MATERIALS SCIENCE AND ENGINEERING

Everything Americans use is composed of materials, from computer chips to flexible concrete skyscrapers, from plastic bags to artificial hips, from fiber optical cables to automobiles. Materials Science and Engineering makes these materials reliable and useful through design, processing, and analysis of controlled compositions, microstructures, and properties. Without new materials, the next generation of computers, automobiles, aircraft telecommunications, skyscrapers, and medical implants will not exist. Materials of the future will be smart and think on their own, in addition to meeting traditional property demands. This field abounds with scientific challenges and technological excitement.

About this Program

- **College:** Herbert Wertheim College of Engineering (https://catalog.ufl.edu/UGRD/colleges-schools/UGENG/)
- **Degree:** Bachelor of Science in Materials Science and Engineering
- **Credits for Degree:** 125

To graduate with this major, students must complete all university, college, and major requirements.

Department Information

The Department of Materials Science and Engineering strives to serve the scientific and engineering community of the state and nation by providing quality education in the field, conducting basic and applied research to enhance science in the field, and supplying short courses, technology transfer, industrial consulting, and distance learning to promote engineering in the field.
Website (https://mse.ufl.edu/)

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Curriculum

- /UGRD/colleges-schools/UGENG/ENG_UCT02/
- /UGRD/colleges-schools/UGENG/ENG_UCT03/
- /UGRD/colleges-schools/UGENG/ENG_UCT06/
- /UGRD/colleges-schools/UGENG/ENG_UCT07/
- Combination Degrees
- Materials Science and Engineering
- Materials Science and Engineering Minor
- Nuclear and Radiological Engineering Minor
- Nuclear Engineering

The bachelor's degree program provides a broad materials science and engineering core with specialization in ceramics, electronic materials, metals or polymeric and biomaterials. Biomaterials is also taught at the combination bachelor's/master's level.

Admission Requirements

It is the department's policy to admit the best-qualified transfer applicants as demonstrated by academic achievement.

Successful applicants must have earned:

- An overall 2.5 grade point average, based on the first two attempts, in the eight preprofessional (critical-tracking) courses
- A minimum grade of C in the following:

Code	Title	Credits
MAC 2311	Analytic Geometry and Calculus 1	4
MAC 2312	Analytic Geometry and Calculus 2	4
MAC 2313	Analytic Geometry and Calculus 3	4
MAP 2302	Elementary Differential Equations	3
CHM 2045/2095	General Chemistry 1	3
CHM 2045L	General Chemistry Laboratory	1
CHM 2046/2096	General Chemistry 2	3
CHM 2046L	General Chemistry 2 Laboratory	1

PHY 2048 & 2048L	Physics with Calculus 1 and Laboratory for PHY 2048	4
PHY 2049 & 2049L	Physics with Calculus 2 and Laboratory for PHY 2049	4

Only the first two attempts in each course, including withdrawals, will be considered for admission to or retention in the department

- A cumulative minimum GPA of 2.0 is required for all courses

Educational Objectives

The program objectives of the MSE program at the University of Florida are to produce engineering practitioners and graduate students who in three to five years after graduation will:

- Have successful careers in Materials Science and Engineering or related disciplines.
- Be prepared to successfully participate in continuing education or education toward advanced degrees.

Department Requirements

A minimum grade of C is required in ENC 2256 / ENC 3246.

The department encourages students to accept internships and opportunities to study abroad. However, it is highly recommended that students seek academic advising for appropriate registration planning.

Mission

The department strives to serve the scientific and engineering community of the state and nation by providing quality education in the field, conducting basic and applied research to enhance science in the field, and supplying short courses, technology transfer, industrial consulting and distance learning to promote engineering in the field.

Critical Tracking

Critical Tracking records each student's progress in courses that are required for progress toward each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites (https://cpm.flvc.org/advance-search/) may be used for transfer students.

Semester 1

- Complete 1 of 9 critical-tracking courses with a minimum grade of C within two attempts: CHM 2045 or CHM 2095, CHM 2046 or CHM 2096, EMA 3010, MAC 2311, MAC 2312, MAC 2313, MAP 2302, PHY 2048, PHY 2049
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 2

- Complete 2 additional critical-tracking course with a minimum grade of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 3

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 4

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 5

- Complete all 9 critical-tracking courses with minimum grades of C in each course within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 6

- Complete EMA 4125 and 1 additional EMA 3000/4000 level course

Semester 7

- Complete 2 additional EMA 3000/4000 level courses

Semester 8

- Complete all remaining EMA 3000/4000 level required courses

Model Semester Plan

Students are expected to complete the General Education International (N) requirement. This is often done concurrently with another General Education requirement (typically, GE-C, H, or S).

