

# Materials Science and Engineering (BS)

The Department of Materials Science and Engineering at NC State University offers a Bachelor of Science in Materials Science and Engineering degree. The program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>.

## Admission

Students complete the standard set of engineering first-year courses, which include courses in the humanities, chemistry, mathematics, physics, and computing. Students may apply to join the Department of Materials Science and Engineering as degree-seeking students via the CODA process (<https://www.engr.ncsu.edu/academics/undergrad/coda/>).

## Curriculum

The MSE curriculum trains students to understand the wide range of phenomena that occur in all classes of materials: metals, polymers, composites, ceramics, and electronic materials.

Fundamental courses provide a foundation in thermodynamics, kinetics, and structure, followed by more applied courses that cover mechanical, thermal, electrical, magnetic, and optical properties of materials.

Two laboratory courses introduce students to analytical methods used to characterize the structure of materials at all length scales and to measure properties of all classes of materials. Cutting-edge technologies in materials science and engineering such as nanotechnology, biomaterials, computer modeling, and forensics (materials degradation and failure analysis) are covered.

Five technical electives are included, which allow students to select from a broad range of courses in materials processing, engineering, chemistry, physics, mathematics, and other disciplines. The flexibility afforded by these technical electives allows students to customize their education to prepare them for careers in industry or for graduate school.

The two-semester capstone senior design sequence provides a bridge between concepts learned in the classroom and the practical application of these concepts in an industrial setting. Teams of students work on real-world materials problems supported by local industrial sponsors.

## Opportunities

The Department of Materials Science and Engineering offers two undergraduate concentrations (Biomaterials (<http://catalog.ncsu.edu/undergraduate/engineering/materials-science-engineering/materials-science-engineering-bs-biomaterials-concentration/>) and Nanomaterials (<http://catalog.ncsu.edu/undergraduate/engineering/materials-science-engineering/materials-science-engineering-bs-nanomaterials-concentration/>)) and an Accelerated Bachelor's/Master's (ABM) Program (<https://www.mse.ncsu.edu/undergraduate/abm/>).

The ABM program gives students the opportunity to earn a bachelor's and a master's degree in five years. Four graduate courses (12 credit hours) can be taken while still an undergraduate student and can be double-counted towards both the bachelor's and master's degrees.

## Contact Information

3002 Engineering Building 1 (EB1)  
911 Partners Way, Raleigh NC 27695-7907  
919.515.2377

Website

To see more about what you will learn in this program, visit the Learning Outcomes website (<https://apps.oirp.ncsu.edu/pgas/>)!

## Plan Requirements

Code	Title	Hours	Counts towards
<b>Math</b>			
MA 141	Calculus I	4	
MA 241	Calculus II	4	
MA 242	Calculus III	4	
MA 341	Applied Differential Equations I	3	
ST 370	Probability and Statistics for Engineers	3	
<b>Sciences</b>			
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory	4	
CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory	4	
CH 220 or CH 221	Introductory Organic Chemistry	3	
CH 222	Organic Chemistry I Lab	1	
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory	4	
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4	
<b>Economics</b>			
EC 205	Fundamentals of Economics	3	

or EC 201 Principles of Microeconomics  
or ARE 201 Introduction to Agricultural & Resource Economics

**Required Courses**

MSE 201	Structure and Properties of Engineering Materials	3
MSE 255	Experimental Methods for Structural Analysis of Materials	2
MSE 260	Mathematical Methods for Materials Engineers	3
MSE 270	Materials Science and Engineering Seminar	1
MSE 300	Structure of Materials at the Nanoscale	3
MSE 301	Introduction to Thermodynamics of Materials	3
MSE 320	Introduction to Defects in Solids	3
MSE 335	Experimental Methods for Analysis of Material Properties	2
MSE 355	Electrical, Magnetic and Optical Properties of Materials	3
MSE 360	Kinetic Processes in Materials	3
MSE 370	Microstructure of Inorganic Materials	3
MSE 380	Microstructure of Organic Materials	3
MSE 420	Mechanical Properties of Materials	3
MSE 423	Introduction to Materials Engineering Design	1
MSE 470	Materials Science and Engineering Senior Design Project	3

MSE 480	Materials Forensics and Degradation	3
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**MSE Processing Elective (choose 1 course) (p. 3)** 3

