BIOMEDICAL ENGINEERING, BS

Biomedical engineering (BME) is the application of engineering tools for solving problems in biology and medicine. BMEs apply their multidisciplinary expertise to problems such as designing new medical instruments and devices, understanding and repairing the human body, and applying resourceful and cross-disciplinary approaches to age-old problems in the fields of medicine, biology, and beyond. A biomedical engineer can expect to work in a wide variety of multidisciplinary teams with professionals such as physicians, biologists, researchers, nurses, therapists, mathematicians, administrators, and many others while working in industry, as entrepreneurs, in the medical profession, and in academia.

To prepare students for such careers, the 128-credit, four-year BME undergraduate degree emphasizes engineering design; access to cooperatives/internships at local or national medical device manufacturers, hospitals, or laboratories; continuous advising; flexibility in engineering specialization areas; participation in program evaluation and improvement; study-abroad opportunities; and an option to complete a one-year MS degree following the undergraduate program.

The backbone of the BME program is its **unique, seven-semester design curriculum**. Students take an advising/design project course in their first year and every semester their fourth year (with options to work in industry and/or focus on pre-health requirements). A faculty member advises small teams of students, serving as advisor/consultant/mentor, to guide them through real-world design projects solicited from clients throughout the university, medical profession, industry, and the community. These clients serve as resources for students in their projects, conduct discussions, and expose the students to various aspects of the BME field. Over the course of each semester, teams design, fabricate, and ultimately present a product that meets the needs of the client. This novel approach gives students an exceptionally balanced education by incorporating clinical and biomedical industry experience, thus expanding their network. Overall, the design experiences highlight the very multidisciplinary nature of BME.

Within the program, BME students choose a course of study that emphasizes one of the following four specializations within the field:

1. **Bioinstrumentation and medical devices** is the application of electronics, measurement principles, and techniques to develop devices used in diagnosis and treatment of disease. Examples include the electrocardiogram, brain–computer interface, implantable electrodes, sensors, tumor ablation, and other medical devices. Neuroengineering, a subfield, involves using engineering technology to study the function of neural systems and the development of implantable technology for neuroprosthetic and rehabilitation applications.
2. **Biomedical imaging and optics** involves the design and enhancement of systems for noninvasive anatomical, cellular, and molecular imaging. In addition to common imaging techniques such as magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET), biomedical imaging includes topics such as biophotonics, optics, and multimode imaging, and is now expanding to serve functional and therapeutic purposes as well. Advanced capabilities result when fundamentals of engineering, physics, and computer science are applied in conjunction with the expertise of clinical collaborators.
3. **Biomechanics** applies engineering mechanics for understanding biological processes and for solving medical problems at systemic, organ, tissue, cellular, and molecular levels. This includes the mechanics of connective tissues (ligament tendon, cartilage, and bone) as well as orthopedic devices (fracture fixation hardware and joint prostheses), vascular remodeling, muscle mechanics with injury and healing, human motor control, neuromuscular adaptation (with age, injury, and disease), microfluidics for cellular applications, cellular motility and adhesion, and rehabilitation engineering.
4. **Biomaterials, cellular and tissue engineering** involves the characterization and use of structural materials, derived from synthetic or natural sources, to design medical products that safely interact with tissues for therapeutic or diagnostic purposes such as artificial blood vessels, heart valves, orthopedic joints, and drug delivery vehicles. Tissue engineers understand structure–function relationships in normal and pathological tissues to engineer living tissues and/or biological substitutes to restore, maintain, or improve function. At the cellular and molecular level this includes the study or manipulation of biological processes such as the cell's differentiation, proliferation, growth, migration, apoptosis, and can involve genetic and stem cell engineering.

Although the various disciplines within BME can be separately defined, solving a biomedical program requires an overall understanding of the field. For example, the design of an artificial hip requires an understanding of the forces and **biomechanics** of human movement as well as the mechanical and material properties of the prosthetic device. The **material** choice and topography play a critical role in cellular and tissue integration, which ultimately leads to long-term stability of the implant. In addition, **biomedical imaging** techniques are required to characterize the morphology of the diseased hip and the success of the procedure. Finally, **instrumentation** devices are utilized during the hip replacement surgery.

