

**BIOMEDICAL ENGINEERING DEGREE REQUIREMENTS
PREREQUISITE LIST 2019-2020**

Course	Title	Units	Qtrs	Prerequisites
Lower Division Courses:				
MAT 21A	Calculus	4	F W S	Mathematics Placement Required
MAT 21B	Calculus	4	F W S	MAT 17A (B) or 21A (C-)
MAT 21C	Calculus	4	F W S	MAT 17B (B) or 17C (C-) or 21B (C-)
MAT 21D	Vector Analysis	4	F W S	MAT 17C (B) or 21C (C-)
MAT 22A/27A	Linear Algebra/with Apps Biology	3	F W S	MAT 17C (C-) or 21C (C-); ENG 6 or MAT 22AL (may be concurrent)
MAT 22B/27B	Differential Equations/with Apps Biology	3	F W S	MAT 22A (C-)/MAT 27A (C-); ENG 6 or MAT 22AL (C-)
CHE 2A	General Chemistry	5	F W	Chemistry Placement Required
CHE 2B	General Chemistry	5	W S	CHE 2A (C-) or 2AH (C-)
CHE 2C	General Chemistry	5	F S	CHE 2B (C-) or 2BH (C-)
PHY 9A	Classical Physics	5	F S	MAT 21B
PHY 9B	Classical Physics	5	F W	PHY 9A; MAT 21C, 21D (can be concurrent)
PHY 9C	Classical Physics	5	W S	PHY 9B; MAT 21D, 22A (can be concurrent)
ENG 6	Eng. Problem Solving	4	F W S	MAT 21A (C-), 21B (C-) (can be concurrent)
ENG 17	Circuits I	4	F W S	MAT 21C (C- recommended)
BIS 2A	Biology: Essentials of Life on Earth	5	F W S	None
Organic Chemistry Courses: CHE 118 series (required for Pre-Med).				
CHE 8A	Organic Chemistry: Brief Course	2	F S	CHE 2B (C-) or 2BH (C-)
CHE 8B	Organic Chemistry: Brief Course	4	F W	CHE 8A or 118A
CHE 118A	O Chem – Health/Life Sciences	4	F W	CHE 2C (C-) or 2CH (C-)
CHE 118B	O Chem – Health/Life Sciences	4	W S	CHE 118A
CHE 118C	O Chem – Health/Life Sciences	4	F S	CHE 118B
Biomedical Engineering Lower Division:				
BIM 1	Introduction to BME	2	F	None
BIM 20	Fundamentals of Bioengineering <i>Only 2 units if ECH 51, ENG 105 prior</i>	4	S	CHE 2B or 2BH (C-); MAT 21D (C-); PHY 9B, ENG 6 Corequisite with BIM 089C/20L
BIM 089C/20L	CAD for BME	2	S	CHE 2B or 2BH (C-); MAT 21D (C-), PHY 9B, ENG 6 coreq BIM 20
Biomedical Engineering Upper Division: Select either BIM 116 or NPB 101 (Pre-Med, Biomechanics).				
BIM 116	Physiology for Biomedical Engineers	5	F	BIS 2A(C-); PHY 9C; MAT 22B recommended
NPB 101	Systemic Physiology	5	F W S	BIS 2A; CHE 2B; PHY 9C recommended
BIM 105	Probability and Statistics for BME	4	F	MAT 21D (C-); ENG 6 (can be concurrent)
BIM 106	Biotransport Phenomena	4	W	NPB 101 or BIM 116; PHY 9B; MAT 22B; BIM 20 (C-)
BIM 108	Biomedical Signals and Control	4	S	ENG 6, 17; MAT 22B (C-) <i>No credit given if EEC 150A taken prior. Only 2 units of credit if EME 171 taken prior.</i>
BIM 109	Biomaterials	4	S	BIS 2A; CHE 2C or 2CH; BIM 106
BIM 110L	BME Senior Design Lab	2	F	BIM 105, 106, 108, 109; BIM 116 or NPB 101
BIM 110A	BME Senior Design Experience	3	W	BIM 110L (can be concurrent), BIM 111 (can be concurrent)
BIM 110B	BME Senior Design Experience	3	S	BIM 110A
BIM 111	Biomedical Instrumentation Lab	6	F W	BIM 105, 108; ENG 100 or EEC 100; NPB 101 or BIM 116
Upper Division Engineering Courses: Select ENG 100 or EEC 100. 2 extra units of EEC 100 count as EE units.				
ENG 100	Electronic Circuits and Systems	3	F W S	ENG 17 (C- or better recommended)
EEC 100	Circuits II	5	F W	ENG 17 (C-), MAT 022B
ENG 105	Thermodynamics	4	F W S	MAT 22B (C-); PHY 9B (C-)
ENG 190	Prof. Responsibilities of Engineers	3	W S	Upper division standing
Science Electives: 7 units. Choose from courses below or any graded upper division course in CHE, PHY or Biological Sciences that is designated as Science and Engineering topical breadth. 2 units from CHE 118A can be applied towards Science Electives.				
PHY 9D	Modern Physics	4	F S	PHY 9C; MAT 22A, 22B recommended, (may be concurrent)
BIS 2B	Biology: Princ. of Ecology & Evolution	5	F W S	None
BIS 2C	Biology: Biodiversity & Tree of Life	5	F W S	BIS 2B (C-)
BIM 102	Cellular Dynamics	4	F	BIS 2A; CHE 8B or 118B <i>*Only 2 units of credit if BIS 104 taken prior.</i>
BIM 161A	Biomolecular Engineering	4	F ^a	BIS 2A; CHE 8B or 118B
ECS 32A	Introduction to Programming	4	F W S	None.
ECS 32B	Introduction to Data Structures	4	F W S	ECS 10 or ECS 30 or ECS 32A or ECS 36A (All C-) <i>*No credit if ECS 36C or ECS 60 or higher taken prior.</i>
NPB 109	Kinesiology-Analysis and Control of Human Movement	4	S	PHY 9A, 9B; NPB 101 and CHA 101/L recommended