**Engineering Elective (choose 1 course) (p. 3)** 3

**Technical Elective (choose 3 courses) (p. 3)** 9-11

**Ethics Elective (verify requirement) (p. 4)** 3

**Orientation Courses**

E 101	Introduction to Engineering & Problem Solving	1
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E 115	Introduction to Computing Environments	1
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**Other**

ENG 331	Communication for Engineering and Technology	3
or ENG 333	Communication for Science and Research	

**GEP Courses**

ENG 101	Academic Writing and Research	4
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GEP Humanities ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/</a> )	3-6
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GEP Social Sciences ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/</a> )	3
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GEP Health and Exercise Studies ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/</a> )	2
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GEP Additional Breadth ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/</a> ) (Humanities/Social Sciences/Visual and Performing Arts)	3
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GEP Interdisciplinary Perspectives ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/</a> )	3-5
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GEP U.S. Diversity ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-us-diversity/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-us-diversity/</a> ) (verify requirement)	
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GEP Global Knowledge (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/>) (verify requirement)

Foreign Language Proficiency (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/>) (verify requirement)

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**Total Hours** **126**

## Technical Electives

Code	Title	Hours	Counts towards
Any MSE Processing Elective (p. 3)			
Any Engineering Elective (p. 3)			
BCH 451	Principles of Biochemistry	4	
CH 223	Organic Chemistry II	3	
CH 315	Quantitative Analysis	3	
CH 401	Systematic Inorganic Chemistry I	3	
CH 437	Physical Chemistry for Engineers	4	
MA 305	Introductory Linear Algebra and Matrices	3	
MA 351	Introduction to Discrete Mathematical Models	3	
MA 401	Applied Differential Equations II	3	
MA 402	Mathematics of Scientific Computing	3	
MA 405	Introduction to Linear Algebra	3	
MEA 463	Fluid Physics	3	
PY 328	Stellar and Galactic Astrophysics	3	
PY 407	Introduction to Modern Physics	3	
PY 411/511	Mechanics I	3	
PY 412/512	Mechanics II	3	
PY 414/514	Electromagnetism I	3	
PY 415/515	Electromagnetism II	3	

## Engineering Electives

Code	Title	Hours	Counts towards
Any MSE Processing Elective (p. 3)			
CE 214	Engineering Mechanics-Statics	3	
CE 225	Mechanics of Solids	3	
CSC 110	Computer Science Principles - The Beauty and Joy of Computing	3	
E 304	Introduction to Nano Science and Technology	3	
ECE 331	Principles of Electrical Engineering	3	
ISE 311	Engineering Economic Analysis	3	
MAE 206	Engineering Statics	3	
MAE 208	Engineering Dynamics	3	
MAE 214	Solid Mechanics	3	
MSE 409/509/NE 409/509	Nuclear Materials	3	
MSE 465/565	Introduction to Nanomaterials	3	
MSE 485	Biomaterials	3	
MSE 490	Special Topics in Materials Engineering	1-4	
NE 202	Radiation Sources, Interaction and Detection	4	
TE 205	Analog and Digital Circuits	4	

## MSE Processing Electives

Code	Title	Hours	Counts towards
MSE 440	Processing of Metallic Materials	3	
MSE 445	Ceramic Processing	3	
MSE 455	Polymer Technology and Engineering	3	
MSE 456	Composite Materials	3	
MSE 460	Microelectronic Materials	3	

MSE 540	Processing of Metallic Materials	3
MSE 545	Ceramic Processing	3
MSE 556	Composite Materials	3

## Ethics Electives

Code	Title	Hours	Counts towards
IDS 201	Environmental Ethics	3	
PHI 214	Issues in Business Ethics	3	
PHI 221	Contemporary Moral Issues	3	
PHI 227	Data Ethics	3	
PHI 325	Bio-Medical Ethics	3	
PHI 375	Ethics	3	
STS 302	Contemporary Science, Technology and Human Values	3	
STS 304	Ethical Dimensions of Progress	3	
STS 325	Bio-Medical Ethics	3	

## Semester Sequence

This is a sample.

