

MATERIALS SCIENCE AND ENGINEERING MAJOR

Notice of Addendum: The program description on this page was updated via an addendum. To see the update, visit ADDENDA TO THIS CATALOG (<https://academiccatalog.umd.edu/undergraduate/addenda/#materials-science-engineering-major>).

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The development, production and use of novel materials has become a major issue in all fields of engineering. Materials which are strong and light at the same time are needed for space structures; faster electro-optical switching materials will result in improved mass communications; and stronger high temperature plastics would improve the efficiency of transportation systems. Students will have the opportunity to work with faculty and industry on complex problems through projects, internships, and research and co-op experiences. A wide variety of careers are open to graduates of this program ranging from production and quality control in the traditional materials industries to the molecular construction of electronic materials in ultra-clean environments, and to the applications of materials in electronic packages. The application of materials to solve environmental, biomedical, energy, and reliability problems are also career options.

Students majoring in Materials Science and Engineering will receive a Bachelor of Science upon successful completion of the program. Courses offered by this department may be found under the acronym ENMA.

The Bachelor of Science in Materials Science and Engineering degree program at the University of Maryland is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria and the Materials Engineering Program Criteria.

Program Education Objectives

The mission of the Materials Science and Engineering Department at the University of Maryland is to provide a quality engineering education, research at the forefront of the field, and leadership to the Materials and Engineering communities. Our educational programs will have the following objectives:

- Produce high quality alumni who will be successful in their chosen careers in industry, government or academia, in the State of Maryland, the nation and the world.
- Produce alumni who demonstrate the ability to define and solve engineering and science problems in the field of Materials Science and Engineering throughout their careers.
- Produce alumni who demonstrate the ability to relate basic physics, math, chemistry and engineering principles to the field of Materials Science and Engineering so they can function professionally as materials engineers and scientists.
- Produce alumni who design and engineer materials and materials systems for future generations of products and demonstrate a continuous upgrading of their knowledge to address and impact the rapid pace of technological advances.

The department will support our students with an educational program that has sufficient breadth in both fundamental and specialized engineering topics to ensure our graduates meet the current and future needs of society. In the area of research, the department conducts a

range of scientific research programs and establishes partnerships with government and industry, both in Maryland and elsewhere, to accomplish this goal.

Student Learning Outcomes

The overall educational outcomes of the Materials Science and Engineering Program are to provide undergraduate engineering students:

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.

REQUIREMENTS

Requirements for the Materials Science and Engineering major include thorough preparation in mathematics, chemistry, physics, and engineering science as well as the required university general education requirements. All students will be required to select an area of specialization, an upper-class science elective, and two technical electives. A minimum of 122 credits is required for a bachelor's degree. A sample program follows:

| Freshman Year | | | |
|---------------------|---------|---|-----------|
| First Semester | Credits | Second Semester | Credits |
| CHEM135 | | 3 MATH141 | 4 |
| ENES100 | | 3 ENMA165 | 3 |
| MATH140 | | 4 PHYS161 | 3 |
| ENGL101 | | 3 GenEd | 3 |
| CHEM136 | | 1 Oral Communication | 3 |
| ENMA180 | | 1 | |
| | | 15 | 16 |
| Sophomore Year | | | |
| First Semester | Credits | Second Semester | Credits |
| MATH241 | | 4 MATH246 | 3 |
| PHYS260 | | 3 PHYS270 | 3 |
| PHYS261 | | 1 PHYS271 | 1 |
| ENMA300 | | 3 Select one of the following: ¹ | 3-4 |
| ENES200 or ENEE 200 | | 3 CHEM231 & CHEM232 | |
| | | CHEM481 | |

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|--|----------------|--|----------------|
| | ENMA301 | 3 | |
| | GenED | 3 | |
| | 14 | | 16-17 |
| Junior Year | | | |
| First Semester | Credits | Second Semester | Credits |
| ENMA312 (Or Upper Level Science Elective) | 3 | ENMA312 (Or Upper Level Science Elective) | 3 |
| ENMA362 | 3 | ENMA465 | 3 |
| ENMA460 | 3 | ENMA461 | 3 |
| Scholarship in Practice ² | 3 | Specialization Elective | 3 |
| Specialization Elective | 3 | ENMA470 | 3 |
| | 15 | | 15 |
| Senior Year | | | |
| First Semester | Credits | Second Semester | Credits |
| ENMA441 | 3 | Technical Elective (at or above 300 level) | 3 |
| ENMA471 | 3 | Specialization Elective | 3 |
| Specialization Elective | 3 | Specialization Elective | 3 |
| ENMA487 | 1 | GenED ² | 3 |
| Professional Writing | 3 | ENMA490 | 3 |
| Technical Elective (at or above 300 level) | 3 | | |
| | 16 | | 15 |

Total Credits 122-123

¹ CHEM231/CHEM232 is required for students focusing on polymers and biomaterials.

² All students must complete two Distributive Studies courses that are approved for I-series courses. The Understanding Plural Societies (UP) and Cultural Competence (CC) courses may also fulfill Distributive Studies categories.

Other Requirements for the Major

Students majoring in Materials Science and Engineering must follow the academic policies developed by the A. James Clark School of Engineering. Students must achieve a "C-" or better on all coursework in their major (including required non-engineering courses such as chemistry and physics). Students must achieve a minimum cumulative GPA of 2.0 and completion of all degree requirements to graduate. Students are encouraged to visit the Department webpage for a curriculum guideline. A multi-year academic plan will be developed in conjunction with their advisor. All Materials Science and Engineering students must be mentored by three different faculty members, preferably during their sophomore and junior years (once per semester) to assist them in choosing their specialization area and to plan for post graduation.

FOUR-YEAR PLAN

Click here (<https://eng.umd.edu/advising/four-year-plans/>) for roadmaps for four-year plans in the A. James Clark School of Engineering.

Additional information on developing a four-year academic plan can be found on the following pages:

- <http://4yearplans.umd.edu>
- the Student Academic Success-Degree Completion Policy (<https://academiccatalog.umd.edu/undergraduate/registration-academic-requirements-regulations/academic-advising/#success>) section of this catalog