

UNIVERSITY OF CALIFORNIA

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SANTA BARBARA • SANTA CRUZ

UNDERGRADUATE STUDENT AFFAIRS  
THE HENRY SAMUELI SCHOOL OF ENGINEERING

305 Rockwell Engineering Center  
Irvine, CA 92697-2710  
(949) 824-4334

March 7, 2019

To: David Casper  
Chair, Subcommittee on Courses & Continuing, Part-Time, & Summer Session  
Education

From: Gregory Washington  
The Stacey Nicholas Dean of Engineering

Re: UCI Request to Change the Name and Degree Title of the Materials Science Engineering Undergraduate Program to the Materials Science and Engineering Undergraduate Program

The Department of Materials Science and Engineering requests renaming the undergraduate major in 'Materials Science Engineering' to 'Materials Science and Engineering', effective Fall 2019. The same title change is requested for the minor.

This title is more consistent with the established naming of programs across the country around the world, and matches the title we use for our graduate M.S. and Ph.D. programs. With the formation of the Department, the faculty feel it is appropriate that the originally requested title now be granted to reinforce that the undergraduate and graduate programs form a single, unified discipline.

Please let me know if you need any additional information.

Sincerely,

A handwritten signature in black ink, appearing to read 'Gregory Washington'.

Gregory Washington

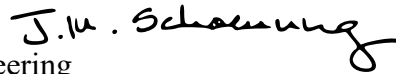
cc: Michelle Aucoin, Senate Analyst, Subcommittee on Courses & Continuing, Part-Time, & Summer Session Education  
Robin Jeffers, Director, Undergraduate Student Affairs, Samueli School of Engineering  
Robert Cassidy, Director, CASA, Samueli School of Engineering  
Priscilla Nguyen, Curriculum Management Specialist, Samueli School of Engineering

January 24, 2019

To: David Casper  
Chair, Subcommittee on Courses & Continuing, Part-Time, & Summer Session  
Education

Via: Michael Green  
Associate Dean for Undergraduate Student Affairs

From: Julie M. Schoenung, Professor and Chair  
Department of Materials Science and Engineering



Re: B.S. & Minor in Materials Science and Engineering

The Department of Materials Science and Engineering requests renaming the undergraduate major in 'Materials Science Engineering' to 'Materials Science and Engineering', effective Fall 2019. The same title change is requested for the minor. The request for this change has been voted on by the MSE faculty, receiving unanimous support. As Department Chair, I also strongly support this change.

This title is more consistent with the established naming of programs across the country and around the world, and matches the title we use for our graduate M.S. and Ph.D. programs. With the formation of the new Department of Materials Science and Engineering, the time is right to harmonize the program titles, in an effort to reinforce that the undergraduate and graduate programs form a single, unified discipline.

A change in program title will require some additional action with ABET, the program's accrediting body. The program has an accreditation visit in Fall 2019 and is conversing with ABET whether some or all of this action can take place during that visit provided that the new title appear in the 2019-2020 Catalogue.

Student catalogue rights would be respected, with students able to remain in the program until degree completion or given the choice of changing into the new title under the 2019-2020 Catalogue with no restrictions. Students that applied for Fall 2019 would matriculate under the new title.

cc: Michelle Aucoin  
Senate Analyst, Subcommittee on Courses & Continuing, Part-Time, & Summer Session  
Education  
Robin Jeffers, Director, Undergraduate Student Affairs, Samueli School of Engineering  
Robert Cassidy, Director, CASA, Samueli School of Engineering  
Priscilla Nguyen, Analyst, Samueli School of Engineering

## REQUEST FOR APPROVAL OF NEW OR MODIFIED UNDERGRADUATE DEGREE REQUIREMENTS

School: Samueli School of Engineering Department: Materials Science and Engineering

B.S. or B.A. in Materials Science and Engineering Proposed Effective Date: Fall 2019

Minor/Concentration/Specialization/Emphasis in Materials Science and Engineering; Specialization in Biomaterials; Electronics Processing and Materials; Materials and Mechanical Design

*State proposed degree requirements. For revision of existing programs, attach a copy of the present degree requirements as well as the proposed requirements with the changes underlined.*

1. Renumbering CBEMS course designations in both B.S. and Minor sections throughout the Catalogue and Sample Program
2. Updating CBEMS H199 with ENGR H199 in Specialization in Electronics Processing and Materials and Specialization in Materials and Mechanical Design
3. Updating nominal units due to Chemistry lab unit increase

*Rationale, including the effect, if any, on other academic units. (attach additional sheet if necessary)  
Attach a statement of agreement from the Department Chair of affected units.*

1. Courses for the major were previously housed in the Department of Chemical Engineering and Materials Science under the CBEMS subject designation. With the formation of the new Department of Materials Science and Engineering, courses will renumber under the EngrMSE subject designation in an effort to reinforce that the undergraduate and graduate programs form a single, unified discipline.
2. CBEMS H199 has been deactivated. CHP students take ENGR H199.
3. The Chemistry department proposed to increase units on Chem 1LC, Chem 1LD, Chem 51LB, Chem 51LC, Chem 51LD from 2 to 3 units. SCOC approved the proposal on 1/9/2019.

