

# MATERIALS SCIENCE & ENGINEERING, BACHELOR OF SCIENCE

College of Engineering

## Materials Science & Engineering Undergraduate Program

The Materials Science & Engineering Bachelor of Science is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>) under the commission's General Criteria and Program Criteria for Materials, Metallurgical, Ceramics, and Similarly Named Engineering Programs.

Materials science and engineering is directed toward an understanding of the structure, properties, and processing of materials. Society demands new and improved materials with capabilities far superior to common metals, polymers, and ceramics. New materials are needed for high-speed transportation systems, surgical and dental implants, new generations of power plants, renewable energy sources, and solid-state electronic and photonics devices in computer and communication technology. Both the development of new materials and the understanding of present-day materials demand a thorough knowledge of basic engineering and scientific principles, including crystal structure, elastic and plastic behavior, thermodynamics, phase equilibria and reaction rates, and structural and physical and chemical behavior of engineering materials.

Materials engineers study phenomena found in many different engineering operations, from fracture behavior in automobiles to fatigue behavior in aircraft frames, from corrosion behavior in petro-chemical refineries to radiation-induced damage in nuclear power plants, and from the fabrication of steel to the design of semiconductors. Materials engineers are also increasingly involved in developing the new materials needed to attain higher efficiencies in existing and proposed energy conversion schemes and will play a central role in the development of new technologies based on composites and high-temperature superconductivity.

The undergraduate materials science and engineering program provides the background for activities in research, processing, and the design of materials. The curriculum is based on a common core of courses basic to engineering; courses taken during your first two years provide a strong foundation in fundamental engineering concepts.

### Objectives

We educate students in the fundamentals of materials science and engineering, balanced with the application of these principles to practical problems; educate students as independent, critical thinkers who can also function effectively in a team; educate students with a sense of community, ethical responsibility, and professionalism; educate students for careers in industry, government, and academia; teach students the necessity for continuing education and self-learning; and foster proficiency in written and oral communications.

Students are encouraged to adhere carefully to all prerequisite requirements. The instructor is authorized to drop students from a course for which stated prerequisites have not been completed.

### Honors Program

An Honors Program is available to qualified students in Materials Science & Engineering. It is a two-year program designed to challenge the most talented students in these majors. Students are invited to participate in their sophomore year. In the upper division coursework, students will complete either an honors thesis or a project that might involve local industry. Students must maintain a grade point average of 3.500 to continue in the program. Successful completion of the Honors Program will be acknowledged on the student's transcript.

The major requirements below are in addition to meeting University Degree Requirements (<https://catalog.ucdavis.edu/undergraduate-education/university-degree-requirements/>) & College Degree Requirements (<https://catalog.ucdavis.edu/undergraduate-education/college-degree-requirements/>); unless otherwise noted. The minimum number of units required for the Materials Science & Engineering Bachelor of Science is 157.

Code	Title	Units
<b>Lower Division Required Courses</b>		
<i>Mathematics</i>		
MAT 021A	Calculus	4
MAT 021B	Calculus	4
MAT 021C	Calculus	4
MAT 021D	Vector Analysis	4
MAT 022A	Linear Algebra	3
MAT 022B	Differential Equations	3
<i>Physics</i>		
PHY 009A	Classical Physics	5
PHY 009B	Classical Physics	5
PHY 009C	Classical Physics	5
PHY 009D	Modern Physics	4
<i>Chemistry</i>		
CHE 002A	General Chemistry	5
or CHE 002AH	Honors General Chemistry	
CHE 002B	General Chemistry	5
or CHE 002BH	Honors General Chemistry	
CHE 002C	General Chemistry	5
or CHE 002CH	Honors General Chemistry	
<i>Engineering</i>		
ENG 003	Introduction to Engineering Design	4
or ENG 003Y	Introduction to Engineering Design	
Choose one:		
ENG 017	Circuits I	
or ENG 017V	Circuits I	
ENG 035	Statics	
ENG 045	Properties of Materials	4
or ENG 045Y	Properties of Materials	
<i>Materials Science Engineering</i>		
EMS 002	Materials Marvels: The Science of Superheroes	3
<i>Programming</i>		
ECH 060	Chemical Engineering Problem Solving	4
or ECS 032A	Introduction to Programming	
or ECS 032AV	Introduction to Programming	