Engineering Electives: 24 units. Choose any graded upper division BIM course (except BIM 102, 161A, 161L, 161S which are science electives) or choose from the Supplemental list. 2 units from EEC 100 can be applied towards Engineering Electives. ^a Offered alternate years. Check with advisor.

BIM Courses

BIM 120	Introduction to Materials Science for BME	4	W	BIM 20 (C-) or ENG 105 (C-); PHY 9C; MAT 22B rec. Open to upper division BME majors only.
BIM 125	Introduction to Design and Analysis of Experiments for BME	4		BIM 105
BIM 140	Protein Engineering	4	S	BIS 2A
BIM 141	Cell & Tissue Mechanics	4	W	PHY 9B; ENG 6, 35
BIM 142	Principles and Practices of Biomedical Imaging	4	S	MAT 22B; BIM 108 (can be concurrent)
BIM 143	Biomolecular Systems Engineering: Synthetic Biology	4	S	BIS 2A; MAT 21C or equiv.
BIM 143L	Synthetic Biology Lab	2	S	BIM 143 (concurrent enrollment required)
BIM 144	Fundamentals of Biophotonics and Bioimaging	4	W	PHY 9B; MAT 22B; or instructor consent; BIM 108 helpful; biology/physiology course recommended
BIM 145	Immuno-engineering	4	W	BIM 161A or BIS 102
BIM 152	Molecular Control of Biosystems	4	W	BIS 2A; PHY 9B; MAT 22B
BIM 162	Intro to the Biophysics of Molecules & Cells	4	F	MAT 22B(C-); PHY 9C (C-)
BIM 163	Bioelectricity, Biomechanics, & Signaling Systems	4	S	MAT 22B (C-); BIM 116 or NPB 101
BIM 167	Biomedical Fluid Mechanics	4	S	BIM 106 (C-); BIM 116 or NPB 101
BIM 170	Aspects of Medical Device Design & Manufacturing	2	W	Open to upper division BME majors only.
BIM 171	Clinical Applications for Biomedical Device Design	4	F	BIM 116 (C-) or NPB 101 (C-); NPB 101 recommended Open to BME majors only.
BIM 173	Cell & Tissue Engineering	4	F	BIM 106 (C-), 109 (C-)
BIM 174	Microcontroller Applications Lab	2	F	ENG 17 (C-). Open to upper division BME majors only.
BIM 176	Microfluidic Lab	2	W	CHE 2A, ENG 17, upper division standing
BIM 89C	Clinical Needs Finding	1	S	BIM 1
BIM 189C/154	Computational Genomics (Aviran)	4	S	ENG 6 (C-), MAT 21D (C-), MAT 22A (C-), BIM 105 (C-)
BIM 189C/175	Advanced Mfg: Welding & Metalworking (Choi)	1	W	BIM 110L
BIM 189C	Neuroengineering Lab (Moxon)	2	W	BIM 105; ENG 100 or EEC 100
BIM 189C	Intro to Rapid Prototyping for BME (Passerini)	2	W	BIM 110L
BIM 189C	Computational tools in Bioengineering & Biomedicine (Saiz)	4		BIS 2A; PHY 9B; MAT 22B; or instructor consent
BIM 192	Internship in BME	4	FWSSS	Consent of instructor AND Dept approved petition
BIM 199	Special Study for Advanced UG's (Lab Research)	4	FWSSS	Consent of instructor AND Dept approved petition

