

BIOMEDICAL ENGINEERING, B.S.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (<http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext>) section of the *Guide*.

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| General Education | <ul style="list-style-type: none"> • Breadth—Humanities/Literature/Arts: 6 credits • Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits • Breadth—Social Studies: 3 credits • Communication Part A & Part B * • Ethnic Studies * • Quantitative Reasoning Part A & Part B * |
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* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

SUMMARY OF REQUIREMENTS

Code	Title	Credits
<i>Mathematics</i>		19
<i>Science</i>		37
<i>General Education</i>		21
<i>Engineering Courses:</i>		
Introduction to Engineering		3
Engineering Mechanics Core Courses		6
Biomedical Engineering Core Courses		18
Biomedical Engineering Area Technical Elective Requirements		15
Biomedical Advanced Technical Elective		3
Engineering Technical Elective		3
Total Credits		At least 128

MATHEMATICS

Code	Title	Credits
MATH 221 & MATH 222 & MATH 234	Calculus and Analytic Geometry 1 and Calculus and Analytic Geometry 2 and Calculus--Functions of Several Variables	13
MATH 320 or MATH 319	Linear Algebra and Differential Equations Techniques in Ordinary Differential Equations	3
B M E 325 or STAT 324 or STAT/ MATH 431	Applied Statistics for Biomedical Engineers Introductory Applied Statistics for Engineers Introduction to the Theory of Probability	3
Total Credits		19

SCIENCE

Code	Title	Credits
COMP SCI 220 or COMP SCI 200 or COMP SCI 300 or COMP SCI 310	Data Science Programming I Programming I Programming II Problem Solving Using Computers	3-4
E M A 201 or PHYSICS 201 or PHYSICS 207	Statics (only statics counts for Engineering credits below) General Physics General Physics	3
PHYSICS 202 or PHYSICS 208	General Physics General Physics	5
One of the following:		5-9
CHEM 109	Advanced General Chemistry	
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	
CHEM 343 or CHEM 341	Introductory Organic Chemistry Elementary Organic Chemistry	3
CHEM 345 & CHEM 344 or CHEM 327 or CHEM 329	Intermediate Organic Chemistry and Introductory Organic Chemistry Laboratory Fundamentals of Analytical Science Fundamentals of Analytical Science	5
ZOOLOGY/ BIOLOGY 101 & ZOOLOGY/ BIOLOGY 102	Animal Biology and Animal Biology Laboratory (or)	5
ZOOLOGY/ BIOLOGY/ BOTANY 151	Introductory Biology (or)	
BIOCORE 381 & BIOCORE 383	Evolution, Ecology, and Genetics and Cellular Biology	
ANAT&PHY 335	Physiology (or)	5
ANAT&PHY 435	Fundamentals of Human Physiology (or)	
BIOCORE 485 & BIOCORE 486	Principles of Physiology and Principles of Physiology Laboratory	

ANAT&PHY 337	Human Anatomy	3
or ZOOLOGY 430	Comparative Anatomy of Vertebrates	
or ZOOLOGY 470	Introduction to Animal Development	
or ZOOLOGY/ PSYCH 523	Neurobiology	
or ZOOLOGY 570	Cell Biology	
or ZOOLOGY 611	Comparative and Evolutionary Physiology	
or GENETICS 466	Principles of Genetics	
or BIOCORE 587	Biological Interactions	
Total Credits		37-42

GENERAL EDUCATION

Code	Title	Credits
<i>Communications A</i>		3
LSC 100	Science and Storytelling	
or COM ARTS 1C	Introduction to Speech Composition	
or ENGL 100	Introduction to College Composition	
or ESL 118	Academic Writing II	
<i>Communications B</i>		
INTEREGR 397	Engineering Communication (was EPD 397 before Fall 2020)	3
or ZOOLOGY/ BIOLOGY/ BOTANY 152	Introductory Biology	
or BIOCORE 384	Cellular Biology Laboratory	
At least 15 credits of liberal studies following the College of Engineering guidelines (http://guide.wisc.edu/undergraduate/engineering/#requirementstext)		15
Total Credits		21

ENGINEERING COURSES

Code	Title	Credits
<i>Introduction to Engineering</i>		3
INTEREGR 170	Design Practicum	
<i>Required engineering mechanics core courses</i>		6
E M A 201	Statics	
E M A 303	Mechanics of Materials	
or M E 306	Mechanics of Materials	
<i>Required B M E core courses</i>		18
B M E 200	Biomedical Engineering Design	
B M E 201	Biomedical Engineering Fundamentals and Design	
B M E 300	Biomedical Engineering Design	
B M E 301	Biomedical Engineering Design	
B M E 310	Bioinstrumentation	
B M E 315	Biomechanics	
B M E 400	Capstone Design Course in Biomedical Engineering	
B M E 402	Biomedical Engineering Design	
B M E/ PHM SCI 430	Biological Interactions with Materials	
<i>Engineering area technical electives (see below)</i>		15
<i>One advanced B M E technical elective from any area</i>		3

<i>Engineering technical elective: Any engineering course(s) from a degree-granting engineering program</i> ¹	3
Total Credits	48

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- The number of credits in this area can range from 0 to 11 credits. This number of credits depends on how students decide to fulfill various requirements, when they enter or progress into program, and if they study abroad. Examples include (and are not limited to): Taking PHYSICS 201 General Physics instead of E M A 201 Statics adds 3 credits to this area. Taking B M E 325 Applied Statistics for Biomedical Engineers instead of STAT 324 Introductory Applied Statistics for Engineers removes 3 credits from this area. Transfer students are not required to take INTEREGR 170 Design Practicum and this adds 3 credits to this area. Students who study abroad may miss a 1-credit design course and this adds 1 credit to this area. Regardless of the choices made, all students must have at minimum 48 credits of engineering courses from degree-granting programs.
 - EPD courses are not included in this category.
 - InterEGR courses are not included in this category except INTEREGR 170 Design Practicum and INTEREGR 301 Engineering and Biology: Technological Symbiosis
 - Only 3 credits of an engineering independent study may count (e.g., B M E 399 Independent Study, B M E 489 Honors in Research, CBE 699 Advanced Independent Studies, etc.).
 - Special topics courses must have prior approval of the B M E Curriculum Committee.
 - B M E 325 Applied Statistics for Biomedical Engineers counts for engineering credits.

