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 will 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
- **Degree:** Bachelor of Science in Materials Science and Engineering
- **Credits for Degree:** 125
- **Additional Information**
- **Related Materials Science and Engineering Programs**

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

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 also is taught at the combined 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 1 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 Physics with Calculus 1	4
PHY 2049 & 2049L	Physics with Calculus 2 and Laboratory for Physics with Calculus 2	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 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.

Related Materials Science and Engineering Programs

- Combined Degree
- Materials Science and Engineering minor

Critical Tracking

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

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

Model Semester Plan

Students are expected to complete the general education international (N) and diversity (D) requirements. 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		
ENC 1101	Expository and Argumentative Writing (Take in the fall if you don't place out of it)	
Select one:		3
CHM 2045	General Chemistry 1 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2095	Chemistry for Engineers 1 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2045L	General Chemistry 1 Laboratory (Gen Ed Physical Sciences)	1
MAC 2311	Analytic Geometry and Calculus 1 (**Critical Tracking**; State Core Gen Ed Mathematics)	4
State Core Gen Ed Composition; Writing Requirement: 6,000 words [1]		3
State Core Gen Ed Social and Behavioral Sciences		3
	Credits	14
Semester Two		
Select one:		3
CHM 2046	General Chemistry 2 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2096	Chemistry for Engineers 2 (**Critical Tracking**; Gen Ed Physical Sciences)	
CHM 2046L	General Chemistry 2 Laboratory (Gen Ed Physical Sciences)	1
ENC 3246	Professional Communication for Engineers (Gen Ed Composition; Writing Requirement: 6,000 words)	3
IUF 1000	What is the Good Life (Gen Ed Humanities)	3
MAC 2312	Analytic Geometry and Calculus 2 (**Critical Tracking**)	4
	Credits	14
Semester Three		
Select one:		3-4
EIN 4354	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 Physics with Calculus 1 (Gen Ed Physical Sciences)	1
Select a computer programming course:		2
COP 2271	Computer Programming for Engineers (or see advisor for approved list)	
	Credits	16-17
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 Physics with Calculus 2	1
	Credits	17
Semester Five		
EEL 3003	Elements of Electrical Engineering	3
EGM 3520	Mechanics of Materials	3
EMA 3050	Introduction to Inorganic Materials	3
EMA 3066	Introduction to Organic Materials	3
EMA 3080C	Materials Laboratory 1 (Writing Requirement: 4,000 words)	2
EMA 4314	Energetics and Kinetics in Materials Science	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	Transport Phenomena in Materials Processing	3
EMA 4223	Mechanical Behavior of Materials	3
	Credits	15
Semester Seven		
EMA 4324	Stability of Materials	3
EMA 4913 or EMA 4915	Research in Materials Science and Engineering 1 or Integrated Product and Process Design Program 1	1-3
Gen Ed Social and Behavioral Sciences; Writing Requirement: 6,000 words; with International or Diversity		3
Senior materials laboratory elective		1
Technical electives		9
	Credits	17-19
Semester Eight		
EMA 4121	Interfacial Engineering	3
EMA 4714	Materials Selection and Failure Analysis	3
EMA 4914 or EMA 4916	Research in Materials Science and Engineering 2 or Integrated Product and Process Design Program 2	3

State Core Gen Ed Humanities with International or Diversity		3
Technical elective		3
	Credits	15
	Total Credits	125

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

Approved Electives

Senior Materials Laboratory Electives

There are co-requisite requirements for certain electives. Students taking a laboratory elective must also be enrolled in the corresponding co-requisite 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
EMA 4623	Process Metallurgy	3
EMA 4645	Processing of Ceramic Materials	3
EMA 4666	Polymer Processing	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
ENU 4800	Introduction to Nuclear Reactor Materials	3

- 3 credits minimum of technical electives in the fall semester needs to be a materials processing course.
- 3 credits maximum of non-EMA or ENU technical electives can be approved courses from outside the MSE department.

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.

Accredited by the Engineering Accreditation Commission of ABET.

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