

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.

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

At NC State, Materials Science and Engineering students are trained to understand the complexities of all classes of material. Our curriculum begins with core courses in thermodynamics, kinetics, and structure, building a strong foundation before advancing to mechanical, thermal, electrical, magnetic, and optical properties.

Hands-on learning is a cornerstone of the program, with two laboratory courses that immerse students in analytical techniques to characterize materials at all scales and measure their properties. Our program covers cutting-edge technologies like nanomaterials, biomaterials, advanced functional materials, materials forensics, computational modeling, and AI-driven materials optimization.

With five technical electives, students can tailor their education with courses in materials processing, engineering, chemistry, physics, mathematics, statistics, biological sciences, computer science, data science, and beyond. This flexibility allows students to prepare for diverse career paths in industry or pursue graduate studies.

In our two-semester capstone senior design project, students apply their knowledge to solve practical materials challenges with industry partners. Working in teams, you'll tackle hands-on problems and bridge classroom learning with real-world impact.

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

Plan Requirements

Code	Title	Hours
Math		
MA 141	Calculus I ^{1,2}	4
MA 241	Calculus II ^{1,2}	4
MA 242	Calculus III ³	4
MA 341	Applied Differential Equations I	3
ST 370	Probability and Statistics for Engineers	3
Sciences		
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory ^{1,2}	4
CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory	4
CH 220 or CH 221	Introductory Organic Chemistry or Organic Chemistry I	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 ^{1,2}	4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
Economics		
EC 205 or EC 201 or ARE 201	Fundamentals of Economics or Principles of Microeconomics or Introduction to Agricultural & Resource Economics	3
Ethics Elective (verify requirement) (p. 3)		
Required Courses		
MSE 201	Structure and Properties of Engineering Materials ²	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
Electives		

MSE Processing Elective (choose 1 course) (p. 2)	3
Engineering Elective (choose 1 course) (p. 2)	3
Technical Electives (choose 3 courses) (p. 2)	9-11
Technical Writing	
ENG 331 Communication for Engineering and Technology or ENG 333 Communication for Science and Research	3
Orientation Courses	
E 101 Introduction to Engineering & Problem Solving ^{1,3}	1
E 102 Engineering in the 21st Century ³	2
E 115 Introduction to Computing Environments ¹	1
GEP Courses	
ENG 101 Academic Writing and Research ^{1,3}	4
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)	6
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)	3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)	2
GEP Elective (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)	3
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)	
GEP Foundations of American Democracy (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-fad/) (verify requirement)	
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)	
Total Hours	126

¹ College of Engineering CODA class² Grade of C or higher required³ Grade of C- or higher required

MSE Processing Electives

Code	Title	Hours
MSE 440/540	Processing of Metallic Materials	3
MSE 445/545	Ceramic Processing	3
MSE 455/555	Polymer Technology and Engineering	3
MSE 456/556	Composite Materials	3
MSE 460/560	Microelectronic Materials	3

Engineering Electives

Code	Title	Hours
Any MSE Processing Elective (p. 2)		
CE 214	Engineering Mechanics-Statics	3
CE 225	Mechanics of Solids	3
CSC 110	Computer Science Principles - The Beauty and Joy of Computing	3
CSC 111	Introduction to Computing: Python	3

CSC 113	Introduction to Computing - MATLAB	3
CSC 116	Introduction to Computing - Java	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/ECE/PY 489	Solid State Solar and Thermal Energy Harvesting	3
MSE 490	Special Topics in Materials Science and Engineering	1-4
MSE 495	Materials Engineering Projects (Department Approval Required)	3
NE 202	Radiation Sources, Interaction and Detection	4
TE 205	Analog and Digital Circuits	4

Other engineering electives (with departmental approval). Contact your MSE academic advisor for options.

500-level courses (with departmental approval). Available to students who are admitted to an engineering ABM program OR have a minimum 3.5 overall GPA.

Technical Electives

Code	Title	Hours
Any MSE Processing Elective (p. 2)		
Any Engineering Elective (p. 2)		
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

Other technical electives (with departmental approval). Contact your MSE academic advisor for options.

500-level courses (with departmental approval). Available to students who are admitted to an engineering ABM program OR have a minimum 3.5 overall GPA.

Ethics Electives

Code	Title	Hours
EED 414/514	Ethics for Engineering Education	3
IDS 201	Environmental Ethics	3
PHI 214	Issues in Business Ethics	3
PHI 221	Contemporary Moral Issues	3
PHI 227	Data Ethics	3
PHI/STS 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

Semester Sequence

This is a sample.

First Year

Fall Semester		Hours
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory ^{1,2}	4
ENG 101	Academic Writing and Research ^{1,3}	4
E 102	Engineering in the 21st Century ³	2
MA 141	Calculus I ^{1,2}	4
EC 205 or EC 201 or ARE 201	Fundamentals of Economics or Principles of Microeconomics or Introduction to Agricultural & Resource Economics	3
Hours		17

Spring Semester

CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory	4
E 101	Introduction to Engineering & Problem Solving ^{1,3}	1
E 115	Introduction to Computing Environments ¹	1
MA 241	Calculus II ^{1,2}	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory ^{1,2}	4
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		15

Second Year

Fall Semester		
MSE 201	Structure and Properties of Engineering Materials ²	3
ST 370	Probability and Statistics for Engineers	3
MA 242	Calculus III ³	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 (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)	1
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Hours		15
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 (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		16

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. 2)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		17

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. 2)		3
Hours		15

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. 2)		3
Technical Elective (p. 2)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		16
Spring Semester		
MSE 470	Materials Science and Engineering Senior Design Project	3

MSE 480	Materials Forensics and Degradation	3
Technical Elective (p. 2)		3
Ethics Elective (p. 3)GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		15
Total Hours		126

¹ College of Engineering CODA class

² Grade of C or higher required

³ Grade of C- or higher required

Career Opportunities

Earning a Bachelor of Science in MSE offers graduates a wealth of exciting career opportunities across diverse industries. The interdisciplinary nature of an MSE education prepares individuals to work in roles that involve designing, developing, and optimizing materials that drive innovation and address societal needs. Here's what you can expect:

Starting Salary: Graduates in MSE typically earn an average starting salary of \$70,000 to \$90,000 per year.