Students choose the biomedical engineering field to be of service to people; for the excitement of working with living systems; and to apply advanced technology to the complex problems of medical care. Students in the BME program can expect to develop skills in innovative thinking, critical analysis of ethics, project management, and technical writing, all in an environment that cultivates creativity, teamwork, and curiosity. With many possible focuses within the major, BME students have the opportunity to explore and cultivate their interests in specific topics while applying the concepts of engineering to medical applications, hands-on projects, and cutting-edge research.

Students successfully completing the BS degree in BME with an overall GPA of 3.0 or a GPA of 3.25 for the last 60 credits of the BS program are eligible to apply for the one-year MS degree.

HOW TO GET IN

HOW TO GET IN

ADMISSION TO THE COLLEGE AS A FIRST-YEAR STUDENT

Students applying to UW–Madison (https://www.admissions.wisc.edu/apply/) need to indicate an engineering major (https://engineering.wisc.edu/degrees-programs/undergraduate/) as their first choice in order to be considered for direct admission to the College of Engineering. Being directly admitted to a major means students will start

in the program of their choice in the College of Engineering and will need to meet progression requirements (https://engineering.wisc.edu/student-services/undergraduate-student-advising/progression/) at the end of the first year to guarantee advancement in that program.

CROSS-CAMPUS TRANSFER TO ENGINEERING

UW–Madison students in other schools and colleges on campus must meet minimum admission requirements (https://engineering.wisc.edu/admissions/undergraduate/cross-campus-students/) for admission consideration to engineering degree programs. Cross-campus admission is competitive and selective, and the grade point average expectations may increase as demand trends change. The student's overall academic record at UW–Madison is also considered. Students apply to their intended engineering program by submitting the online application by stated deadlines for spring and fall. The College of Engineering offers an online information tutorial and drop-in advising (https://engineering.wisc.edu/admissions/undergraduate/cross-campus-students/) for students to learn about the cross-campus transfer process.

OFF-CAMPUS TRANSFER TO ENGINEERING

With careful planning, students at other accredited institutions can transfer coursework that will apply toward engineering degree requirements at UW–Madison. Off-campus transfer applicants are considered for direct admission to the College of Engineering by applying to the Office of Admissions with an engineering major listed as their first choice. Those who are admitted to their intended engineering program must meet progression requirements (https://engineering.wisc.edu/admissions/undergraduate/transfer-from-off-campus/) at the point of transfer or within their first two semesters at UW–Madison to guarantee advancement in that program. A minimum of 30 credits in residence in the College of Engineering is required after transferring, and all students must meet all requirements for their major in the college. Transfer admission to the College of Engineering is competitive and selective, and students who have exceeded the 80 credit limit at the time of application are not eligible to apply.

The College of Engineering has dual degree programs with select four-year UW System campuses. Eligible dual degree applicants are not subject to the 80 credit limit.

Off-campus transfer students are encouraged to discuss their interests, academic background, and admission options with the Transfer & Academic Program Manager in the College of Engineering: ugtransfer@engr.wisc.edu or 608-262-2473.

SECOND BACHELOR'S DEGREE

The College of Engineering does not accept second undergraduate degree applications. Second degree student (https://engineering.wisc.edu/admissions/undergraduate/adult-students-second-degree-students/)s (https://engineering.wisc.edu/student-services/undergraduate-student-advising/) might explore the Biological Systems Engineering program at UW–Madison, an undergraduate engineering degree elsewhere, or a graduate program in the College of Engineering.

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*.