Supplemental List.

ENG 4	Eng. Graphics in Design (CAD)	3	F W	None
ENG 35	Statics	4	F W S	PHY 9A(C-); MAT 21D (C-) (can be concurrent)
ENG 45	Properties of Materials	4	F W S	MAT 21C (C-); CHE 2A (C-); PHY 9A (C-)
ENG 45Y	Properties of Materials	4	SSII	MAT 21C (C-); CHE 2A; PHY 9A
ENG 102	Dynamics	4	F W S	ENG 35 (C-); MAT 22B (C-)
ENG 103	Fluid Mechanics	4	F W S	ENG 35 (C-); MAT 22B (C-); PHY 9B (C-)
ENG 104	Mechanics of Materials	4	F W S	ENG 35 (C-); MAT 22B (C-)
ENG 104L	Mechanics of Materials Lab	1	W S	ENG 104
ENG 106	Engineering Economics	3	W	Upper Division Standing in Engineering
EBS 128	Biomechanics and Ergonomics	4	S	ENG 102; BIM 105 with consent of instructor
EBS 130	Modeling of Dynamic Processes in Biological Systems	4	W	ENG 6; MAT 22B (C-); EBS 75
EBS 165	Bioinstrumentation and Control	4	F	ENG 100
EBS 175	Rheology of Biological Materials	3	S ^a	ENG 103 or EBS 103;
ECH 141	Fluid Mechanics Biochem/ChemE	4	W	ECH 51 (C-), ECH 140
ECH 144	Rheology and Polymer Processing	3		ECH 141; Offered irregularly
ECH 145A	Chem Eng Thermodynamics Lab	3	W	ECH 152A, 152B (can be concurrent). Open to majors.
ECH 145B	Chem Eng Transport Lab	3	S	ECH 141, 145A. Open to majors.
ECH 155	Chem Eng Kinetics/Reactor Design Lab	4	W S	ECH 145B, 148A, 148B (can be concurrent), 157 (can be concurrent); upper div comp satisfied (can be concurrent) Open to majors.
ECH 160	Fundamentals of Biomanufacturing	3		MIC 102 or BIS 102 or ABI 102; Offered irregularly
ECH 161A	Biochemical Eng Fundamentals	4	W	ECH 148A

