Materials Science and Engineering

Subject abbreviation: MSE
The Marlan and Rosemary Bourns College of Engineering

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www.engr.ucr.edu/mse

Program Committee
Alexander A. Balandin, Ph.D., (Electrical Engineering)
Sakhrat Khizroev, Ph.D., (Electrical Engineering)
Mart Molle, Ph.D. (Computer Science and Engineering)
Nosang Myung, Ph.D. (Chemical and Environmental Engineering)
Cengiz Ozkan, Ph.D. (Mechanical Engineering)
Valentine Vullev, Ph.D. (Bioengineering)

Major
The B.S. degree in Materials Science and Engineering is offered jointly by the five participating departments of The Marlan and Rosemary Bourns College of Engineering. The program aims to produce students who are effective team players in materials engineering or related engineering, science or managerial positions, who use and improve on their skills in the job; who can enter into graduate or professional degree programs; and who are responsible engineers, professionals or scientists demonstrating ethical and professional responsibility and continuing to learn through a variety of educational experiences.

The program aims to produce graduates who:
- can apply knowledge of the scientific and engineering principles underlying major elements of materials engineering -- the structure, properties, processing, and performance of materials
- can design and conduct experiments relevant to materials science and engineering as well as analyze and interpret experimental data
- can identify, formulate, and solve materials selection and design problems
- can work in multidisciplinary teams
- can appreciate professional and ethical responsibility and the importance of continued learning after graduation
- can communicate effectively
- have a basic understanding of the impact of engineering on society, including the economy and environment
- have an elementary understanding of contemporary issues in materials science and engineering

University Requirements
See Undergraduate Studies section.

College Requirements
See The Marlan and Rosemary Bourns College of Engineering, Colleges and Programs section.

The Electrical Engineering major uses the following major requirements to satisfy the college’s Natural Sciences and Mathematics breadth requirement.

1. One course in the biological sciences chosen from an approved list
2. CHEM 001A, CHEM 011A
3. MATH 008B or MATH 009A
4. PHYS 040A, PHYS 040B

Major Requirements

1. Lower-division requirements (68 units)
   a) CHEM 001A, CHEM 011A, CHEM 001B, CHEM 011B, CHEM 001C, CHEM 011C
   b) CS 030
   c) EE 001A, EE 011A
   d) MATH 009A, MATH 009B, MATH 009C, MATH 010A, MATH 010B, MATH 046
   e) ME 010
   f) MSE 001
   g) PHYS 040A, PHYS 040B, PHYS 040C

2. Upper-division requirements (52 units)
   a) CHEM 112A
   b) CEE 135
   c) CHE 100
   d) EE 138
   e) ENGR 180
   f) ME 110, ME 114, ME 156
   g) MSE 160, MSE 161, MSE 175A, MSE 175B
   h) STAT 155
   i) Technical Electives (20 units): chosen from BIEN 140A/CEE 140A, BIEN 140B/CEE 140B, CEE 147, EE 133, EE 136, EE 137, EE 139, ME 113, ME 116, ME 138, ME 153, ME 180

Visit the Student Affairs Office in the College of Engineering or www.engr.ucr.edu/studentaffairs for a sample program.

Lower-Division Course

MSE 001. Fundamentals of Materials Science and Engineering (2) Lecture, 1 hour; discussion, 1 hour; laboratory, 1 hour. An introduction of properties and applications of different types of materials essential for various areas of engineering. Explores the relationship between structure and properties as well as processing of the materials. Illustrates a wide range of properties required for different types of applications. Graded Satisfactory (S) or No Credit (NC).

Upper-Division Courses

MSE 160. Nanostructure Characterization Laboratory (4) Lecture, 3 hours, laboratory, 3 hours. Prerequisite(s): ME 114. Covers structure of materials at the nanoscale, including semiconductors, ceramics, metals, and carbon nanotubes. Explores relationships among morphology, properties, and processing. Addresses primary methods of characterization, including scanning electron microscopy, scanning probe microscopy, X-ray diffraction, and transmission electron microscopy. Also covers fundamental discussions of X-ray, vibrational, and electron waves in solids and introductory diffraction theory.

MSE 161. Analytical Materials Characterization (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): MSE 160. Analysis of the surfaces of materials via ion, electron, and photon spectroscopies. Includes Rutherford back scattering; secondary ion mass spectroscopy; electron energy loss spectroscopy; Auger electron spectroscopy; X-ray photoelectron spectroscopy; photoluminescence; extended X-ray absorption fine structure; Fourier transform infrared spectroscopy; and Raman spectroscopy. Also covers sputtering, high-vacuum generation, and focused ion beam milling.

MSE 175A. Senior Design (4) Lecture, 2 hours; discussion, 1 hour; practicum, 3 hours. Prerequisite(s): CHE 116 or ME 116A; EE 139; senior standing in Materials Science and Engineering. Covers preparation of formal engineering reports and statistical analysis on a series of problems illustrating methodology from various branches of applied materials science and engineering. Addresses the entire design process: design problem definition; generation of a design specification; documentation; design review process; prototype fabrication; testing and calibration; cost estimation; and federal guidelines. Requires a term project and oral presentation. Graded In-Progress (IP) until MSE 175A and MSE 175B are completed, at which time a final, letter grades is assigned.

MSE 175B. Senior Design (4) Lecture, 1 hour; discussion, 1 hour; practicum, 6 hours. Prerequisite(s): MSE 175A; senior standing in Materials Science and Engineering. Covers preparation of formal engineering reports and statistical analysis on a series of problems illustrating methodology from various branches of applied materials science and engineering. Addresses the entire design process: design problem definition; generation of a design specification; documentation; design review process; prototype fabrication; testing and calibration; cost estimation; and federal guidelines. Requires a term project and oral presentation. Satisfactory (S) or No Credit (NC) grading is not available.