General Education
- 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 *

* 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
Mathematics		*19*
Science		*32*
General Education		*21*
Engineering Courses:		
Introduction to Engineering		3
Engineering Mechanics Core Courses		6
Biomedical Engineering Core Courses		23
Biomedical Engineering Area Technical Elective Requirements AND		
Advanced Biomedical Technical Elective		18
Engineering Technical Elective		2
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	Linear Algebra and Differential Equations	3

or MATH 319	Techniques in Ordinary Differential Equations	
B M E 325	Applied Statistics for Biomedical Engineers	3
or STAT 324	Introductory Applied Statistics for Engineers	
or STAT/ MATH 431	Introduction to the Theory of Probability	
Total Credits		**19**

SCIENCE

Code	Title	Credits
COMP SCI 220	Data Science Programming I	3-4
or COMP SCI 200	Programming I	
or COMP SCI 300	Programming II	
PHYSICS 202	General Physics	5
or PHYSICS 208	General Physics	
General Chemistry - select one option:		5-9
CHEM 109	Advanced General Chemistry	
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	
CHEM 343	Organic Chemistry I	3
Biology - select one option:		5-6
ZOOLOGY/ BIOLOGY 101 & ZOOLOGY/ BIOLOGY 102	Animal Biology and Animal Biology Laboratory	
ZOOLOGY/ BIOLOGY/ BOTANY 151	Introductory Biology	
BIOCORE 381 & BIOCORE 383	Evolution, Ecology, and Genetics and Cellular Biology	
Human Physiology/Systems Biology - select one option:		5
ANAT&PHY 335	Physiology	
BIOCORE 485 & BIOCORE 486	Principles of Physiology and Principles of Physiology Laboratory	
Advanced Biology/Life Science elective - select one option:		3
ANAT&PHY 337	Human Anatomy	
BIOCORE 587	Biological Interactions	
BIOCHEM 501	Introduction to Biochemistry	
BIOCHEM 507	General Biochemistry I	
BIOCHEM 508	General Biochemistry II	
BIOCHEM/ M M & I 575	Biology of Viruses	
GENETICS 466	Principles of Genetics	
ZOOLOGY 470	Introduction to Animal Development	
ZOOLOGY/ PSYCH 523	Neurobiology	
ZOOLOGY 570	Cell Biology	
Science Elective - select one option:		3
ANAT&PHY 337	Human Anatomy	
BIOCHEM 501	Introduction to Biochemistry	
BIOCHEM 507	General Biochemistry I	
BIOCHEM 508	General Biochemistry II	
BIOCHEM/ M M & I 575	Biology of Viruses	
CHEM 327	Fundamentals of Analytical Science	
CHEM 329	Fundamentals of Analytical Science	
CHEM 345	Organic Chemistry II	
CRB 640	Fundamentals of Stem Cell and Regenerative Biology	
CRB 650	Molecular and Cellular Organogenesis	
CRB/B M E 670	Biology of Heart Disease and Regeneration	
COMP SCI 300	Programming II	
COMP SCI 320	Data Science Programming II	
COMP SCI 400	Programming III	
GENETICS 466	Principles of Genetics	
GENETICS 467	General Genetics 1	
GENETICS 468	General Genetics 2	
GENETICS 520	Neurogenetics	
KINES 531	Neural Control of Movement	
MICROBIO 101	General Microbiology	
MICROBIO 303	Biology of Microorganisms	
MICROBIO 330		
M M & I 341	Immunology	
M M & I/PATH-BIO 528	Immunology	
ZOOLOGY 470	Introduction to Animal Development	
ZOOLOGY/ PSYCH 523	Neurobiology	
ZOOLOGY 570	Cell Biology	
Total Credits		**32-38**

GENERAL EDUCATION

Code	Title	Credits
Communications A		*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	
Communications B (choose one):		*3*
B M E 301	Biomedical Engineering Design and Communication (if taken Fall 2023 or later)	
ZOOLOGY/ BIOLOGY/ BOTANY 152	Introductory Biology	
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
Introduction to Engineering		*3*
INTEREGR 170	Design Practicum [1]	
Required Engineering Mechanics core courses		*6*
E M A 201	Statics [2]	
or PHYSICS 201	General Physics	
or PHYSICS 207	General Physics	
E M A 303	Mechanics of Materials	
Required B M E core courses		*23*
B M E 200	Biomedical Engineering Design	
B M E 201	Biomedical Engineering Design and Fundamentals	
B M E 300	Biomedical Engineering Design and Leadership	
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 Capstone Design II	
B M E/ PHM SCI 430	Biological Interactions with Materials	
Biomedical Engineering Area Technical Electives (see below) AND		
One Advanced B M E Technical Elective from any area (see complete list below)		*18*
Engineering Technical Elective: Any engineering course(s) from a degree-granting engineering program [3]		*2*
Total Credits		**52**

