Required Courses for Materials Science & Engineering Degree – 2018-19

This program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org

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To make an advising appointment, please visit: appointments.ucdavis.edu

Note: Curriculum and course offerings are subject to change. You must fulfill the degree requirements stated in the catalog of the year you graduate or the year immediately prior. For additional detail on degree requirements and coursework, please visit: https://ucdavis.pubs.curricunet.com/Catalog/ems

Writing and General Education Requirements

Lower Division English Composition (4 units)
Select ONE of the following courses:

	UWP 1, 1V, or 1Y	Expository Writing
	ENL 3	Introduction to Literature
	COM 1	Bks of West Civ /Ancient World
	COM 2	Bks of West Civ/MidAge-Enligh.
	COM 3	Bks of West Civ/Modern Crisis
	COM 4	Bks of Contemporary World
	NAS 5	Intro to Native American Lit.

Course must be completed with a C- or better. A 4 or 5 on your AP English exam will also satisfy this requirement.

Upper Division English Composition (0 or 4 units)
Select ONE of the following courses:

	UWP 102E or 102F	Writing in the Disciplines
	UWP 104A, 104E, or 104T	Writing in the Professions

Course must be completed with a C- or better. This requirement can also be satisfied by passing the Upper Division Composition Exam.

Rhetoric and Communication (4 units)
Select ONE of the following courses:

	CMN 1	Introduction to Public Speaking
	CMN 3	Interpersonal Communication Competence *(SS GE credit)*

General Education Requirement:
This requirement is partially satisfied with coursework completed for the MSE degree. A detailed GE checklist can be found here.

Lower Division Major Requirements

Math, Physics, and Chemistry (56 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	MAT 21A	Calculus	4	F	W	S	Two years of high school algebra, plane geometry, plane trigonometry, and analytical geometry, and satisfying the Mathematics Placement Requirement
	MAT 21B	Calculus	4	F	W	S	C- or better in MAT 21A or 21AH
	MAT 21C	Calculus	4	F	W	S	C- or better in MAT 21B or 21BH
	MAT 21D	Vector Analysis	4	F	W	S	C- or better in MAT 21C or 21CH
	MAT 22A	Linear Algebra	3	F	W	S	C- or better in MAT 21C; ENG 6, EME 5, ECH 60, or MAT 22AL (can be concurrent)
	MAT 22B	Differential Equations	3	F	W	S	C- or better in MAT 22A or MAT 67
	PHY 9A	Classical Physics	5	F		S	MAT 21B
	PHY 9B	Classical Physics	5	F	W		PHY 9A, MAT 21C, MAT 21D☺
	PHY 9C	Classical Physics	5		W	S	PHY 9B, MAT 21D, MAT 22A☺
	PHY 9D	Classical Physics	4	F		S	PHY 9C, MAT 22A, MAT 22B recommended ☺
	CHE 2A	General Chemistry	5	F	W		Multiple pathways
	CHE 2B	General Chemistry	5		W	S	C- or better in CHE 2A or 2AH
	CHE 2C	General Chemistry	5	F		S	C- or better in CHE 2B or 2BH

Engineering (14 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	EMS 2	Materials Marvels	3		W		None
	ECH 60	Computational Methods	4			S	MAT 21C
	ENG 17	Circuits	4	F	W	S	MAT 21C (C- or better recommended) ☺
	ENG 45 or ENG 45Y	Properties of Materials	4 4	F	W	S SS	C- or better in all of the following: MAT 21C, CHE 2A & PHY 9A ENG 45Y is a hybrid course only offered in Summer Session (same prerequisites as ENG 45)

Upper Division Major Requirements

Engineering (3 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	ENG 190	Professional Responsibilities of Engineers *(SS GE3 credit)*	3		W	S	Upper division standing in the College of Engineering