Faculty concerned for the purposes of this major: MSE Faculty

**INSTRUCTIONS:** To ensure consideration for inclusion in the *General Catalogue*, one copy of this request must reach the Committee on Educational Policy, c/o Academic Senate, no later than the December deadline.

**NOTE:** New courses must be simultaneously submitted for approval to the Committee on Courses. Approval of the new or modified undergraduate degree requirements is contingent upon approval of the course(s) by the Committee on Courses.

(see the guidelines for establishing undergraduate majors and minors  
[http://www.senate.uci.edu/4\\_SenCom/EducPolicy/CEP%20Docs/CEP\\_Docs\\_index.html](http://www.senate.uci.edu/4_SenCom/EducPolicy/CEP%20Docs/CEP_Docs_index.html))

Faculty vote: # For 9 # Against 0 # Abstain 0 # Not voting 0

Was there student participation? Yes  No

APPROVED:

Julie Schpenung 3/8/2019  
Julie Schpenung, Department Chair Date

Michael Green 3/11/2019  
Michael Green, Associate Dean Date

Approved Effective: Fall 2019

Committee on Educational Policy Chair Date

## Current

### Undergraduate Major in Materials Science Engineering

**Program Educational Objectives:** Graduates of the Materials Science Engineering program will (1) establish a productive Materials Science and Engineering career in industry, government or academia; (2) apply critical reasoning and the requisite analytical/quantitative skills in seeking solutions to materials science and engineering problems; (3) promote innovation in materials development and design through effective leadership, skilled communications, and multidisciplinary teamwork; (4) exhibit a commitment to engineering ethics, environmental stewardship, continued learning, and professional development.

(Program educational objectives are those aspects of engineering that help shape the curriculum; achievement of these objectives is a shared responsibility between the student and UCI.)

Since the beginning of history, materials have played a crucial role in the growth, prosperity, security, and quality of human life. In fact, materials have been so intimately related to the emergence of human culture and civilization that anthropologists and historians have identified early cultures by the name of the significant materials dominating those cultures. These include the stone, bronze, and iron ages of the past. At the present time, the scope of materials science and engineering has become very diverse; it is no longer confined to topics related to metals and alloys but includes those relevant to ceramics, composites, polymers, biomaterials, nanostructures, intelligent materials, and electronic devices. In addition, present activities in materials science and engineering cover not only areas whose utility can be identified today, but also areas whose utility may be unforeseen. The services of materials scientists and engineers are required in a variety of engineering operations dealing, for example, with emerging energy systems, design of semiconductors and optoelectronic and nano devices, development of new technologies based on composites and high-temperature super-conductivity, biomedical products, performance (e.g., quality, reliability, safety, energy efficiency) in automobile and aircraft components, improvement in nondestructive testing techniques, corrosion behavior in refineries, radiation damage in nuclear power plants, and fabrication of advanced materials.

The undergraduate major in Material Science Engineering (MSE) provides students with a thorough knowledge of basic engineering and scientific principles. The undergraduate curriculum in MSE includes (a) a core of Chemistry, Physics, and Mathematics; (b) basic Engineering courses; (c) Materials and Engineering core; and (d) technical courses in Materials Science, Engineering, and Sciences.

Because of the interdisciplinary nature of MSE and its intimate relations with other Engineering disciplines (Aerospace, Biomedical, Chemical, Civil, Computer, Electrical, Environmental, and Mechanical Engineering), qualified students will be able to satisfy in a straightforward manner the degree requirements of their Engineering major and the MSE major.

### Admissions

**High School Students:** See School Admissions information.

**Transfer Students:** Preference will be given to junior-level applicants with the highest grades overall, and who have satisfactorily completed the following **required** courses: two years of approved calculus, one year of calculus-based physics with laboratories (mechanics, electricity and magnetism), completion of lower-division writing, one year of general chemistry (with laboratory), statics, Materials Science Engineering, and one course in introductory programming. For course equivalency specific to each college, visit [assist.org](http://assist.org).

Students are encouraged to complete as many of the lower-division degree requirements as possible prior to transfer. Students who enroll at UCI in need of completing lower-division coursework may find that it will take longer than two years to complete their degrees. For further information, contact The Henry Samueli School of Engineering at 949-824-4334.

## Requirements for the B.S. in Materials Science Engineering

All students must meet the [University Requirements](#).

All students must meet the [School Requirements](#).

### Major Requirements

#### Mathematics and Basic Science Courses:

##### Core Courses:

ENGR 1A or CHEM 1A	General Chemistry for Engineers General Chemistry
CHEM 1B- 1C	General Chemistry and General Chemistry
CHEM 1LC	General Chemistry Laboratory
MATH 2A- 2B	Single-Variable Calculus and Single-Variable Calculus
MATH 2D	Multivariable Calculus
MATH 3A	Introduction to Linear Algebra
MATH 3D	Elementary Differential Equations
MATH 2E	Multivariable Calculus
PHYSICS 7C- 7LC	Classical Physics and Classical Physics Laboratory
PHYSICS 7D- 7E	Classical Physics and Classical Physics
PHYSICS 7LD	Classical Physics Laboratory

#### Basic Engineering or Science Elective Courses:

Select four (4) units from the following:

BIO SCI 93	From DNA to Organisms
BME 50A	Cell and Molecular Engineering
CHEM 51A	Organic Chemistry
EECS 70B	Network Analysis II
ENGR 7A- 7B	Introduction to Engineering I and Introduction to Engineering II <sup>1</sup>
ENGRCEE 20	Introduction to Computational Problem Solving
ENGRMAE 52	Computer-Aided Design
ENGRMAE 80 or ENGRCEE 80	Dynamics Dynamics
PHYSICS 51A	Modern Physics
STATS 7	Basic Statistics

#### Engineering Topics Courses:

Students must complete a minimum of 22 units of engineering design.