[1] Students transferring from other engineering majors may count their previous program's introduction to engineering course(s) here (CBE 150 Introduction to Chemical Engineering, E C E 210 Introductory Experience in Electrical Engineering, E C E/COMP SCI 252 Introduction to Computer Engineering, G L E 171 Introduction to Geological Engineering, INTEREGR 170 Design Practicum, I SY E 191 The Practice of Industrial Engineering, M E 201 Introduction to Mechanical Engineering, M S & E 260 Materials Experience, and NAV SCI 301 Naval Engineering).

[2] It is highly recommended that students take E M A 201 Statics instead of PHYSICS 201 General Physics. E M A 201 Statics is a requisite for E M A 303 Mechanics of Materials and thus taking PHYSICS 201/PHYSICS 207 General Physics alone is not recommended.

[3] The number of credits in this area can range from 2 or more such that at least 2 credits are met here and 48 engineering credits are met overall. 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 that may add additional credits include (and are not limited to): Taking PHYSICS 201 General Physics instead of E M A 201 Statics may add 3 credits. Transfer students are not required to take INTEREGR 170 Design Practicum, which may add 3 credits. Students who study abroad may miss a design course which may add credit. Regardless of the choices made, all students must have at minimum 48 credits of engineering courses from degree-granting programs.

- InterEGR courses are not included in this category except INTEREGR 170 Design Practicum.
- 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.) toward the 48 engineering credit count.
- Special topics courses must have prior approval of the B M E Curriculum Committee.

BIOMEDICAL ENGINEERING AREA TECHNICAL ELECTIVE REQUIREMENTS

- Choose area technical electives from one of the following areas below and at least one advanced B M E elective from any area as shown in the complete list below for a total of 18 credits.
- Introduction to engineering courses (CBE 150, E C E 210, E C E/ COMP SCI 252, G L E 171, INTEREGR 170, I SY E 191, M E 201, M S & E 260, and NAV SCI 301), seminar courses, and research credits cannot count in these areas. Special topics courses must have prior approval of the BME Curriculum Committee.

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 B M E 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
B M E 603	Special Topics in Bioinstrumentation and Medical Devices	1-3
B M E 640	Medical Devices Ecosystem: The Path to Product	3

Biomedical Imaging and Optics:

Code	Title	Credits
Required Area Elective		
E C E 330	Signals and Systems	3
Area Electives in Biomedical Imaging and Optics		**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 204	Data Science & Engineering	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	Mathematical Methods in Medical Physics	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 B M E Area Technical Electives in Biomedical Imaging and Optics		
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 604	Special Topics in Biomedical Imaging and Optics	1-3
B M E/MED PHYS/ PHMCOL-M/PHYSICS/ RADIOL 619	Microscopy of Life	3
B M E 651	Biophotonics Laboratory	3

Biomechanics:

Code	Title	Credits
Required Area Elective		
E M A 202	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	Introduction to Materials Science	3
or M S & E 351	Materials Science-Structure and Property Relations in Solids	
M S & E/CHEM 421	Polymeric Materials	3
CBE 320	Introductory Transport Phenomena	4
or B M E 330	Engineering Principles of Molecules, Cells, and Tissues	
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/M E 516	Finite Elements for Biological and Other Soft Materials	3
B M E/ MED PHYS 535	Introduction to Energy-Tissue Interactions	3
B M E/I SY E 564	Occupational Ergonomics and Biomechanics	3
B M E/M E 605	Special Topics in Biomechanics	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	Engineering Principles of Molecules, Cells, and Tissues	4
or CBE 320	Introductory Transport Phenomena	
Area Electives in Biomaterials, Cellular and Tissue Engineering		**11**
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
B M E 511	Tissue Engineering Laboratory	1
Advanced B M E Area Technical Electives in Biomaterials, Cellular and Tissue Engineering		
B M E/M E 505	Biofluidics	3
B M E 510	Introduction to Tissue Engineering	3
B M E/M E 516	Finite Elements for Biological and Other Soft Materials	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 606	Special Topics in Biomaterials, Cellular and Tissue Engineering	1-3
B M E/M E 615	Tissue Mechanics	3
B M E/MED PHYS/ PHMCOL-M/PHYSICS/ RADIOL 619	Microscopy of Life	3