### First Year

Code	Title	Hours
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory <sup>1</sup>	4
E 101	Introduction to Engineering & Problem Solving <sup>1,2</sup>	1
E 115	Introduction to Computing Environments <sup>1,2</sup>	1
ENG 101	Academic Writing and Research <sup>1,2</sup>	4
MA 141	Calculus I <sup>1</sup>	4
Select one of the following Economics courses:		3
EC 205	Fundamentals of Economics	
EC 201	Principles of Microeconomics	
ARE 201	Introduction to Agricultural & Resource Economics	
ARE 201A	Introduction to Agricultural & Resource Economics	
<b>Hours</b>		<b>17</b>

### Spring Semester

CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory	4
MA 241	Calculus II <sup>1</sup>	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory <sup>1</sup>	4

GEP Health and Exercise Studies ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/</a> )		1
E 102	Engineering in the 21st Century	2
<b>Hours</b>		<b>15</b>

### Second Year

#### Fall Semester

MSE 201	Structure and Properties of Engineering Materials <sup>1</sup>	3
ST 370	Probability and Statistics for Engineers	3
MA 242	Calculus III	4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
GEP Health and Exercise Studies ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/</a> )		1
<b>Hours</b>		<b>15</b>

#### Spring Semester

MSE 255	Experimental Methods for Structural Analysis of Materials	2
MSE 260	Mathematical Methods for Materials Engineers	3
MSE 270	Materials Science and Engineering Seminar	1
CH 220 or CH 221	Introductory Organic Chemistry or Organic Chemistry I	3
CH 222	Organic Chemistry I Lab	1
MA 341	Applied Differential Equations I	3
GEP Requirement ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/</a> )		3
<b>Hours</b>		<b>16</b>

### Third Year

#### Fall Semester

MSE 300	Structure of Materials at the Nanoscale	3
MSE 301	Introduction to Thermodynamics of Materials	3
MSE 320	Introduction to Defects in Solids	3
MSE 335	Experimental Methods for Analysis of Material Properties	2
Technical Elective (p. 3)		3
GEP Requirement ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/</a> )		3
<b>Hours</b>		<b>17</b>

#### Spring Semester

MSE 355	Electrical, Magnetic and Optical Properties of Materials	3
MSE 360	Kinetic Processes in Materials	3
MSE 370	Microstructure of Inorganic Materials	3
MSE 380	Microstructure of Organic Materials	3
Engineering Elective (p. 3)		3
<b>Hours</b>		<b>15</b>

**Fourth Year****Fall Semester**

MSE 420	Mechanical Properties of Materials	3
MSE 423	Introduction to Materials Engineering Design	1
ENG 331 or ENG 333	Communication for Engineering and Technology or Communication for Science and Research	3
MSE Processing Elective (p. 3)		3
Technical Elective (p. 3)		3
GEP Requirement ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/</a> )		3
<b>Hours</b>		<b>16</b>

**Spring Semester**

MSE 470	Materials Science and Engineering Senior Design Project	3
MSE 480	Materials Forensics and Degradation	3
Technical Elective (p. 3)		3
Ethics Elective (p. 4)		3
GEP Requirement ( <a href="http://catalog.ncsu.edu/undergraduate/gep-category-requirements/">http://catalog.ncsu.edu/undergraduate/gep-category-requirements/</a> )		3
<b>Hours</b>		<b>15</b>
<b>Total Hours</b>		<b>126</b>

<sup>1</sup> Courses required for Change of Degree Audit (CODA). CH 101, CH 102; MA 141, MA 241; PY 205, PY 206 must be completed with a C or higher.

<sup>2</sup> Minimum grade of C-, E 115 requires satisfactory completion (S).

## Career Opportunities

An MSE degree is interdisciplinary and, upon graduation, will qualify you for a variety of jobs with an average starting salary of \$60-70k per year.

## Example Job Titles

Materials Engineer, Product Engineer, Metallurgist Engineer, Quality Control Engineer, Failure Analysis Engineer, Renewable Energy Materials Engineer, Biomaterial Engineer, Polymer Materials Engineer, Project Manager

## Example Job Description

- Identify and produce a diverse range of materials for applications of interest
- Develop and improve methods for the analysis of complex materials
- Assist in the selection of materials for product application, the calculation of design parameters, the performance of material properties testing
- Apply scientific methods to resolve technical challenges related to materials and their use in products and processes