BIOMEDICAL ENGINEERING AREA TECHNICAL ELECTIVE REQUIREMENTS

Choose 15 credits of area technical electives in one of the following tracks and at least one advanced B M E elective from any area:

Bioinstrumentation and Medical Devices:

Code	Title	Credits
Required Area Elective		
E C E 230	Circuit Analysis	4
Area Electives in Bioinstrumentation		11
Choose from any ECE course, the courses below, and from the advanced BME electives in this area		
M E 445	Mechatronics in Control & Product Realization	3

Advanced BME Area Technical Electives in Bioinstrumentation and Medical Devices

B M E/E C E 462	Medical Instrumentation	3
B M E/E C E 463	Computers in Medicine	3
B M E/ MED PHYS 535	Introduction to Energy-Tissue Interactions	3
B M E 550	Introduction to Biological and Medical Microsystems	3
B M E 556	Systems Biology: Mammalian Signaling Networks	3

Biomedical Imaging and Optics:

Code	Title	Credits
Required Area Elective		
E C E 330	Signals and Systems	3
Area Electives in Biomedical Imaging		12
Choose from the following and from the advanced BME electives in this area		

E C E 203	Signals, Information, and Computation	3
E C E 331	Introduction to Random Signal Analysis and Statistics	3
E C E 431	Digital Signal Processing	3
E C E/COMP SCI 533	Image Processing	3
B M E/H ONCOL/ MED PHYS/ PHYSICS 501	Radiation Physics and Dosimetry	3
B M E/ MED PHYS 566	Physics of Radiotherapy	3
B M E/ MED PHYS 573	Medical Image Science: Mathematical and Conceptual Foundations	3
B M E/ MED PHYS 574	Imaging in Medicine: Applications	3
B M E/ MED PHYS 580	The Physics of Medical Imaging with Ionizing Radiation	4
N E 305	Fundamentals of Nuclear Engineering	3
N E 408	Ionizing Radiation	3
N E 427	Nuclear Instrumentation Laboratory	2

Advanced BME Area Technical Electives in Biomedical Imaging

B M E/ MED PHYS 530	Medical Imaging Systems	3
B M E/ MED PHYS 535	Introduction to Energy-Tissue Interactions	3
B M E/ MED PHYS 578	Non-Ionizing Diagnostic Imaging	4
B M E/MED PHYS/ PHMCOI-M/ PHYSICS/ RADIOL 619	Microscopy of Life	3

Biomechanics:

Code	Title	Credits
Required Area Elective		
E M A 202 or M E 240	Dynamics	3

Area Electives in Biomechanics 12

Choose from any E M A or M E course, the courses below, and from the advanced B M E electives in this area

M S & E 350 or M S & E 351	Introduction to Materials Science Materials Science-Structure and Property Relations in Solids	3
M S & E/CHEM 421	Polymeric Materials	3
CBE 320 or B M E 330	Introductory Transport Phenomena Engineering Principles of Molecules, Cells, and Tissues	4
CBE 324	Transport Phenomena Lab	3
CBE/M E 525	Macromolecular Hydrodynamics	3

Advanced B M E Area Technical Electives in Biomechanics

B M E/M E 414	Orthopaedic Biomechanics - Design of Orthopaedic Implants	3
B M E/M E 415	Biomechanics of Human Movement	3

B M E/M E 505	Biofluidics	3
B M E/I SY E 564	Occupational Ergonomics and Biomechanics	3
B M E/M E 603	Topics in Bio-Medical Engineering	1-3
B M E/M E 615	Tissue Mechanics	3
B M E/I SY E 662	Design and Human Disability and Aging	3

Biomaterials, Cellular and Tissue Engineering:

Code	Title	Credits
Required Area Elective		
B M E 330 or CBE 320	Engineering Principles of Molecules, Cells, and Tissues Introductory Transport Phenomena	4

Area Electives in Biomaterials, Cellular and Tissue Engineering 12

Choose from any CBE or M S & E course, the courses below, and from the advanced B M E electives in this area

M E 417	Transport Phenomena in Polymer Processing	3
M E 418	Engineering Design with Polymers	3
M E/STAT 424	Statistical Experimental Design	3
M E/BSE/ FOOD SCI 441	Rheology of Foods and Biomaterials	3
B M E 511	Tissue Engineering Laboratory	1

Advanced BME Area Technical Electives in Biomaterials, Cellular and Tissue Engineering

B M E 510	Introduction to Tissue Engineering	3
B M E 520	Stem Cell Bioengineering	3
B M E 545	Engineering Extracellular Matrices	3
B M E 550	Introduction to Biological and Medical Microsystems	3
B M E 556	Systems Biology: Mammalian Signaling Networks	3
B M E/CBE 560	Biochemical Engineering	3
B M E/M E 615	Tissue Mechanics	3
B M E 630	Nanomaterials for Biomedical Applications	3

TOTAL DEGREE CREDITS: AT LEAST 128

UNIVERSITY DEGREE REQUIREMENTS

Total Degree To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

Residency Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

Quality of Work Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.