MATERIALS SCIENCE AND ENGINEERING

Not all courses are offered every semester. Refer to the schedule of courses for each term's specific offerings.
More Info (https://one.uf.edu/soc/)

Unless otherwise indicated in the course description, all courses at the University of Florida are taught in English, with the exception of specific foreign language courses.

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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Map (http://campusmap.ufl.edu/#/index/0184)

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

Courses

EGN 1935 Special Topics in Freshman Engineering 1-3 Credits
Grading Scheme: Letter Grade
Laboratory, lectures or conferences cover selected topics in engineering.

EGN 4912 Engineering Directed Independent Research 0-3 Credits
Grading Scheme: S/U
Provides firsthand, supervised research with a faculty advisor or postdoctoral or graduate student mentor. Projects may involve inquiry, design, investigation, scholarship, discovery, or application.
Prerequisite: Department permission.

EGS 1006 Introduction to Engineering 1 Credit
Grading Scheme: Letter Grade
Introduces the 11 departments that offer undergraduate degrees at UF. Students break into groups of 20, rotating weekly through each department. During these visits, students participate in hands-on experiments to help them make informed decisions about career alternatives.

EMA 1004 Materials Impact on Society 3 Credits
Grading Scheme: Letter Grade
Discovery and development of specific classes of materials are considered from the perspective of having dramatically altered the course of human history and societies. Materials are presented in historical and technical contexts and considered in terms of their political, financial, health and technology impacts.

EMA 3000L Sophomore Materials Laboratory 1 Credit
Grading Scheme: Letter Grade
Conceptual perspective of the origin of materials behavior and the interrelationships of the materials tetrahedron: structure/property/performance/processing. Conduct experiments on the materials tetrahedron.
Corequisite: EMA 3010.

EMA 3010 Materials 3 Credits
Grading Scheme: Letter Grade
Conceptual perspective for origin of materials behavior and the interrelationships of structure/property/performance. Materials selection and use of familiar material (metals, ceramics, polymers, electronic materials and composites) in electronics and structural and other engineering applications.
Prerequisite: CHM 2045 or CHM 2095.

EMA 3011 Fundamental Principles of Materials 3 Credits
Grading Scheme: Letter Grade
Covers the fundamental principles of structure, reactivity and energies describing materials systems, directly relating individual principles to specific materials properties or functions.
Prerequisite: EMA 3010.

EMA 3013C Materials Laboratory 2 2 Credits
Grading Scheme: Letter Grade
General undergraduate materials laboratory. (WR)
Prerequisite: EMA 3080C.
Attributes: Satisfies 2000 Words of Writing Requirement

EMA 3050 Introduction to Inorganic Materials 3 Credits
Grading Scheme: Letter Grade
Uses, structure, processing and properties of inorganic materials, including metals, alloys and ceramics. Scientific principles are introduced through discussion of developed inorganic materials for high technology applications.
Prerequisite: EMA 3011.

EMA 3066 Introduction to Organic Materials 3 Credits
Grading Scheme: Letter Grade
Uses structure, processing, and properties of organic materials, including polymers, biomacromolecules, and small molecule organic materials. Introduces scientific principles through discussion of developed organic materials for high technology applications.
Prerequisite: EMA 3010 or BME 3101.

EMA 3080C Materials Laboratory 1 2 Credits
Grading Scheme: Letter Grade
First part of the general undergraduate materials laboratory.
Prerequisite: EMA 3000L and EMA 3800.
Attributes: Satisfies 4000 Words of Writing Requirement

EMA 3413 Electronic Properties of Materials 3 Credits
Grading Scheme: Letter Grade
Atomistic and quantum-mechanical description of the electrical, optical, magnetic and thermal properties of materials. Deals with metals, alloys, semiconductors, polymers, dielectrics and amorphous materials with special emphasis given to high technology applications of electronic materials.
Prerequisite: EMA 3011

EMA 3513C Analysis of the Structure of Materials 4 Credits
Grading Scheme: Letter Grade
Laboratory fundamentals of crystallography, x-ray and electron diffraction, scanning and transmission electron microscopy, surface analysis and microprobe techniques.
Prerequisite: EMA 3010.

EMA 3800 Error Analyses and Optimization Methodologies in Materials Research 3 Credits
Grading Scheme: Letter Grade
Statistical approach for materials research, basic and relevant statistical concepts, error analyses, factorial matrices, reducing the variance, nested designs and sampling plans, mixture designs, optimization technology, response surface method and Taguchi.
Corequisite: EMA 3010 and (COP 2271 or COP 2273).