Materials Science Fundamentals (20 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	EMS 160	Thermodynamics of Materials Proc.	4	F			C- or better in each of the following: ENG 45, PHY 9B, MAT 22B; CHE 2C recommended
	EMS 162	Structure & Characterization of Engineering Materials	4		W		C- or better in each of the following: ENG 45, MAT 22A, PHY 9B
	EMS 164	Rate Processes in Materials Science	4		W		C- or better in ENG 45; EMS 160
	EMS 172	Electronic, Optical & Magnetic Properties of Materials	4	F			CHE 110A or PHY 9D; ENG 6 or ECH 60 or equivalent (recommended)
	EMS 174	Mechanical Behavior of Materials	4			S	C- or better in ENG 45; EMS 162 (recommended)

Materials Science Laboratory (6 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	EMS 162L	Structure & Characterization of Engineering Materials Lab	2		W		EMS 162 ☺ (concurrent enrollment recommended)
	EMS 172L	Electronic, Optical & Magnetic Properties Lab	2	F			EMS 172 ☺ (concurrent enrollment recommended)
	EMS 174L	Mechanical Behavior Lab	2			S	EMS 174 ☺(concurrent enrollment recommended)

Engineering Application of Materials (16 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	EMS 180	Materials in Engineering Design	4			S	C- or better in ENG 45, upper division standing
	EMS 181	Materials Processing	4		W		C- or better in ENG 45; ENG 105 or EEC 140A or EMS 164 or ECH152B or equivalent
	EMS 188A	Materials Design Project	4		W		EMS 160, 162, 164, 172, and 174
	EMS 188B	Materials Design Project	4			S	EMS 188A

Applied Mathematics Elective (4 units) *Choose one of the following courses.*

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	ECH 140	Mathematical Methods	4	F			MAT 22B; ECH 60 or equivalent
	ECI 114	Probabilistic Systems Analysis for Civil Engineers	4		W	S	C- or better in MAT 21C
	EME 115	Introduction to Numerical Analysis and Methods	4	F			C- or better in ENG 6, EME 5, ECS 30, or ECM 6; C- or better in MAT 21A, 21B, 21C, 21D, 22A, 22B; C- or better in PHY 9A, 9B or 9C
	ENG 180	Engineering Analysis	4	F			C- or better in ENG 6, EME 5, or ECS 30; C- or better in MAT 21D and MAT 22B
	MAT 135A	Probability	4	F	W		MAT 21C; MAT 108 or 25
	PHY 104A	Mathematical Physics	4	F			C- or better in PHY 9B, 9C, and 9D; C- or better in MAT 21D, 22A, and 22B; or 🕮
	STA 131A	Intro. To Probability Theory	4	F		S	MAT 21B; MAT 21C; MAT 22A or 67

Basic Science Elective (3-4 units) *Choose one of the following courses.*

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	CHE 110A	Physical Chemistry: Intro. to Quantum Mech.	4	F		S	PHY 9C, CHE 2C, MAT 21C; Completion of MAT 21D, 22A, 22AL, and PHY 9C strongly recommended.
	CHE 124A	Inorganic Chemistry: Fundamentals	3	F	W	S	CHE 2C
	CHE 128A	Organic Chemistry	3	F	W		C or better in CHE 2C
	PHY 108/108L	Optics/Optics Lab	4			S	PHY 9A, 9B, 9C, 9D, MAT 21A, B, C, D; or 🕮
	PHY 110A	Electricity and Magnetism	4		W		C- or better in PHY 9B, 9C, 9D, MAT 21D, 22A, and 22B; PHY 104A; PHY 105A; or consent of department
	PHY 122A	Advanced Condensed Matter Lab	4		W	S	PHY 104A, 105A, 110B, 115A and 112 ☺; or consent of department
	*PHY 151**	Stellar Structure & Evolution	4	F			PHY 9A, 9B, 9C, 9D or 🕮
	*PHY 160**	Environmental Physics and Society	3			S	PHY 9D or 7C; or PHY 10 or 1B and MAT 16B; or equivalent

Sustainability in Engineering Elective (3-4 units) *Choose one of the following courses.*