One Advanced B M E Technical Elective from any area (complete list) - 1 course:

Code	Title	Credits
Required 1 course		**3**
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/E C E 462	Medical Instrumentation	3
B M E/E C E 463	Computers in Medicine	3
B M E/M E 505	Biofluidics	3
B M E 510	Introduction to Tissue Engineering	3
B M E/M E 516	Finite Elements for Biological and Other Soft Materials	3

B M E 520	Stem Cell Bioengineering	3
B M E/ MED PHYS 535	Introduction to Energy-Tissue Interactions	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/I SY E 564	Occupational Ergonomics and Biomechanics	3
B M E/ MED PHYS 578	Non-Ionizing Diagnostic Imaging	4
B M E 603	Special Topics in Bioinstrumentation and Medical Devices	1-3
B M E 604	Special Topics in Biomedical Imaging and Optics	1-3
B M E/M E 605	Special Topics in Biomechanics	1-3
B M E 606	Special Topics in Biomaterials, Cellular and Tissue Engineering	1-3
B M E/M E 615	Tissue Mechanics	3
B M E/MED PHYS/ PHMCOL-M/PHYSICS/ RADIOL 619	Microscopy of Life	3
B M E 640	Medical Devices Ecosystem: The Path to Product	3
B M E 651	Biophotonics Laboratory	3
B M E/I SY E 662	Design and Human Disability and Aging	3

HONORS IN UNDERGRADUATE RESEARCH PROGRAM

Qualified undergraduates may earn an Honors in Research designation on their transcript and diploma by completing 8 credits of undergraduate honors research, including a senior thesis. For more information about the program and the application form, visit: https://go.wisc.edu/bme-honors-application (https://go.wisc.edu/bme-honors-application/)

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.

LEARNING OUTCOMES

LEARNING OUTCOMES

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

FOUR-YEAR PLAN

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

First Year

Fall	Credits	Spring	Credits
INTEREGR 170[3]	3	INTEREGR 170[3]	3
or Liberal Studies Elective[Med]		or Liberal Studies Elective[Med]	
MATH 221	5	MATH 222	4
Communications A	3	E M A 201, PHYSICS 201, or PHYSICS 207[2]	3
CHEM 109 (or CHEM 103 and CHEM 104)[1]	5	CHEM 343	3
		COMP SCI 200, 220, or 300[4]	3
	16		**16**

Second Year

Fall	Credits	Spring	Credits
B M E 200[5]	2	B M E 201	3
MATH 234	4	MATH 320 or 319	3
PHYSICS 202 or 208	5	E M A 303	3
Science Elective[6, Med]	3	Liberal Studies Elective	3

B M E 325, STAT 324, or STAT 431[4]	3	Free-General Elective Credits[6, Med]	2
		B M E 310[7]	3
	17		**17**

Third Year

Fall	Credits	Spring	Credits
B M E 300[5]	3	Select one of the following options:[9, Med]	5
Select one of the following options:	5	B M E 301 (3 cr) & Free-General Elective (2 cr)	
ZOOLOGY/ BIOLOGY 101 & ZOOLOGY/ BIOLOGY 102		ZOOLOGY/ BIOLOGY/ BOTANY 152	
ZOOLOGY/ BIOLOGY/ BOTANY 151[Med]		BIOCORE 383 & BIOCORE 384	
BIOCORE 381 & BIOCORE 382 (the first lab - 382 - is recommended not required)[8, Med]		Liberal Studies Elective	3
Liberal Studies Elective	3	Free-Engineering Technical Elective	2
B M E 315[7]	3	B M E/PHM SCI 430[7]	3
Area-Required Engineering Technical Elective	3	Area-Engineering Technical Elective	3
	17		**16**