EMA 4020L Metallurgy Laboratory 1 Credit
Grading Scheme: Letter Grade
Concepts, skills, and techniques required for an understanding of metals and metallurgy processing.
Prerequisite: EMA 3050;
Corequisite: EMA 4120.

EMA 4041L Advanced Ceramics Laboratory 1 1 Credit
Grading Scheme: Letter Grade
Forming, drying, firing and testing of traditional ceramics.
Corequisite: EMA 4645.

EMA 4061 Biomaterials: Structure and Properties 3 Credits
Grading Scheme: Letter Grade
Materials commonly used for biomedical application, such as their properties from a biocompatibility or medical device perspective. In addition, materials interactions with biological systems are examined from the molecular (e.g., protein), cellular, tissue and systemic (whole body) perspective. This is the foundation for the second biomaterials course, which applies these principles toward the application of biomaterials in medical implants, prostheses and devices, along with the regulatory issues associated with biomaterials development.
Corequisite: EMA 3066.

EMA 4061L Biomaterials Laboratory 1 Credit
Grading Scheme: Letter Grade
Hands-on laboratory experience in the processing and characterization of biomaterials for use in medical applications.
Corequisite: EMA 4061.

EMA 4062 Biopolymers: Manufacture, Stability and Biocompatibility 3 Credits
Grading Scheme: Letter Grade
Polymer manufacturing processes and biochemical/biophysical behavior are considered from the perspective of achieving those properties needed for the engineering of polymeric implants and devices. Unique economic, ethical and regulatory issues are also presented.
Prerequisite: EMA 3066.

EMA 4120 Physical Metallurgy 1 3 Credits
Grading Scheme: Letter Grade
In-depth discussion of fundamentals of physical metallurgy and principles of microstructure evolution.
Prerequisite: EMA 3050.

EMA 4121 Interfacial Engineering 3 Credits
Grading Scheme: Letter Grade
Correlation of properties, structural and mechanical history, thermal history and service behavior of various interfaces.
Prerequisite: EMA 3050 and EMA 3066 and EMA 3413.

EMA 4125 Kinetics of Materials 3 Credits
Grading Scheme: Letter Grade
Science and application of diffusion and phase transformations in alloys, semiconductors, ceramics, and polymers, phenomenological description and atomic theory, analytical and numerical solutions, solidification and solid-state transformations, including nucleation, growth, and coarsening.
Prerequisite: EMA 4314.

EMA 4144 Physical Ceramics 1 3 Credits
Grading Scheme: Letter Grade
Structure of complex ceramic compounds and glasses. Influence of structural imperfections and stoichiometry on physical characteristics, surface and interfacial phenomena, diffusion and phase transformations in ceramic systems.
Prerequisite: EMA 3050.

EMA 4145 Physical Ceramics 2 3 Credits
Grading Scheme: Letter Grade
Influence of ceramic microstructure on processing. Chemical bonds, surface phenomena, forming energetics, drying and firing kinetics. Diffusion, nucleation, crystal growth, solid-solid and solid-liquid reactions.
Prerequisite: EMA 3050.

EMA 4161 Physical Properties of Polymers 3 Credits
Grading Scheme: Letter Grade
Molecular structure and the physical property relationships for polymers: viscoelastic behavior, the glass transition, thermomechanical and rheological properties, the crystalline and amorphous molecular solid state. Correlation of properties with design engineering of polymer applications. Laboratory section included.
Prerequisite: EMA 3066 and EMA 3513C.

EMA 4161L Polymers Laboratory 1 Credit
Grading Scheme: Letter Grade
Concepts, skills, and techniques required for an understanding of polmer and polymer composite processing.
Corequisite: EMA 4161.

EMA 4223 Mechanical Behavior of Materials 3 Credits
Grading Scheme: Letter Grade
Plastic deformation and fracture of metals and alloys, ceramics and polymers.
Prerequisite: EGM 3520.

EMA 4224 Physical Metallurgy 2 3 Credits
Grading Scheme: Letter Grade
In-depth discussion of fundamentals of alloy design, mechanical properties and failure mechanisms.
Prerequisite: EMA 4120 and EMA 4223.