ECH 161B	Bioseparations	4	W	ECH 143
ECH 161L	Bioprocess Engineering Laboratory	4	S	(ECH 145B, 161A, 161B) or VEN 186 or (BIS 103, MCB 120L)
ECH 170	Intro to Colloid and Surface Phenomena	3		CHE 110A; <i>Offered irregularly</i>
ECS 124	Theory & Practice of Bioinformatics	4	F	ENG 6; BIS 2A; BIM 105
EEC 110A	Electronic Circuits I	4	W S	EEC 100, 140A (can be concurrent)
EEC 110B	Electronic Circuits II	4	S	EEC 110A
EEC 118	Digital Integrated Circuits	4	S	EEC 110A, (EEC 018 or EEC 180A)
EEC 130A	Electromagnetics I	4	F W	MAT 21D; PHY 9C; ENG 17
EEC 130B	Introductory Electromagnetics II	4	W S	EEC 130A
EEC 140A	Principles of Device Physics I	4	F W	ENG 17 (can be concurrent); PHY 9D
EEC 140B	Principles of Device Physics II	4	S	EEC 140A
EEC 150B	Intro to Signals and Systems II	4	F	EEC 150A or BIM 108 with consent of instructor
EEC 157A	Control Systems	4	F	EEC 100
EEC 157B	Control Systems	4	S	EEC 157A
EEC 160	Signal Analysis & Communications	4	F	EEC 150A or BIM 108 with consent of instructor
EME 50	Manufacturing Processes	4	F W	ENG 4 (C-); PHY 9A (C-); Restricted
EME 150A	Mechanical Design	4	F S	ENG 45 or 45Y(C-); ENG 104(C-); EME 50(C-)(can be concurrent); Restricted
EME 150B	Mechanical Design	4	W S	EME 150A (C-); Restricted
EME 151	Statistical Methods in Design/Manu.	4	W	EME 150A (C-); Restricted. Offered irregularly
EME 152	Computer-Aided Mechanism Design	4	F	ENG 6 (C-), 102 (C-); Restricted
EME 154	Mechatronics	4	S	ENG 100(C-), 102(C-); EME 50(C-); Restricted
EME 165	Heat Transfer	4	F S	ENG 6 (C-), 103 (C-), 105 (C-); Restricted
EME 171	Analysis, Simulation and Design of Mechatronic Systems	4	F W	ENG 100 (C-), 102 (C-); Restricted
EME 172	Automatic Control Eng. Systems	4	F W S	ENG 100 (C-), 102 (C-); Restricted
EMS 147	Principles of Polymer Materials Science	3	S	CHE 2A, 2B; (CHE 8A, 8B) or (ENG 45 or 45Y); Intro Physics
EMS 160	Thermodynamics of Materials Processes and Phase Stability	4	F	ENG 45 or 45Y (C-); PHY 9B (C-); MAT 22B (C-); CHE 2C recommended
EMS 162	Structure and Characterization of Engineering Materials	4	W	ENG 45 or 45Y (C-); MAT 22A (C-); PHY 9B (C-)
EMS 162L	Structure and Characterization of Materials Laboratory	2	W	EMS 162 (concurrent enrollment recommended)
EMS 164	Kinetics of Materials	4	W	ENG 45 or 45Y (C-); EMS 160
EMS 172	Smart Materials	4	F	CHE 110A or PHY 9D; ENG 6 recommended
EMS 172L	Smart Materials Laboratory	3	F	EMS 172 (concurrent enrollment recommended)
EMS 174	Mechanical Behavior of Materials	4	S	ENG 45 or 45Y (C-); EMS 162 recommended
EMS 174L	Mechanical Behavior Laboratory	3	S	EMS 174 (concurrent enrollment recommended)
EMS 180	Materials in Engineering Design	4	F	ENG 45 or 45Y (C-); upper division standing
EMS 181	Mfg of 3D & Composite Materials	4	W	ENG 45 or 45Y (C-), ENG 105
EMS 182	Failure Analysis	4	F	ENG 45 or 45Y(C-); EMS 174 recommended; <i>Offered irregularly</i>
BME Professional Development Courses (Non-Degree) * These courses do not count for BME degree.				
BIM 88V	Introduction to Research	2	W S	None
BIM 89C	BME Professional Development	1	W	None. <i>Open to BME majors only.</i>
Other Requirements				
Lower Division Composition: Select one from the following 4-unit courses. UWP 1, 1Y (Introduction to Academic Literacies) ENL 3 (Intro to Literature) COM 1 (Ancient World), COM 2 (Medieval & Early Modern World), COM 3 (Modern World), COM 4 (Contemporary World) NAS 5 (Intro to Native American Literature)				
Upper Division Composition: Select one from the following 4-unit courses or pass the exam. UWP 101, 102 BE; 104 AEFIT Exam: writing.ucdavis.edu/compexam				