Fourth Year

Fall	Credits	Spring	Credits
B M E 400	3	B M E 402[5]	3
Select one of the following options:	5	Advanced Biology/Life Science Elective	3
ANAT&PHY 335		Liberal Studies Elective[Med]	3
BIOCORE 485 & BIOCORE 486		Advanced Biomedical Engineering Technical Elective	3
Area-Engineering Technical Elective	3	Area-Engineering Technical Elective	3
Area-Engineering Technical Elective	3		
	14		**15**

Total Credits 128

FOOTNOTES

Med These courses are identified as requirements for most medical schools and are included within the 128 degree credits. Students not wishing to attend medical school may choose any of the listed options. Choosing other options will affect the total number of credits.
Medical schools have varying requirements. Liberal electives, free-general electives, and zoology electives can often be used to satisfy these. **Check requirements early.** For example, to prepare for the MCAT it is recommended that students take psychology and sociology. In addition, some schools require an intermediate humanities or social science with an intensive writing component (Comm B) or credits in the English department. All these can be fulfilled within the liberal studies requirements and thus early planning starting freshman year is important. A good resource is: http://prehealth.wisc.edu/.

1 CHEM 103 General Chemistry I & CHEM 104 General Chemistry II may be substituted for CHEM 109 Advanced General Chemistry. For this choice, the excess 4 credits are counted as free-general electives. Most medical schools require one year of basic chemistry. UW–Madison's medical school (and others) accepts CHEM 109 as a full-year equivalent.

2 It is highly recommended that students take E M A 201 Statics instead of PHYSICS 201 General Physics. E M A 201 Statics is a requisite for E M A 303 and thus taking PHYSICS 201/PHYSICS 207 General Physics alone is not recommended.

3 INTEREGR 170 Design Practicum is required only for students directly admitted to B M E as freshmen and counts toward the 48 engineering credits.

4 It is recommended that students take statistics and/or computer science in the freshman year for those needing additional core course options. B M E 325 Applied Statistics for Biomedical Engineers is open to first year students. MATH/STAT 431 Introduction to the Theory of Probability is only recommended for students interested in a math certificate or second major.

5 Students who are admitted late to the program and/or students who take part in another experience (such as co-op and/or study abroad), missing B M E 200 Biomedical Engineering Design or B M E 300 Biomedical Engineering Design and Leadership, or students who may graduate early missing B M E 402 Biomedical Engineering Capstone Design II on a rare approved exception, may substitute for up to two of these courses for the semester they are not in the program or at UW-Madison.
Approved substitutions include: B M E 1 Cooperative Education Program, engineering research credit, or any course numbered 200 or above additional engineering technical elective lab or design experience.
For more information on the unique design sequence see: http://bmedesign.engr.wisc.edu/about/.

6 Premeds or students interested in biomaterials, cellular and tissue engineering should choose to take CHEM 345 and it is recommended to use Free-General Electives for CHEM 344.

7 The three core courses are all required: B M E 310 Bioinstrumentation, B M E 315 Biomechanics, B M E/PHM SCI 430 Biological Interactions with Materials, but they can be taken in any order. It is recommended that students take the one in their track of interest first, or as early as possible.