Core Courses:

CBEMS 65A or ENGRMAE 91	Thermodynamics of Materials Introduction to Thermodynamics
CBEMS 65B or CBEMS 125B-CBEMS 125C or ENGRMAE 120	Diffusion in Materials
CBEMS 154	Polymer Science and Engineering

CBEMS 155	Mechanical Behavior and Design Principles
CBEMS 155L	Mechanical Behavior Laboratory
CBEMS 160	Advanced Lab in Synthesis of Materials
CBEMS 164	X-ray Diffraction, Electron Microscopy, and Microanalysis
CBEMS 164L	X-ray Diffraction, Electron Microscopy, and Microanalysis Lab
CBEMS 165	Materials Kinetics and Phase Transformations
CBEMS 169	Electronic and Optical Properties in Materials
CBEMS 175	Design Failure Investigation
CBEMS 189A- 189B- 189C	Senior Design Project I and Senior Design Project II and Senior Design Project III
EECS 70A	Network Analysis I
or ENGRMAE 60	Electric Circuits
ENGR 54	Principles of Materials Science and Engineering
ENGR 150	Mechanics of Structures
ENGRMAE 10	Introduction to Engineering Computations
ENGRMAE 30	Statics
or ENGR 30	Statics
or ENGRCEE 30	Statics
ENGRMAE 150L	Mechanics of Structures Laboratory

### Engineering Electives:

Students must complete a minimum of five courses from:

BME 50A	Cell and Molecular Engineering
BME 110A- 110B	Biomechanics I and Biomechanics II
BME 111	Design of Biomaterials
BME 120	Sensory Motor Systems
CBEMS 110	Reaction Kinetics and Reactor Design
CBEMS 130	Separation Processes
CBEMS 141	Nano-Scale Materials and Applications
CBEMS 158	Ceramic Materials
CBEMS 163	Computer Techniques in Experimental Research
CBEMS 174	Semiconductor Device Packaging
CBEMS 176	Surface and Adhesion Science
CBEMS 191	Materials Outreach
CBEMS 199	Individual Study
EECS 70B	Network Analysis II
EECS 170LA	Electronics I Laboratory
EECS 170B	Electronics II
EECS 174	Semiconductor Devices
EECS 176	Fundamentals of Solid-State Electronics and Materials
EECS 180A	Engineering Electromagnetics I
ENGR 165	Advanced Manufacturing
ENGRMAE 106	Mechanical Systems Laboratory
ENGRMAE 145	Theory of Machines and Mechanisms
ENGRMAE 147	Vibrations
ENGRMAE 151	Mechanical Engineering Design

ENGRMAE 152	Introduction to Computer-Aided Engineering
ENGRMAE 155	Composite Materials and Structures
ENGRMAE 157	Lightweight Structures
ENGRMAE 170	Introduction to Control Systems

Students select, with the approval of a faculty advisor, any additional engineering topics courses needed to satisfy school and department requirements.

### **Engineering Professional Topics Course:**

ENGR 190W	Communications in the Professional World
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(The nominal Materials Science Engineering program will require 183 units of courses to satisfy all university and major requirements. Because each student comes to UCI with a different level of preparation, the actual number of units will vary. Dual engineering majors are reminded that they are required to satisfy all requirements of both majors individually. Students should not assume that courses for one, such as senior design, will satisfy the requirements of the other, without prior approval.)

<sup>1</sup> ENGR 7A-ENGR 7B is available only to lower-division students. Both ENGR 7A-ENGR 7B must be taken to be counted as a Basic Engineering or Science Elective course.

Students majoring in MSE may elect, with approval of their faculty advisor, to use available engineering electives to complete one of the following specializations.

