

BIOMEDICAL ENGINEERING - BS

Department Head: M. McShane

Director of Undergraduate Programs: M. McDougall

Committed to solving the world's greatest health problems through the exploration of new ideas, integrated research and innovation, the Department of Biomedical Engineering at Texas A&M University is producing the next generation of biomedical engineers in industry and at tier-one research institutions, developing new technologies and new jobs, and achieving revolutionary advancements for the future of health care.

The undergraduate curriculum in biomedical engineering involves the development and application of engineering science and technology for living and medical systems. Based around a basic core of courses, the bachelor's degree is designed to prepare students for team involvement with other engineers and with physicians and life scientists to solve a wide array of biological and medical problems. Elective courses are included to accommodate individual student specialty interests within the fields of biomechanics, biomaterials, bioinstrumentation, and biomolecular and cellular engineering. Students interested in specialized professional school programs such as medical school can meet admission prerequisites through slight modifications and additions to the curriculum.

The department offers a Bachelor of Science degree and a minor. For more information, including degree requirements and application deadlines, visit <http://engineering.tamu.edu/biomedical> (<http://engineering.tamu.edu/biomedical/>).

Program Requirements

The freshman year is identical for degrees in aerospace engineering, architectural engineering, civil engineering, computer engineering, computer science, electrical engineering, electronic systems engineering technology, environmental engineering, industrial distribution, industrial engineering, interdisciplinary engineering, manufacturing and mechanical engineering technology, mechanical engineering, multidisciplinary engineering technology, nuclear engineering, ocean engineering, and petroleum engineering (Note: not all programs listed are offered in Qatar). The freshman year is slightly different for chemical engineering, biomedical engineering and materials science and engineering degrees in that students take CHEM 119 or CHEM 107/CHEM 117 and CHEM 120.

Students pursuing degrees in biological and agricultural engineering should refer to the specific curriculum for this major. It is recognized that many students will change the sequence and number of courses taken in any semester. Deviations from the prescribed course sequence, however, should be made with care to ensure that prerequisites for all courses are met.

First Year

Fall		Semester Credit Hours
CHEM 107	General Chemistry for Engineering Students ^{1,4}	3
CHEM 117	General Chemistry for Engineering Students Laboratory ^{1,4}	1

ENGL 103 or ENGL 104	Introduction to Rhetoric and Composition ¹ or Composition and Rhetoric	3
ENGR 102	Engineering Lab I - Computation ¹	2
MATH 151	Engineering Mathematics I ^{1,2}	4
University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/) ³		3
Semester Credit Hours		16
Spring		
ENGR 216/ PHYS 216	Experimental Physics and Engineering Lab II - Mechanics ¹	2
MATH 152	Engineering Mathematics II ¹	4
PHYS 206	Newtonian Mechanics for Engineering and Science ¹	3
University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/) ³		3
Select one of the following:		3-4
CHEM 120	Fundamentals of Chemistry II ⁴	
University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/) ^{3,5}		
Semester Credit Hours		15-16
Total Semester Credit Hours		31-32

¹ A grade of C or better is required.

² Entering students will be given a math placement exam. Test results will be used in selecting the appropriate starting course which may be at a higher or lower level.

³ Of the 21 hours shown as University Core Curriculum electives, 3 must be from creative arts, 3 from social and behavioral sciences (see IDIS curriculum for more information), 3 from language, philosophy and culture (see CVEN, EVEN and PETE curriculum for more information), 6 from American history and 6 from government/political science. The required 3 hours of international and cultural diversity and 3 hours of cultural discourse may be met by courses satisfying the creative arts, social and behavioral sciences, language, philosophy and culture, and American history requirements if they are also on the approved list of international and cultural diversity (<http://catalog.tamu.edu/undergraduate/general-information/degree-information/international-cultural-diversity-requirements/>) courses and cultural discourse (<http://catalog.tamu.edu/undergraduate/general-information/degree-information/cultural-discourse-requirements/>) courses.

⁴ BMEN, CHEN and MSEN require 8 hours of freshman chemistry, which may be satisfied by CHEM 119 or CHEM 107/CHEM 117 and CHEM 120; Credit by Examination (CBE) for CHEM 119 plus CHEM 120; or 8 hours of CBE for CHEM 119 and CHEM 120. BMEN, CHEN and MSEN should take CHEM 120 second semester freshman year. CHEM 120 will substitute for CHEM 107/CHEM 117.

⁵ For BS-PETE, allocate 3 hours to core communications course (ENGL 210, COMM 203, COMM 205, or COMM 243) and/or 3 hours to UCC elective. For BS-MEEN, allocate 3 hours to core communications course (ENGL 203, ENGL 210, or COMM 205) and/or 3 hours to UCC elective.