EMA 4314 Thermodynamics of Materials 3 Credits
Grading Scheme: Letter Grade
Foundations of thermodynamics provided by the thermodynamic laws, variables, and relations, and their applications to materials for equilibrium conditions and phase diagrams.
Prerequisite: EMA 3010 & MAP 2302.

EMA 4324 Stability of Materials 3 Credits
Grading Scheme: Letter Grade
Mechanisms, energetics and kinetics of corrosion and degradation of engineering materials. Economic solutions to degradation problems based upon design and materials selection.
Prerequisite: EMA 4314.

EMA 4414L Electronic Materials Laboratory 1 Credit
Grading Scheme: Letter Grade
Hands-on experience for those specializing in electronic materials. Laboratory topics include characterization of optical and electronic properties of semiconductor materials, electronic devices characterization and semiconductor processing.
Corequisite: EMA 4614.

EMA 4462 Polymer Characterization 3 Credits
Grading Scheme: Letter Grade
Use of a broad variety of spectroscopic and other scattering phenomena in polymer research.
Prerequisite: EMA 3066 or equivalent.

EMA 4614 Production of Electronic Materials 3 Credits
Grading Scheme: Letter Grade
Production of materials for use in solid state electronic devices; nucleation and growth kinetics, solidification of single phase alloys, segregation, dynamics of crystal growth, selection of materials and growth techniques, characterization.
Prerequisite: EMA 3413.

EMA 4615 Compound Semiconductor Materials 3 Credits
Grading Scheme: Letter Grade
Physical properties of technologically important compound semiconductor materials. Epitaxial growth and practical application of compound semiconductor heterostructures.
Prerequisite: EEE 3396C.

EMA 4623 Process Metallurgy 3 Credits
Grading Scheme: Letter Grade
Engineering aspects of mineral processing, including unit operations and flow sheets. Science and technology of metal extraction with applications to specific ferrous and non-ferrous metals.
Corequisite: EMA 4120.

EMA 4645 Processing of Ceramic Materials 3 Credits
Grading Scheme: Letter Grade
Introduces the technology and science of processing ceramic materials, including traditional clay-based ceramics, modern technical ceramics and glasses. Topics include the nature of fine particles, forming methods and consolidation by heat.
Prerequisite: EMA 3050.

EMA 4666 Polymer Processing 3 Credits
Grading Scheme: Letter Grade
Major processing methods for polymers and polymeric composites as related to the rheological behavior of these systems. Synthesis of polymers via industrial processes.
Prerequisite: EMA 3066.

EMA 4714 Materials Selection and Failure Analysis 3 Credits
Grading Scheme: Letter Grade
Philosophy and practice of engineering selection of materials. Case studies in product liability and failure analysis.
Prerequisite: EMA 4223 and EMA 4324.

EMA 4905 Individual Work 1-4 Credits
Grading Scheme: Letter Grade
Selected problems or projects in the student's major field of engineering study.

EMA 4913 Research in Materials Science and Engineering 1 1 Credit
Grading Scheme: Letter Grade
Short research problems in materials science and engineering, usually including a final thesis.

EMA 4914 Research in Materials Science and Engineering 2 3 Credits
Grading Scheme: Letter Grade
Continuation of EMA 4913: short research problems in materials science and engineering, usually including a final thesis.

EMA 4915 Integrated Product and Process Design Program 1 3 Credits
Grading Scheme: Letter Grade
First part of a two-course sequence in which multidisciplinary teams of engineering and business students partner with industry sponsors to design and build authentic products and processes-on time and within budget. Working closely with industry liaison engineers and a faculty coach, students gain practical experience in teamwork and communication, problem solving and engineering design, and develop leadership, management and people skills.

EMA 4916 Integrated Product and Process Design Program 2 3 Credits
Grading Scheme: Letter Grade
Second part of the integrated product and process design sequence in which multidisciplinary teams of engineering and business students partner with industry sponsors to design and build authentic products and processes-on time and within budget.

EMA 4935 Special Topics 1-3 Credits
Grading Scheme: Letter Grade
Laboratory, lectures or conferences covering selected topics in materials science and engineering.

EMA 4949 Co-Op Work Experience 1 Credit
Grading Scheme: S/U
Practical engineering work under industrial supervision, as set forth in the Herbert Wertheim College of Engineering regulations.
Prerequisite: one-term industrial employment, including extra work according to a pre-approved outline.