### **Specialization in Biomaterials:**

Requires a minimum of 14 units from:

BME 50A	Cell and Molecular Engineering
BME 110A- 110B	Biomechanics I and Biomechanics II
BME 111	Design of Biomaterials
BME 120	Sensory Motor Systems
CBEMS 154	Polymer Science and Engineering
CBEMS 199	Individual Study

### **Specialization in Electronics Processing and Materials:**

Requires a minimum of 14 units from:

CBEMS 174	Semiconductor Device Packaging
CBEMS 199	Individual Study (up to 3 units; or CBEMS H199, up to 3 units)
EECS 70B	Network Analysis II
EECS 170LA	Electronics I Laboratory
EECS 174	Semiconductor Devices
ENGR 165	Advanced Manufacturing

### **Specialization in Materials and Mechanical Design:**

Requires a minimum of 14 units from:

CBEMS 199	Individual Study (up to 3 units; or CBEMS H199, up to 3 units)
ENGRMAE 106	Mechanical Systems Laboratory
ENGRMAE 145	Theory of Machines and Mechanisms
ENGRMAE 147	Vibrations
ENGRMAE 151	Mechanical Engineering Design
ENGRMAE 152	Introduction to Computer-Aided Engineering
ENGRMAE 155	Composite Materials and Structures

ENGRMAE 157 Lightweight Structures  
 ENGRMAE 170 Introduction to Control Systems

**Planning a Program of Study**

A sample program of study chart for the major in Materials Science Engineering is available in the Undergraduate Student Affairs Office. Students should keep in mind that this program is based upon a sequence of prerequisites, beginning with adequate preparation in high school mathematics, physics, and chemistry. Students who are not adequately prepared, or who wish to make changes in the sequence for other reasons, must have their program approved by their faculty advisor. Materials Science Engineering majors must consult at least once every year with the academic counselors in the Undergraduate Student Affairs Office and with their faculty advisors.

**Sample Program of Study — Materials Science Engineering**

**Freshman**

**Fall**

MATH 2A  
 ENGR 1A  
 ENGRMAE 10  
 General Education

**Winter**

MATH 2B  
 CHEM 1B  
 PHYSICS 7C  
 PHYSICS 7LC  
 General Education

**Spring**

MATH 2D  
 CHEM 1C  
 CHEM 1LC  
 PHYSICS 7D  
 PHYSICS 7LD

**Sophomore**

**Fall**

MATH 3A  
 ENGR 30  
 ENGR 54  
 PHYSICS 7E

**Winter**

MATH 3D  
 CBEMS 65A  
 General Education  
 General Education

**Spring**

MATH 2E  
 EECS 70A  
 CBEMS 65B  
 Basic Engineering/Science Elective

**Junior**

**Fall**

CBEMS 165  
 ENGR 150  
 ENGRMAE 150L  
 Engineering Elective

**Winter**

CBEMS 155  
 CBEMS 155L  
 CBEMS 164  
 CBEMS 164L  
 General Education

**Spring**

CBEMS 175  
 Engineering Elective  
 Engineering Elective  
 General Education

**Senior**

**Fall**

CBEMS 154  
 CBEMS 189A  
 ENGR 190W  
 General Education

**Winter**

CBEMS 169  
 CBEMS 189B  
 Engineering Elective  
 General Education

**Spring**

CBEMS 160  
 CBEMS 189C  
 Engineering Elective  
 General Education



## Minor in Materials Science Engineering

The interdisciplinary field of materials science and engineering has become critical to many emerging areas of advanced technology and their applications. As a result, there are needs and opportunities for engineers and scientists with education and training in materials science and engineering. The goal of the minor in Materials Science Engineering (MSE) is to provide students at UCI with such education and training that will enable them, upon graduation, to not only participate in projects or programs of an interdisciplinary nature but also address challenging societal needs and complex technological advances.

### Admission

Admission in the MSE minor requires a minimum 2.5 overall UCI GPA. Students are required to complete all prerequisites for required courses and selected electives. In particular, students need to complete the following courses before applying:

CHEM 1A	General Chemistry
CHEM 1LE	Accelerated General Chemistry Lab
MATH 2D	Multivariable Calculus
MATH 2E	Multivariable Calculus
MATH 3A	Introduction to Linear Algebra
MATH 3D	Elementary Differential Equations
PHYSICS 7C	Classical Physics
PHYSICS 7LC	Classical Physics Laboratory
PHYSICS 7D	Classical Physics
PHYSICS 7LD	Classical Physics Laboratory

### Requirements for the Minor in Materials Science Engineering

The minor in Materials Science Engineering requires a total of seven courses—five required courses and two electives:

Required courses:

CBEMS 155	Mechanical Behavior and Design Principles
ENGR 54	Principles of Materials Science and Engineering

Select three of the following:

CBEMS 165	Materials Kinetics and Phase Transformations <sup>1</sup>
CBEMS 169	Electronic and Optical Properties in Materials
CBEMS 175	Design Failure Investigation
CBEMS 199	Individual Study (contingent upon the availability of research positions in the Materials Science Engineering faculty's research groups)

#### Electives:

Select two of the following:

BME 110A- 110B	Biomechanics I and Biomechanics II
BME 111	Design of Biomaterials
BME 120	Sensory Motor Systems
CBEMS 141	Nano-Scale Materials and Applications
CBEMS 154	Polymer Science and Engineering
CBEMS 158	Ceramic Materials
CBEMS 163	Computer Techniques in Experimental Research

CBEMS 174	Semiconductor Device Packaging
CBEMS 191	Materials Outreach
CHEM 225	Polymer Chemistry: Synthesis and Characterization of Polymers
EECS 170A-170B	Electronics I and Electronics II
ENGR 150	Mechanics of Structures
ENGR 165	Advanced Manufacturing
ENGRMAE 151	Mechanical Engineering Design
ENGRMAE 155	Composite Materials and Structures
ENGRMAE 157	Lightweight Structures
MATH 112A	Introduction to Partial Differential Equations and Applications
PHYSICS 112A	Electromagnetic Theory
PHYSICS 133	Introduction to Condensed Matter Physics
PHYSICS 135	Plasma Physics

<sup>1</sup> For students who plan to pursue a graduate degree in MSE, it is highly recommended that they take CBEMS 165 in addition to two of the following courses: CBEMS 169, CBEMS 175, or CBEMS 199.