Second Year

		Semester Credit Hours
Fall		
BMEN 101	Introduction to Biomedical Engineering ^{1,6}	1
BMEN 207	Computing for Biomedical Engineering ¹	3
ENGR 217/ PHYS 217	Experimental Physics and Engineering Lab III - Electricity and Magnetism	2
MATH 251 or MATH 253	Engineering Mathematics III or Engineering Mathematics III	3
PHYS 207	Electricity and Magnetism for Engineering and Science	3
VTPP 434	Physiology for Bioengineers I	4
Semester Credit Hours		16
Spring		
BMEN 211	Biomedical Applications of Signals and Systems ¹	3
BMEN 253	Medical Device Design I ¹	1
CHEM 227	Organic Chemistry I	3
MATH 308	Differential Equations	3
VTPP 435	Physiology for Bioengineers II	4
Select one of the following:		3
COMM 203	Public Speaking	
COMM 205	Communication for Technical Professions	
ENGL 203	Writing about Literature	
ENGL 210	Technical and Business Writing	
Semester Credit Hours		17

Third Year

		Semester Credit Hours
Fall		
BMEN 305	Bioinstrumentation ¹	1
BMEN 321	Biomedical Electronics ¹	3
BMEN 341	Biofluid Mechanics ¹	3
BMEN 343	Introduction to Biomaterials ¹	3
BMEN 350	Statistics for Biomedical Engineering ¹	3
University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/) ^{1,3}		3
High Impact Experience ⁷		0
BMEN 399	Engineering Professional Development	
Semester Credit Hours		16
Spring		
BMEN 344	Biological Responses to Medical Devices ¹	3
BMEN 345	Biomaterials Lab ¹	1
BMEN 353	Medical Device Design II ¹	1
BMEN 361	Biosolid Mechanics ¹	3
BMEN 420	Medical Imaging ¹	3
University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/) ³		6
Semester Credit Hours		17

Fourth Year

		Semester Credit Hours
Fall		
BMEN 452	Mass and Energy Transfer in Biosystems ¹	3
BMEN 453	Analysis and Design Project I ¹	2

BMEN 465	Biomechanics Experiential Learning Lab ¹	1
University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/) ³		3
Technical electives ⁸		6
Semester Credit Hours		15
Spring		
BMEN 450	Case Studies ^{1,6}	1
BMEN 454	Analysis and Design Project II ¹	2
University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/) ³		3
Technical electives ⁸		9
Semester Credit Hours		15
Total Semester Credit Hours		96

⁶ Writing intensive course.

⁷ All students are required to complete a high-impact experience in order to graduate. A list of possible high-impact experiences is available in the BMEN advising office.

⁸ Technical electives are to be selected from the course list below. Students must select a one of the following tracks and take 15 hours from within that track: Bioinstrumentation, Biomaterials, Biomechanics, or Biomolecular & Cellular Engineering. Course selection should be done in consultation with student's advisor and track coordinator.

Total Program Hours 128

Code	Title	Semester Credit Hours
Bioinstrumentation		
Required courses		9
BMEN 322	Biosignal Analysis	
BMEN 401	Principles and Analysis of Biological Control Systems	
BMEN 428/	Embedded Systems for Medical	
CSC 461	Applications	
Select from the following:		3-6
BMEN 291	Research	
or BMEN 491	Research	
BMEN 402	Biomedical Optics Laboratory	
BMEN 422	Bioelectromagnetism	
BMEN 425	Biophotonics	
BMEN 427	Magnetic Resonance Engineering	
or ECEN 462	Magnetic Resonance Engineering	
BMEN 448	Healthcare Technology in the Developing World	
ECEN 411	Introduction to Magnetic Resonance Imaging and Magnetic Resonance Spectroscopy	
ECEN 412	Ultrasound Imaging	
ECEN 414	Biosensors	
ECEN 447	Digital Image Processing	
Biomaterials		

Select from the following: 6-15

BMEN 480 Biomedical Engineering of Tissues

BMEN 482 Polymeric Biomaterials

BMEN 483 Polymeric Biomaterial Synthesis

BMEN 486 Biomedical Nanotechnology

BMEN 487 Drug Delivery

Select from the following: 0-9

BMEN 291 Research

or BMEN 401 Research

CHEM 466 Polymer Chemistry

CHEN 451 Introduction to Polymer Engineering

MEEN 458 Processing and Characterization of Polymers

MSEN 410 Materials Processing

MSEN 420 Polymer Science

Biomechanics

Select from the following: 12-15

BMEN 291 Research

or BMEN 401 Research

BMEN 432 Molecular and Cellular Biomechanics

BMEN 457 Orthopedic Biomechanics

BMEN 458 Motion Biomechanics

BMEN 461 Cardiac Mechanics

BMEN 463 Soft Tissue Mechanics and Finite Element Methods

BMEN 468 Advanced Biomechanics

BMEN 471 Numerical Methods in Biomedical Engineering

MEEN 363 Dynamics and Vibrations

MEEN 368 Solid Mechanics in Mechanical Design

MEEN 440 Bio-inspired Engineering Design

MEEN 441 Design of Mechanical Components and Systems

MEEN 442 Computer Aided Engineering

MEEN 444 Finite Element Analysis in Mechanical Engineering

Biomolecular and Cellular Engineering

Required courses 6

BMEN 431 Biomolecular Engineering

BMEN 433 Biomolecular and Cellular Engineering Laboratory

Select from the following: 6-9

BMEN 291 Research

or BMEN 401 Research

BMEN 471 Numerical Methods in Biomedical Engineering

or BIOL 350r Computational Genomics

BMEN 432 Molecular and Cellular Biomechanics

Select up to one course from the following:

BMEN 480 Biomedical Engineering of Tissues

BMEN 486 Biomedical Nanotechnology

BMEN 487 Drug Delivery

Select from the following to apply to any of the tracks above: 0-3

ACCT 640 Accounting Concepts and Procedures I

BMEN 400/ History of Human and Veterinary

VTPP 401 Medicine in Europe

BMEN 404 FDA Good Laboratory and Clinical Practices

BMEN 469 Entrepreneurial Pathways in Medical Devices

CHEM 228 Organic Chemistry II

VTPB 410 Cell Mechanisms of Disease

400-Level BMEN with department approval
(<http://catalog.tamu.edu/undergraduate/course-descriptions/bmen/>)