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's academic record and scheduling availability of courses. Prerequisites still apply.

Course	Title	Credits
Semester One		
Quest 1 (Gen Ed Humanities); Writing Requirement: 2,000 words; with International		3
Select one:		3
CHM 2045	General Chemistry 1 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2095	Applied General Chemistry 1 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2045L	General Chemistry Laboratory (Gen Ed Physical Sciences)	1
Select one:		3
ENC 1101	Expository and Argumentative Writing (State Core Gen Ed Composition (https://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext); Writing Requirement: 6,000 words) [1]	
ENC 1102	Argument and Persuasion (State Core Gen Ed Composition (https://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext); Writing Requirement: 6,000 words) [1]	
MAC 2311	Analytic Geometry and Calculus 1 (**Critical Tracking**; State Core Gen Ed Mathematics)	4
	Credits	**14**
Semester Two		
Quest 2 (Gen Ed Social/Behavioral Science); Writing Requirement: 2,000 words; with International		3
Select one:		3
CHM 2046	General Chemistry 2 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2096	Applied General Chemistry 2 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2046L	General Chemistry 2 Laboratory (Gen Ed Physical Sciences)	1
Select one:		3
ENC 2256	Writing in the Disciplines (Gen Ed Composition; Writing Requirement: 6,000 words) [2]	
ENC 3246	Professional Communication for Engineers (Writing Requirement: 6,000 words) [2]	
MAC 2312	Analytic Geometry and Calculus 2 (**Critical Tracking**)	4
	Credits	**14**
Semester Three		
Select one:		3-4
EIN 3354	Engineering Economy	
MAN 3025	Principles of Management	
MAR 3023	Principles of Marketing	
EMA 3010	Materials (**Critical Tracking**)	3
MAC 2313	Analytic Geometry and Calculus 3 (**Critical Tracking**; Gen Ed Mathematics)	4
PHY 2048	Physics with Calculus 1 (**Critical Tracking**; State Core Gen Ed Physical Sciences)	3
PHY 2048L	Laboratory for PHY 2048 (Gen Ed Physical Sciences)	1

Select one:		2-3
COP 2271	Computer Programming for Engineers (MATLAB section)	
COP 2273	Python Programming for Engineers	
	Credits	**16-18**
Semester Four		
EGM 2511	Engineering Mechanics: Statics	3
EMA 3000L	Sophomore Materials Laboratory	1
EMA 3011	Fundamental Principles of Materials	3
EMA 3800	Error Analyses and Optimization Methodologies in Materials Research	3
MAP 2302	Elementary Differential Equations (**Critical Tracking**)	3
PHY 2049	Physics with Calculus 2 (**Critical Tracking**)	3
PHY 2049L	Laboratory for PHY 2049	1
	Credits	**17**
Semester Five		
EEL 3003	Elements of Electrical Engineering	3
EGM 3520	Mechanics of Materials	3
EMA 3050	Inorganic Materials	3
EMA 3066	Organic Materials	3
EMA 3080C	Materials Laboratory 1 (Writing Requirement: 4,000 words)	2
EMA 4314	Thermodynamics of Materials	3
	Credits	**17**
Semester Six		
EMA 3013C	Materials Laboratory 2 (Writing Requirement: 2,000 words)	2
EMA 3413	Electronic Properties of Materials	3
EMA 3513C	Analysis of the Structure of Materials	4
EMA 4125	Kinetics of Materials (**Critical Tracking**)	3
EMA 4223	Mechanical Behavior of Materials	3
	Credits	**15**
Semester Seven		
EMA 4324	Stability of Materials	3
EMA 4913 or EGN 4951	Research in Materials Science and Engineering 1 or Integrated Product and Process Design 1	1-3
State Core Gen Ed Social and Behavioral Sciences (https://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext)		3
Senior materials laboratory elective		1
Technical electives [3]		9
	Credits	**17-19**
Semester Eight		
EMA 4XXX	AI for Materials	3
EMA 4714	Materials Selection and Failure Analysis	3
EMA 4914 or EGN 4952	Research in Materials Science and Engineering 2 or Integrated Product and Process Design 2	3
State Core Gen Ed Humanities; Writing Requirement: 2,000 words or more		3
Technical elective [3]		3
	Credits	**15**
	Total Credits	**125**

1 ACT/SAT placement scores do not exempt this requirement.

2 Students needing Gen Ed Composition (GE-C) credit must take ENC 2256. Those who have already completed 6 credits of GE-C through other courses may take ENC 3246.