## Proposed

### Undergraduate Major in Materials Science and Engineering

**Program Educational Objectives:** Graduates of the Materials Science and Engineering program will (1) establish a productive Materials Science and Engineering career in industry, government or academia; (2) apply critical reasoning and the requisite analytical/quantitative skills in seeking solutions to materials science and engineering problems; (3) promote innovation in materials discovery, development and design through effective leadership, skilled communications, and multidisciplinary teamwork; (4) exhibit a commitment to engineering ethics, environmental stewardship, continued learning, and professional development.

(Program educational objectives are those aspects of engineering that help shape the curriculum; achievement of these objectives is a shared responsibility between the student and UCI.)

Since the beginning of history, materials have played a crucial role in the growth, prosperity, security, and quality of human life. In fact, materials have been so intimately related to the emergence of human culture and civilization that anthropologists and historians have identified early cultures by the name of the significant materials dominating those cultures. These include the stone, bronze, and iron ages of the past. At the present time, the scope of materials science and engineering has become very diverse; it is no longer confined to topics related to metals and alloys but includes those relevant to ceramics, composites, polymers, biomaterials, nanostructures, intelligent materials, and electronic devices. In addition, present activities in materials science and engineering cover not only areas whose utility can be identified today, but also areas whose utility may be unforeseen. The services of materials scientists and engineers are required in a variety of engineering operations dealing, for example, with emerging energy systems, design of semiconductors and optoelectronic and nano devices, development of new technologies based on composites and high-temperature super-conductivity, biomedical products, performance (e.g., quality, reliability, safety, energy efficiency) in automobile and aircraft components, improvement in nondestructive testing techniques, corrosion behavior in refineries, radiation damage in nuclear power plants, and fabrication of advanced materials.

The undergraduate major in Material Science and Engineering (MSE) provides students with a thorough knowledge of basic engineering and scientific principles. The undergraduate curriculum in MSE includes (a) a core of Chemistry, Physics, and Mathematics; (b) basic Engineering courses; (c) Materials and Engineering core; and (d) technical courses in Materials Science, Engineering, and Sciences.

Because of the interdisciplinary nature of MSE and its intimate relations with other Engineering disciplines (Aerospace, Biomedical, Chemical, Civil, Computer, Electrical, Environmental, and Mechanical Engineering), qualified students will be able to satisfy in a straightforward manner the degree requirements of their Engineering major and the MSE major.

### Admissions

**High School Students:** See School Admissions information.

**Transfer Students:** Preference will be given to junior-level applicants with the highest grades overall, and who have satisfactorily completed the following **required** courses: two years of approved calculus, one year of calculus-based physics with laboratories (mechanics, electricity and magnetism), completion of lower-division writing, one year of general chemistry (with laboratory), statics, an introductory Materials Science and Engineering, and one course in introductory programming. For course equivalency specific to each college, visit [assist.org](http://assist.org).

Students are encouraged to complete as many of the lower-division degree requirements as possible prior to transfer. Students who enroll at UCI in need of completing lower-division coursework may find that it will take longer than two years to complete their degrees. For further information, contact The Henry Samueli School of Engineering at 949-824-4334.

## Requirements for the B.S. in Materials Science and Engineering

All students must meet the University Requirements.

All students must meet the School Requirements.

### Major Requirements

#### Mathematics and Basic Science Courses:

##### Core Courses:

ENGR 1A or CHEM 1A	General Chemistry for Engineers General Chemistry
CHEM 1B- 1C	General Chemistry and General Chemistry
CHEM 1LC	General Chemistry Laboratory
MATH 2A- 2B	Single-Variable Calculus and Single-Variable Calculus
MATH 2D	Multivariable Calculus
MATH 3A	Introduction to Linear Algebra
MATH 3D	Elementary Differential Equations
MATH 2E	Multivariable Calculus
PHYSICS 7C- 7LC	Classical Physics and Classical Physics Laboratory
PHYSICS 7D- 7E	Classical Physics and Classical Physics
PHYSICS 7LD	Classical Physics Laboratory

#### Basic Engineering or Science Elective Courses:

Select four (4) units from the following:

BIO SCI 93	From DNA to Organisms
BME 50A	Cell and Molecular Engineering
CHEM 51A	Organic Chemistry
EECS 70B	Network Analysis II
ENGR 7A- 7B	Introduction to Engineering I and Introduction to Engineering II <sup>1</sup>
ENGRCEE 20	Introduction to Computational Problem Solving
ENGRMAE 52	Computer-Aided Design
ENGRMAE 80 or ENGRCEE 80	Dynamics Dynamics
PHYSICS 51A	Modern Physics
STATS 7	Basic Statistics

#### Engineering Topics Courses:

Students must complete a minimum of 22 units of engineering design.