Lower Division Composition/Writing; choose one: a grade of C- or better is required:	4	MAT 128A	Numerical Analysis		
COM 001 Major Works of the Ancient World		MAT 128B	Numerical Analysis in Solution of Equations		
COM 002 Major Works of the Medieval & Early Modern World		MAT 128C	Numerical Analysis in Differential Equations		
COM 003 Major Works of the Modern World		MAT 135A	Probability		
COM 004 Major Works of the Contemporary World		MAT 167	Applied Linear Algebra		
ENL 003 Introduction to Literature		MAT 168	Optimization		
or ENL 003V Introduction to Literature		PHY 104A	Introduction to Mathematical Methods in Physics		
NAS 005 Introduction to Native American Literature		STA 131A	Introduction to Probability Theory		
or NAS 005V Introduction to Native American Literature		Choose one:	3-4		
UWP 001 Introduction to Academic Literacies (Recommended)		CHE 110A	Physical Chemistry: Introduction to Quantum Mechanics		
or UWP 001Y Introduction to Academic Literacies		CHE 124A	Inorganic Chemistry: Fundamentals		
or UWP 001V Introduction to Academic Literacies: Online		CHE 128A	Organic Chemistry		
Lower Division Required Courses Subtotal	79	PHY 108	Optics		
<b>Upper Division Required Courses</b>					
<i>Engineering</i>					
ENG 190 Professional Responsibilities of Engineers	3	PHY 108 & 108L	Optics and Optics Laboratory		
<i>Materials Science Engineering</i>					
EMS 160 Thermodynamics of Materials	4	PHY 110A	Electricity & Magnetism		
EMS 162 Structure & Characterization of Engineering Materials	4	PHY 122A	Advanced Laboratory in Condensed Matter Physics		
EMS 162L Structure & Characterization of Materials Laboratory	3	PHY 151	Stellar Structure & Evolution		
EMS 164 Kinetics of Materials	4	PHY 160/	Environmental Physics & Society		
EMS 170 Sustainable Energy Technologies: Batteries, Fuel Cells, & Photovoltaic Cells	4	ENG 160 DISCONTI (Discontinued for winter 2026) <small>**</small>			
EMS 170L Sustainable Energy Technologies Laboratory	3				
EMS 172 Smart Materials	4				
EMS 172L Smart Materials Laboratory	3				
EMS 174 Mechanical Behavior of Materials	4				
EMS 174L Mechanical Behavior Laboratory	3				
EMS 180 Materials in Engineering Design	4				
EMS 182 Failure Analysis	4				
EMS 181 Manufacturing of 3D & Composite Materials	4				
or EMS 183 Processing of 2D & Nanomaterials					
EMS 186A Materials Design Project	2				
EMS 186B Materials Design Project	3				
EMS 186C Materials Design Project	3				
Choose one:	4				
ECH 140 Mathematical Methods in Biochemical & Chemical Engineering					
ECI 114 Probabilistic Systems Analysis for Civil & Environmental Engineers					
EME 115 Introduction to Numerical Analysis & Methods					
ENG 180 Engineering Analysis					
MAT/BIS 107 Probability & Stochastic Processes with Applications to Biology					
MAT 118A Partial Differential Equations: Elementary Methods					
<b>Focused Electives</b>					
Courses used to satisfy degree requirements are not eligible to be used to satisfy the elective requirement.					
Students may elect to choose up to 5 units from the following lower division courses:					
BIM 020 Fundamentals of Bioengineering					
BIS 002A Introduction to Biology: Essentials of Life on Earth					
EBS 075 Properties of Materials in Biological Systems					
ENG 017 Circuits I or ENG 017V Circuits I					
ENG 035 Statics					
Remaining units must be satisfied by the following:					
BIM 106 Biotransport Phenomena					
BIM 109 Biomaterials					
ECI 130 Structural Analysis					
ECI 132 Structural Design: Metallic Elements					
EEC 140A Principles of Device Physics I or EEC 140AV Principles of Device Physics I					
EEC 140B Principles of Device Physics II					
EEC 146A Integrated Circuits Fabrication					
ENG 100 Electronic Circuits & Systems					
ENG 102 Dynamics					
ENG 103 Fluid Mechanics					
ENG 104 Mechanics of Materials or ENG 104V Mechanics of Materials					
<b>OR</b>					

Any upper division courses in Materials Science & Engineering (EMS); a maximum of 4 units combined in Materials Science & Engineering (EMS) courses numbered 190-197 or 199 can be used to satisfy focused electives requirement.

Choose one; grade of C- or better is required: 0-4

UWP 102E	Writing in the Disciplines: Engineering
UWP 102F	Writing in the Disciplines: Food Science & Technology
UWP 104A	Writing in the Professions: Business Writing
or UWP 104AV	Writing in the Professions: Business Writing
or UWP 104AY	Writing in the Professions: Business Writing
UWP 104E	Writing in the Professions: Science
UWP 104T	Writing in the Professions: Technical Writing

Passing the Upper Division Composition Exam.

Upper Division Required Courses Subtotal 78-83

**Total Units** **157-162**