Common Industries

- **Materials Science:** Innovate and optimize materials such as semiconductors, metals, steel, plastics, ceramics, and composites for a wide range of applications.
- **Electronics and Semiconductors:** Create advanced materials for microchips, sensors, and electronic components.
- **Aerospace:** Develop lightweight, durable materials for aircraft and spacecraft.
- **Energy:** Advanced materials for renewable energy technologies, batteries, and energy storage systems.
- **Sustainability:** Develop sustainable materials and processes to reduce environmental impact.
- **Biomedical:** Design biomaterials for prosthetics, medical devices, and tissue engineering.
- **Automotive:** Innovate materials for improved fuel efficiency, durability, and safety.
- **Pharmaceuticals & Healthcare:** Design and improve materials used in drug delivery systems and medical implants.
- **Environmental Engineering:** Design materials for air and water purification, carbon capture, and environmental cleanup.
- **Consumer Goods:** Improve products like durable coatings, cosmetics, and high-performance clothing with nanomaterials.
- **Regenerative Medicine:** Create materials for applications in stem cell therapy and wound healing.
- **Diagnostics:** Design biosensors and diagnostic devices that utilize biomaterials for medical testing and monitoring.

Career Titles

Materials science and engineering is a dynamic field, offering professionals opportunities to solve complex challenges and make meaningful contributions to society. A career in MSE offers a diverse range of opportunities:

- **Ceramics Engineer:** Designing and testing ceramic materials for applications in aerospace, electronics, and healthcare.
- **Composite Engineer:** Designing and analyzing composite materials for lightweight and durable structures.
- **Consulting Engineer:** Providing technical expertise to solve engineering challenges across industries.
- **Corrosion Engineer:** Analyzing material degradation and developing corrosion-resistant materials and coatings.
- **Data Engineer:** Designing, developing, and optimizing data pipelines and workflows for materials-related data.
- **Defectivity Design Engineer:** Minimizing defects in materials or manufacturing processes and implementing corrective actions.
- **Design Engineer:** Creating and optimizing product designs using CAD and simulation tools.
- **Engineering Technician:** Assisting engineers in testing, developing, and manufacturing materials or products.
- **Failure Analysis Engineer:** Investigating material or product failures to determine root causes and enhance reliability.
- **Field Applications Scientist:** Supporting customers in implementing scientific tools or materials in applications.
- **Manufacturing Engineer:** Developing and optimizing manufacturing processes for material production.
- **Materials Engineer:** Designing, testing, and analyzing materials for various applications.
- **Materials Scientist:** Conducting research to understand material properties and developing innovative materials.
- **Metallurgical Engineer:** Developing processes for extracting, refining, and processing metals and alloys.
- **Packaging Engineer:** Designing and testing innovative packaging solutions for products.
- **Patent Examiner:** Reviewing patent applications for originality and compliance in materials-related innovations.
- **Plastics Engineer:** Developing and optimizing polymer and plastic materials for industrial applications.
- **Polymer Materials Engineer:** Researching and developing advanced polymer materials for diverse applications.
- **Pre-Sales Engineer:** Providing technical expertise to support sales teams in material-related products.
- **Principal Scientist:** Leading R&D initiatives in materials science and mentoring junior researchers.
- **Process Engineer:** Developing and improving manufacturing processes for materials production.
- **Product Designer:** Creating innovative product designs using advanced materials.
- **Product Engineer:** Overseeing the development, testing, and manufacturing of products.
- **Project Manager:** Planning and overseeing material development projects and coordinating teams.
- **Quality Engineer:** Developing and implementing quality assurance processes to ensure material compliance.
- **Quality Control Engineer:** Testing materials and products to ensure quality and performance standards are met.
- **Renewable Energy Materials Engineer:** Developing materials for renewable energy technologies like solar panels and batteries.
- **R&D Engineer:** Leading research projects to develop innovative materials and technologies.

- **Sales Engineer:** Providing technical support for the sale of material-related products and solutions.
- **Semiconductor Processing Engineer:** Developing and optimizing processes for semiconductor fabrication.
- **Systems Engineer:** Designing and integrating systems for material-related projects and optimizing performance.

Learn More About Careers

NCcareers.org (<https://nccareers.org/>)

Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (<https://www.bls.gov/ooh/>)

Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (<https://www.careeronestop.org/>)

View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (<https://careers.dasa.ncsu.edu/explore-careers/career-assessments/>) (NC State student email address required)

This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (<https://careers.dasa.ncsu.edu/about/hours-appointments/>) to discuss the results.

Focus 2 Apply Assessment (<https://www.focus2career.com/Portal/Register.cfm?SID=1929>) (Available to prospective students)

A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

American Society for Testing & Materials (<http://www.astm.org/>)

Materials Research Society (<http://www.mrs.org/home/>)

National Society of Professional Engineers (<http://www.nspe.org/>)