARS, GALAXIES, AND THE UNIVERSE</td>
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<tr>
<td>ASTR 202</td>
<td>EXPLORATION OF THE SOLAR SYSTEM</td>
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<td>BIOT 201</td>
<td>INTRODUCTORY BIOLOGY</td>
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<td>BIOT 301</td>
<td>BIOCHEMISTRY I</td>
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<tr>
<td>BIOT 305 &amp; BIOT 305</td>
<td>FUNDAMENTALS OF CELLULAR AND MOLECULAR NEUROSCIENCE</td>
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<td>CAAM 336</td>
<td>DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING</td>
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<tr>
<td>CAAM 378</td>
<td>INTRODUCTION TO OPERATIONS RESEARCH AND OPTIMIZATION</td>
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<tr>
<td>ELEC 415 &amp; NEUR 415</td>
<td>THEORETICAL NEUROSCIENCE: FROM CELLS TO LEARNING SYSTEMS</td>
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Bachelor of Science in Materials Science and NanoEngineering (BSMSNE) Degree

CAAM 435 / MATH 435  DYNAMICAL SYSTEMS
CAAM 453  NUMERICAL ANALYSIS I
CAAM 501  ANALYSIS I
CAAM 519  COMPUTATIONAL SCIENCE I
CHEM 211  ORGANIC CHEMISTRY I
& CHEM 213  and ORGANIC CHEMISTRY DISCUSSION
CHEM 212  ORGANIC CHEMISTRY II
& CHEM 214  and ORGANIC CHEM DISCUSSION II
CHEM 301  PHYSICAL CHEMISTRY I
CHEM 302  PHYSICAL CHEMISTRY II
CHEM 330  ANALYTICAL CHEMISTRY
CHEM 360  INORGANIC CHEMISTRY
ESCI 307 / CEVE 307 / ENST 307  ENERGY AND THE ENVIRONMENT
ESCI 321  EARTH SYSTEM EVOLUTION AND CYCLES
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
STAT 305  INTRODUCTION TO STATISTICS FOR BIOSCIENCES

Total Credit Hours 3-4

Technical Cluster (MSNE or Engineering courses)  

Select at least 2 courses from the following (or select additional coursework from the Engineering Cluster):

MSNE 365 / ELEC 365  NANOMATERIALS FOR ENERGY
MSNE 409  PHYSICAL METALLURGY
MSNE 433  COMPUTATIONAL MATERIALS MODELING
MSNE 505  MICROSTRUCTURE AND NANOSTRUCTURE EVOLUTION
MSNE 523  PROPERTIES, SYNTHESIS AND DESIGN OF COMPOSITE MATERIALS
MSNE 538 / CEVE 538  COMPUTATIONAL NANOSCIENCE FOR GREEN INFRASTRUCTURE
MSNE 545 / ELEC 545  THIN FILMS
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  MICRO AND NANO HEAT TRANSPORT
MECH 581  METHODOLOGIES AND DESIGN
MSNE 593 / CHBE 593  INTRODUCTION TO POLYMER PHYSICS
& CHBE 594  PROPERTIES OF POLYMERS
& MSNE 650  NANOMATERIALS AND NANOMECHANICS

Total Credit Hours 6

Footnotes and Additional Information
1 The Technical Cluster also includes the Engineering cluster.

Policies for the BSMSNE Degree

Transfer Credit

For Rice University’s policy regarding transfer credit, see Transfer Credit (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 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 (ga.rice.edu/undergraduate-students/honors-distinctions/university) (summa cum laude, magna cum laude, and cum laude) and Distinction in Research and Creative Work (ga.rice.edu/undergraduate-students/honors-distinctions/university). Some departments have department-specific Honors awards or designations.

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.

Fifth-Year MMSNE Degree Option for Rice Undergraduate Students

Rice undergraduate students have the option to earn the MMSNE degree by adding an additional year after completing their bachelor’s degree. Advanced Rice undergraduate students in good academic standing may apply to the graduate program during their junior or senior year. Upon acceptance, depending on course load, financial aid status, and other variables, they may complete part of the course requirements for the MMSNE program during their senior year. A plan of study based on their
particular focus area will need to be approved by the program director and the MMSNE advisor. Students who have taken MSNE 401, MSNE 402, MSNE 406, MSNE 409 and/or MSNE 435 may request to waive the core course requirements on MSNE 503, MSNE 502, MSNE 506, MSNE 509 and/or MSNE 535, respectively, and replace them with other courses upon the approval of the MMSNE advisor.

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

• must complete the requirements for their bachelor's degree and the MMSNE degree independently of each other (i.e., no course may be counted toward the fulfillment of both degrees).
• should be aware of the 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 (12 credit hours) status.

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