3 3 credits minimum of technical electives must be one of the following materials processing courses: EMA 4614, EMA 4062, EMA 4623, EMA 4645, or EMA 4666. A maximum of 6 credits of non-EMA or ENU technical electives can be approved from courses outside the MSE department. These electives must either be listed as pre-approved in the MSE Undergraduate Handbook or be approved through an academic petition to the department.

Approved Electives

Senior Materials Laboratory Electives

There are corequisite requirements for certain electives. Students taking a laboratory elective must also be enrolled in the corresponding corequisite technical elective course.

Code	Title	Credits
Laboratory Elective		
EMA 4041L	Advanced Ceramics Laboratory 1 [1]	1
EMA 4020L	Metallurgy Laboratory [2]	1
EMA 4061L	Biomaterials Laboratory [3]	1
EMA 4161L	Polymers Laboratory [4]	1
EMA 4414L	Electronic Materials Laboratory [5]	1

1 Corequisite: EMA 4645.
2 Corequisite: EMA 4120.
3 Corequisite: EMA 4061.
4 Corequisite: EMA 4161.
5 Corequisite: EMA 4614.

Technical Electives

Code	Title	Credits
EMA/ENU Courses		
Typically taught in Fall		
EMA 4061	Biomaterials: Structure and Properties	3
EMA 4120	Physical Metallurgy 1	3
EMA 4144	Physical Ceramics 1	3
EMA 4161	Physical Properties of Polymers	3
EMA 4614	Production of Electronic Materials	3
CEMA/ENU Courses		
Typically taught in Spring		
EMA 4062	Biopolymers: Manufacture, Stability and Biocompatibility	3
EMA 4145	Physical Ceramics 2	3
EMA 4224	Physical Metallurgy 2	3
EMA 4462	Polymer Characterization	3
EMA 4615	Compound Semiconductor Materials	3
EMA 4623	Process Metallurgy	3
EMA 4645	Processing of Ceramic Materials	3
EMA 4666	Polymer Processing	3
ENU 4800	Introduction to Nuclear Reactor Materials	3

- 3 credits minimum of technical electives must be one of the following materials processing courses: EMA 4614, EMA 4062, EMA 4623, EMA 4645, or EMA 4666.
- 3 credits maximum of non-EMA or ENU technical electives can be approved courses from outside the MSE department. Non-EMA or ENU technical electives must be approved by an academic advisor prior to registration.

Academic Learning Compact

The major enables students to develop an understanding of materials systems and their role in engineering. Emphasis is placed on the ability to apply knowledge of mathematics, science and engineering principles to materials science and engineering; to design and conduct experiments, as well as to analyze and interpret data; and to design a *program name* system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

The Materials Science and Engineering BS Program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org (https://nam10.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.abet.org%2F&data=05%7C01%7CDMAYH%40eng.ufl.edu%7C71f1da0d2bb2405acf0908db1519ea82%7C0d4da0f84a314d76ace60a62331e1b84%7C0%7C0%7C638126973271573797%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=Dc6bpEcUU8fM3vMsOTj6pGPQgyLzoSeoS8v2s%2BFVnBE%3D&reserved=0), under the General Criteria and the Program Criteria for Materials, Metallurgical, Ceramics and Similarly Named Engineering Programs.

Before Graduating Students Must

- Pass an assessment by two or more faculty and/or industry practitioners of performance on a major design experience.
- Pass assessment in two courses of individual assignments targeted to each learning outcome. Assessment will be provided by the instructor of the course according to department standards.
- Complete an exit interview in your final semester.
- Complete requirements for the baccalaureate degree, as determined by faculty.

Students in the Major Will Learn to

Student Learning Outcomes | SLOs

Content

1. Apply knowledge of mathematics, science and engineering principles to materials science and engineering.
2. Design and conduct materials science and engineering experiments and analyze and interpret the data.

Critical Thinking

3. Design a materials science and engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.

Communication

4. Communicate technical data and design information effectively in speech and in writing to other materials engineers.

Curriculum Map

I = Introduced; R = Reinforced; A = Assessed

Courses	SLO 1	SLO 2	SLO 3	SLO 4
EMA 3013C				R
EMA 3050	I			
EMA 3066	R		I	
EMA 3080C		I		I
EMA 3513C		R		A
EMA 4223			R	
EMA 4714	A	A	A	

Assessment Types

- Assignments
- Laboratory reports
- Research papers
- Oral presentations
- Exams
- Additional assessments include:
  - Outcome assessment
  - Student exit survey