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	ECH 158A	Process Economics and Green Design	4	F			ECH 142, 143
	EMS 170	Sustainable Energy Technologies: Batteries, Fuel Cells, and Photovoltaic Cells	4			S	ENG 45 or 45Y
	ENG 106	Engineering Economics	3		W	S	Upper division standing
	ENG 160 or PHY 160	Environmental Physics and Society	3			S	PHY 9D, MAT 16B (or equivalent)
	ENG 188	Science and Technology of Sustainable Power Generation	4			S	PHY 9C; upper-division standing
	ECI 123	Urban Systems and Sustainability	4			S	Upper-division standing
	*ECI 125**	*Building Energy Performance*	4			S	Upper-division standing in Engineering
	ECI 143	Green Engineering Design and Sustainability	4		W		Upper-division standing

Upper Division Elective Credit (9 units) *Choose any upper division elective for credit. Units in excess of 14 for Engineering Focus Area will apply. Students may receive elective credit up to a maximum of 4 units for engineering 199 courses, when approved by the department undergraduate affairs committee (UAC). To request credit, a student must submit a summary of their research to the committee via the academic advisor. A letter of support from the faculty mentor is also required to verify that the students has conducted substantial research activity.*

Engineering Focus Areas (14 units minimum) *Choose one of the following focus areas to complete in it's entirety. Units in excess of 14 will apply toward Upper Division Elective Credit.*

Mechanical Engineering (16 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	ENG 35	Statics	4	F	W	S	C- or better in PHY 9A and MAT 21D ☺
	ENG 102	Dynamics	4	F	W	S	C- or better in ENG 35, MAT 22B, PHY 9B
	ENG 103	Fluid Mechanics	4	F	W	S	C- or better in ENG 35, MAT 22B, PHY 9B
	ENG 104	Mechanics of Materials	4	F	W	S	C- or better in ENG 35 and MAT 22B

Civil Engineering (16 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	ENG 35	Statics	4	F	W	S	C- or better in PHY 9A, MAT 21D ☺
	ENG 104	Mechanics of Materials	4	F	W	S	C- or better in ENG 35 and MAT 22B
	ECI 130	Structural Analysis	4	F		S	C- or better in ENG 104; MAT 22A; Open to ECI majors
	ECI 132	Structural Design: Metallic Elements	4	F			ECI 130

Electrical Engineering (14 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	ENG 100	Electronic Circuits and Systems	3	F	W	S	C- or better recommended in ENG 17
	EEC 140A	Principles of Device Physics I	4	F	W		ENG 17 ☺, PHY 9D
	EEC 140B	Principles of Device Physics II	4			S	EEC 140A
	EEC 146A	Integrated Circuits Fabrication	4	F			EEC 140A

Chemical Engineering (16 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	ECH 51	Material Balances	4	F			C- or better in MAT 21C; MAT 21D ☺
	ECH 140	Numerical Methods	4	F			MAT 22B; ECH 60 or equivalent
	ECH 141	Fluid Mechanics	4		W		C- or better in ECH 51; ECH 140
	ECH 142	Heat Transfer	4			S	ECH 141

Biosystems Engineering (16 units)

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	BIS 2A	Introduction to Biology: Essentials of Life on Earth	5	F	W	S	None
	EBS 75	Properties of Materials in Biological Systems	4		W		BIS 2A; PHY 9C ☺
	ENG 100	Electronic Circuits and Systems	3	F	W	S	C- or better recommended in ENG 17
	EBS 165	Bioinstrumentation and Control	4	F			ENG 100

Biomedical Engineering (17 units) *Must complete NPB 101 (offered F,W,S) as prerequisite for BIM 106 and can be used for Upper Division Elective credit.*

	Course Number	Course Title	Units	Qtr Offered			Prerequisites
	BIS 2A	Introduction to Biology: Essentials of Life on Earth	5	F	W	S	None
	BIM 20	Fundamentals of Bioengineering	4			S	C- or better in CHE 2B and MAT 21D; PHY 9B
	BIM 106	Biotransport Phenomena	4		W		C- or better in BIM 20; BIM 116 or NPB 101; PHY 9B; MAT 22B; Open to BIM majors
	BIM 109	Biomaterials	4			S	BIS 2A, CHE 2C, BIM 106, upper division standing Engineering majors

☺ *May be taken concurrently* 🕮 *May be taken with consent of instructor* *Course not regularly offered

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