Core Courses:

<del>ENGRMSE 65A</del> <del>CBEMS 65A</del> or ENGRMAE 91	Thermodynamics of Materials Introduction to Thermodynamics
<del>ENGRMSE 65B</del> <del>CBEMS 65B</del> <u>or CBE 120B-CBE 120C</u> <del>or CBEMS 125B-CBEMS 125C</del> or ENGRMAE 120	Diffusion in Materials

<del>ENGRMSE 154</del> <del>CBEMS 154</del>	Polymer Science and Engineering
<del>ENGRMSE 155</del> <del>CBEMS 155</del>	Mechanical Behavior and Design Principles
<del>ENGRMSE 155L</del> <del>CBEMS 155L</del>	Mechanical Behavior Laboratory
<del>ENGRMSE 160</del> <del>CBEMS 160</del>	Advanced Lab in Synthesis of Materials
<del>ENGRMSE 164</del> <del>CBEMS 164</del>	X-ray Diffraction, Electron Microscopy, and Microanalysis
<del>ENGRMSE 164L</del> <del>CBEMS 164L</del>	X-ray Diffraction, Electron Microscopy, and Microanalysis Lab
<del>ENGRMSE 165</del> <del>CBEMS 165</del>	Materials Kinetics and Phase Transformations
<del>ENGRMSE 169</del> <del>CBEMS 169</del>	Electronic and Optical Properties in Materials
<del>ENGRMSE 175</del> <del>CBEMS 175</del>	Design Failure Investigation
<del>ENGRMSE 189A- 189B- 189C</del>	Senior Design Project I
<del>CBEMS 189A- 189B- 189C</del>	and Senior Design Project II
	and Senior Design Project III
EECS 70A	Network Analysis I
or ENGRMAE 60	Electric Circuits
ENGR 54	Principles of Materials Science and Engineering
ENGR 150	Mechanics of Structures
ENGRMAE 10	Introduction to Engineering Computations
ENGRMAE 30	Statics
or ENGR 30	Statics
or ENGRCEE 30	Statics
ENGRMAE 150L	Mechanics of Structures Laboratory

### Engineering Electives:

Students must complete a minimum of five courses from:

BME 50A	Cell and Molecular Engineering
BME 110A- 110B	Biomechanics I and Biomechanics II
BME 111	Design of Biomaterials
BME 120	Sensory Motor Systems
<del>CBE 110</del> <del>CBEMS 110</del>	Reaction Kinetics and Reactor Design
<del>CBE 130</del> <del>CBEMS 130</del>	Separation Processes
<del>ENGRMSE 141</del> <del>CBEMS 141</del>	Nano-Scale Materials and Applications
<del>ENGRMSE 158</del> <del>CBEMS 158</del>	Ceramic Materials for Sustainable Energy
<del>ENGRMSE 163</del> <del>CBEMS 163</del>	Computer Techniques in Experimental Research
<del>CBE 187</del> <del>CBEMS 174</del>	Semiconductor Device Packaging
<del>ENGRMSE 176</del> <del>CBEMS 176</del>	Surface and Adhesion Science
<del>ENGRMSE 191</del> <del>CBEMS 191</del>	Materials Outreach
<del>ENGRMSE 199</del> <del>CBEMS 199</del>	Individual Study
EECS 70B	Network Analysis II
EECS 170LA	Electronics I Laboratory
EECS 170B	Electronics II
EECS 174	Semiconductor Devices
EECS 176	Fundamentals of Solid-State Electronics and Materials
EECS 180A	Engineering Electromagnetics I
ENGR 165	Advanced Manufacturing
ENGRMAE 106	Mechanical Systems Laboratory
ENGRMAE 145	Theory of Machines and Mechanisms

ENGRMAE 147	Vibrations
ENGRMAE 151	Mechanical Engineering Design
ENGRMAE 152	Introduction to Computer-Aided Engineering
ENGRMAE 155	Composite Materials and Structures
ENGRMAE 157	Lightweight Structures
ENGRMAE 170	Introduction to Control Systems

Students select, with the approval of a faculty advisor, any additional engineering topics courses needed to satisfy school and department requirements.

**Engineering Professional Topics Course:**

ENGR 190W Communications in the Professional World

(The nominal Materials Science and Engineering program will require ~~184~~ 183 units of courses to satisfy all university and major requirements. Because each student comes to UCI with a different level of preparation, the actual number of units will vary. Dual engineering majors are reminded that they are required to satisfy all requirements of both majors individually. Students should not assume that courses for one, such as senior design, will satisfy the requirements of the other, without prior approval.)

<sup>1</sup> ENGR 7A-ENGR 7B is available only to lower-division students. Both ENGR 7A-ENGR 7B must be taken to be counted as a Basic Engineering or Science Elective course.

Students majoring in MSE may elect, with approval of their faculty advisor, to use available engineering electives to complete one of the following specializations.