8 Students very serious about medical school or a career in research and learning about biology may select to apply for BIOCORE, a rigorous biology honors program:

- BIOCORE 381 Evolution, Ecology, and Genetics
- BIOCORE 382 Evolution, Ecology, and Genetics Laboratory
- BIOCORE 383 Cellular Biology
- BIOCORE 384 Cellular Biology Laboratory
- BIOCORE 485 Principles of Physiology
- BIOCORE 486 Principles of Physiology Laboratory

The BIOCORE courses have limited enrollment and students must be accepted into this program (applying as freshman). It is generally advisable to complete the entire sequence once it is started. Only BIOCORE 382 Evolution, Ecology, and Genetics Laboratory is not required and is not necessary to fulfill premed requirements; however, it is recommended as it has been helpful in understanding

the BICORE lab process. If all the other BIOCORE courses are taken (a total of 16 cr), this will replace the ZOOLOGY/BIOLOGY 101 Animal Biology and ZOOLOGY/BIOLOGY 102 Animal Biology Laboratory, the Advanced Life Science Elective, ANAT&PHY 335 Physiology, and fulfill the Communication B requirement.

9 Students interested in pre-health programs should take ZOOLOGY/BIOLOGY/BOTANY 152 Introductory Biology or BIOCORE 384 Cellular Biology Laboratory to satisfy Communication Part B instead of B M E 301 Biomedical Engineering Design and Communication.

ADVISING AND CAREERS

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Every College of Engineering undergraduate has an assigned academic advisor (https://engineering.wisc.edu/student-services/undergraduate-student-advising/). Academic advisors support and coach students through their transition to college and their academic program all the way through graduation.

Advisors help students navigate the highly structured engineering curricula and course sequencing, working with them to select courses each semester.

When facing a challenge or making a plan toward a goal, students can start with their academic advisor. There are many outstanding resources at UW–Madison, and academic advisors are trained to help students navigate these resources. Advisors not only inform students about the various resources, but they help reduce the barriers between students and campus resources to help students feel empowered to pursue their goals and communicate their needs.

Students can find their assigned advisor in their MyUW Student Center.

ENGINEERING CAREER SERVICES

Engineering Career Services (https://ecs.wisc.edu) (ECS) assists students in finding work-based learning experiences such as co-ops and summer internships, exploring and applying to graduate or professional school, and finding full-time professional employment.

ECS offers two large career fairs per year, assists students with resume building and developing interviewing skills, hosts skill-building workshops, and meets one-on-one with students to discuss offer negotiations.

Students are encouraged to engage with the ECS office early in their academic careers. For more information on ECS programs and workshops, visit: https://ecs.wisc.edu.

PEOPLE

PEOPLE

FACULTY

Paul Campagnola (Chair)
Randolph Ashton
Randy Bartels
David Beebe
Walter Block
Christopher Brace
Joshua Brockman
Kevin Eliceiri
Shaoqin 'Sarah' Gong
Aviad Hai
Pamela Kreeger
Wan-ju Li
Kip Ludwig
Megan McClean
Beth Meyerand
William Murphy
Krishanu Saha
Melissa Skala
Darryl Thelen
Pallavi Tiwari
Justin Williams
Colleen Witzenburg
Filiz Yesilkoy

INSTRUCTIONAL STAFF AND TEACHING FACULTY

Amit Nimunkar
John Puccinelli
Tracy Jane Puccinelli
Darilis Suarez-Gonzalez
Christa Wille

See also Biomedical Engineering Faculty Directory (http://directory.engr.wisc.edu/bme/).

ACCREDITATION

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Accredited by the Engineering Accreditation Commission ofABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Bioengineering and Biomedical and Similarly Named Engineering Programs.

PROGRAM#EDUCATIONAL OBJECTIVES#FOR THE BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING

We recognize that our graduates will choose to use the knowledge and skills that they have acquired during their undergraduate years to pursue a wide variety of career and life goals, and we encourage this diversity of paths. Whatever path graduates choose, be it a job, postgraduate education, or volunteer service, be it in engineering or another field, we have for our graduates the following objectives, that they will:

1. exhibit strong skills in problem solving, leadership, teamwork and communication;
2. use these skills to contribute to their communities;
3. make thoughtful, well-informed career choices;
4. demonstrate a continuing commitment to and interest in their own and others' education

Note: Undergraduate Student Outcomes, number of degrees conferred, and enrollment data are made publicly available at the Biomedical Engineering#Undergraduate Program website. (In this Guide, the program's Student Outcomes are available through the "Learning Outcomes" tab.)