**Specialization in Biomaterials:**

Requires a minimum of 14 units from:

BME 50A	Cell and Molecular Engineering
BME 110A- 110B	Biomechanics I and Biomechanics II
BME 111	Design of Biomaterials
BME 120	Sensory Motor Systems
<u>ENGRMSE 154</u> <del>CBEMS 454</del>	Polymer Science and Engineering
<u>ENGRMSE 199</u> <del>CBEMS 199</del>	Individual Study

**Specialization in Electronics Processing and Materials:**

Requires a minimum of 14 units from:

<u>CBE 187</u> <del>CBEMS 174</del>	Semiconductor Device Packaging
<u>ENGRMSE 199</u> <del>CBEMS 199</del>	Individual Study (up to 3 units; or <u>ENGR H199</u> <del>CBEMS H199</del> , up to 3 units)
EECS 70B	Network Analysis II
EECS 170LA	Electronics I Laboratory
EECS 174	Semiconductor Devices
ENGR 165	Advanced Manufacturing

**Specialization in Materials and Mechanical Design:**

Requires a minimum of 14 units from:

<u>ENGRMSE 199</u> <del>CBEMS 199</del>	Individual Study (up to 3 units; or <u>ENGR H199</u> <del>CBEMS H199</del> , up to 3 units)
ENGRMAE 106	Mechanical Systems Laboratory
ENGRMAE 145	Theory of Machines and Mechanisms
ENGRMAE 147	Vibrations

ENGRMAE 151	Mechanical Engineering Design
ENGRMAE 152	Introduction to Computer-Aided Engineering
ENGRMAE 155	Composite Materials and Structures
ENGRMAE 157	Lightweight Structures
ENGRMAE 170	Introduction to Control Systems

### Planning a Program of Study

A sample program of study chart for the major in Materials Science and Engineering is available in the Undergraduate Student Affairs Office. Students should keep in mind that this program is based upon a sequence of prerequisites, beginning with adequate preparation in high school mathematics, physics, and chemistry. Students who are not adequately prepared, or who wish to make changes in the sequence for other reasons, must have their program approved by their faculty advisor. Materials Science and Engineering majors must consult at least once every year with the academic counselors in the Undergraduate Student Affairs Office and with their faculty advisors.

### Sample Program of Study — Materials Science and Engineering

#### Freshman

##### Fall

MATH 2A  
ENGR 1A  
ENGRMAE 10  
General Education

##### Winter

MATH 2B  
CHEM 1B  
PHYSICS 7C  
PHYSICS 7LC  
General Education

##### Spring

MATH 2D  
CHEM 1C  
CHEM 1LC  
PHYSICS 7D  
PHYSICS 7LD

#### Sophomore

##### Fall

MATH 3A  
ENGR 30  
ENGR 54  
PHYSICS 7E

##### Winter

MATH 3D  
ENGRMSE 65A ~~CBEMS 65A~~  
General Education  
General Education

##### Spring

MATH 2E  
EECS 70A  
ENGRMSE 65B ~~CBEMS 65B~~  
Basic Engineering/Science Elective

#### Junior

##### Fall

ENGRMSE 165 ~~CBEMS 165~~  
ENGR 150  
ENGRMAE 150L  
Engineering Elective

##### Winter

ENGRMSE 155 ~~CBEMS 155~~  
ENGRMSE 155L ~~CBEMS 155L~~  
ENGRMSE 164 ~~CBEMS 164~~  
ENGRMSE 164L ~~CBEMS 164L~~  
General Education

##### Spring

ENGRMSE 175 ~~CBEMS 175~~  
Engineering Elective  
Engineering Elective  
General Education

#### Senior

##### Fall

ENGRMSE 154 ~~CBEMS 154~~  
ENGRMSE 189A ~~CBEMS 189A~~  
ENGR 190W  
General Education

##### Winter

ENGRMSE 169 ~~CBEMS 169~~  
ENGRMSE 189B ~~CBEMS 189B~~  
Engineering Elective  
General Education

##### Spring

ENGRMSE 160 ~~CBEMS 160~~  
ENGRMSE 189C ~~CBEMS 189C~~  
Engineering Elective  
General Education

**UNIT COUNT****Sample Program of Study — Materials Science and Engineering****Freshman**

<b>Fall</b>		<b>Winter</b>		<b>Spring</b>	
MATH 2A	4	MATH 2B	4	MATH 2D	4
ENGR 1A	4	CHEM 1B	4	CHEM 1C	4
ENGRMAE 10	4	PHYSICS 7C	4	CHEM 1LC	<del>2</del> <u>3</u>
General Education	4	PHYSICS 7LC	1	PHYSICS 7D	4
		General Education	4	PHYSICS 7LD	1
		<b>16</b>		<b>17</b>	<b><del>15</del> <u>16</u></b>

**Sophomore**

<b>Fall</b>		<b>Winter</b>		<b>Spring</b>	
MATH 3A	4	MATH 3D	4	MATH 2E	4
ENGR 30	4	<del>ENGRMSE 65A</del> CBEMS-65A	4	EECS 70A	4
ENGR 54	4	General Education	4	<del>ENGRMSE 65B</del> CBEMS-65B	4
PHYSICS 7E	4	General Education	4	Basic Engineering/Science Elective	4
		<b>16</b>		<b>16</b>	<b>16</b>

**Junior**

<b>Fall</b>		<b>Winter</b>		<b>Spring</b>	
<del>ENGRMSE 165</del> CBEMS-165	3	<del>ENGRMSE 155</del> CBEMS-155	4	<del>ENGRMSE 175</del> CBEMS-175	4
ENGR 150	4	<del>ENGRMSE 155L</del> CBEMS-155L	1	Engineering Elective	4
ENGRMAE 150L	1	<del>ENGRMSE 164</del> CBEMS-164	3	Engineering Elective	4
Engineering Elective	4	<del>ENGRMSE 164L</del> CBEMS-164L	2	General Education	4
		General Education	4		
		<b>12</b>		<b>14</b>	<b>16</b>

**Senior**

<b>Fall</b>		<b>Winter</b>		<b>Spring</b>	
<del>ENGRMSE 154</del> CBEMS-154	4	<del>ENGRMSE 169</del> CBEMS-169	4	<del>ENGRMSE 160</del> CBEMS-160	4
<del>ENGRMSE 189A</del> CBEMS-189A	3	<del>ENGRMSE 189B</del> CBEMS-189B	3	<del>ENGRMSE 189C</del> CBEMS-189C	3
ENGR 190W	4	Engineering Elective	4	Engineering Elective	4
General Education	4	General Education	4	General Education	4
		<b>15</b>		<b>15</b>	<b>15</b>

**TOTAL: ~~183~~ 184**



## Minor in Materials Science and Engineering

The interdisciplinary field of materials science and engineering has become critical to many emerging areas of advanced technology and their applications. As a result, there are needs and opportunities for engineers and scientists with education and training in materials science and engineering. The goal of the minor in Materials Science and Engineering (MSE) is to provide students at UCI with such education and training that will enable them, upon graduation, to not only participate in projects or programs of an interdisciplinary nature but also address challenging societal needs and complex technological advances.

### Admission

Admission in the MSE minor requires a minimum 2.5 overall UCI GPA. Students are required to complete all prerequisites for required courses and selected electives. In particular, students need to complete the following courses before applying:

CHEM 1A	General Chemistry
CHEM 1LE	Accelerated General Chemistry Lab
MATH 2D	Multivariable Calculus
MATH 2E	Multivariable Calculus
MATH 3A	Introduction to Linear Algebra
MATH 3D	Elementary Differential Equations
PHYSICS 7C	Classical Physics
PHYSICS 7LC	Classical Physics Laboratory
PHYSICS 7D	Classical Physics
PHYSICS 7LD	Classical Physics Laboratory

### Requirements for the Minor in Materials Science and Engineering

The minor in Materials Science and Engineering requires a total of seven courses—five required courses and two electives:

Required courses:

<u>ENGRMSE 155</u> <del>CBEMS 155</del>	Mechanical Behavior and Design Principles
ENGR 54	Principles of Materials Science and Engineering

Select three of the following:

<u>ENGRMSE 165</u> <del>CBEMS 165</del>	Materials Kinetics and Phase Transformations <sup>1</sup>
<u>ENGRMSE 169</u> <del>CBEMS 169</del>	Electronic and Optical Properties in Materials
<u>ENGRMSE 175</u> <del>CBEMS 175</del>	Design Failure Investigation
<u>ENGRMSE 199</u> <del>CBEMS 199</del>	Individual Study (contingent upon the availability of research positions in the Materials Science Engineering faculty's research groups)

#### Electives:

Select two of the following:

BME 110A- 110B	Biomechanics I and Biomechanics II
BME 111	Design of Biomaterials
BME 120	Sensory Motor Systems
<u>ENGRMSE 141</u> <del>CBEMS 141</del>	Nano-Scale Materials and Applications
<u>ENGRMSE 154</u> <del>CBEMS 154</del>	Polymer Science and Engineering
<u>ENGRMSE 158</u> <del>CBEMS 158</del>	Ceramic Materials <u>for Sustainable Energy</u>
<u>ENGRMSE 163</u> <del>CBEMS 163</del>	Computer Techniques in Experimental Research

<del>CBE 187</del> <del>CBEMS 174</del>	Semiconductor Device Packaging
<del>ENGRMSE 191</del> <del>CBEMS 194</del>	Materials Outreach
CHEM 225	Polymer Chemistry: Synthesis and Characterization of Polymers
EECS 170A- 170B	Electronics I and Electronics II
ENGR 150	Mechanics of Structures
ENGR 165	Advanced Manufacturing
ENGRMAE 151	Mechanical Engineering Design
ENGRMAE 155	Composite Materials and Structures
ENGRMAE 157	Lightweight Structures
MATH 112A	Introduction to Partial Differential Equations and Applications
PHYSICS 112A	Electromagnetic Theory
PHYSICS 133	Introduction to Condensed Matter Physics
PHYSICS 135	Plasma Physics

<sup>1</sup> For students who plan to pursue a graduate degree in MSE, it is highly recommended that they take ENGRMSE 165 ~~CBEMS 165~~ in addition to two of the following courses: ENGRMSE 169, ENGRMSE 175, or ENGRMSE 199. ~~CBEMS 169~~, ~~CBEMS 175~~, or ~~CBEMS 199~~.