# BIOMEDICAL ENGINEERING - BS

## 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 107</td>
<td>General Chemistry for Engineering Students</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 117</td>
<td>General Chemistry for Engineering Students Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 103</td>
<td>Introduction to Rhetoric and Composition</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 102</td>
<td>Engineering Lab I - Computation</td>
<td>2</td>
</tr>
<tr>
<td>MATH 151</td>
<td>Engineering Mathematics I</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Spring

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 216/</td>
<td>Experimental Physics and Engineering Lab II - Mechanics</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 216</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 152</td>
<td>Engineering Mathematics II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 206</td>
<td>Newtonian Mechanics for Engineering and Science</td>
<td>3</td>
</tr>
</tbody>
</table>

### Total Semester Credit Hours

| Semester Credit Hours | 15-16 | 15-16 |

### Second Year

#### Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEN 101</td>
<td>Introduction to Biomedical Engineering</td>
<td>1</td>
</tr>
<tr>
<td>BMEN 207</td>
<td>Computing for Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 217/</td>
<td>Experimental Physics and Engineering Lab III - Electricity and Magnetism</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 217</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 251/</td>
<td>Engineering Mathematics III</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 207</td>
<td>Electricity and Magnetism for Engineering and Science</td>
<td>3</td>
</tr>
<tr>
<td>VTPP 434</td>
<td>Physiology for Bioengineers I</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Spring

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEN 211</td>
<td>Biomedical Applications of Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>BMEN 253</td>
<td>Medical Device Design I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 227</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 308</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>VTPP 435</td>
<td>Physiology for Bioengineers II</td>
<td>4</td>
</tr>
</tbody>
</table>

### Total Semester Credit Hours

| Semester Credit Hours | 16 | 16 |

### University Core Curriculum Electives

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 cultural, 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.
ENGL 210  Technical and Business Writing
Semester Credit Hours 17

Third Year
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
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 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

Bioinstrumentation
Required courses
9
BMEN 322  Biosignal Analysis
BMEN 401  Principles and Analysis of Biological Control Systems
BMEN 428/  Embedded Systems for Medical CSCE 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 468  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  Polymers and Biomaterials
BMEN 483  Polymers Biomaterial Synthesis
BMEN 486  Biomedical Nanotechnology
BMEN 487  Drug Delivery
Select from the following: 0-9
BMEN 291  Research
or BMEN 491  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 491  Research
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEN 432</td>
<td>Molecular and Cellular Biomechanics</td>
</tr>
<tr>
<td>BMEN 457</td>
<td>Orthopedic Biomechanics</td>
</tr>
<tr>
<td>BMEN 458</td>
<td>Motion Biomechanics</td>
</tr>
<tr>
<td>BMEN 461</td>
<td>Cardiac Mechanics</td>
</tr>
<tr>
<td>BMEN 463</td>
<td>Soft Tissue Mechanics and Finite Element Methods</td>
</tr>
<tr>
<td>BMEN 468</td>
<td>Advanced Biomechanics</td>
</tr>
<tr>
<td>BMEN 471</td>
<td>Numerical Methods in Biomedical Engineering</td>
</tr>
<tr>
<td>MEEN 363</td>
<td>Dynamics and Vibrations</td>
</tr>
<tr>
<td>MEEN 368</td>
<td>Solid Mechanics in Mechanical Design</td>
</tr>
<tr>
<td>MEEN 440</td>
<td>Bio-inspired Engineering Design</td>
</tr>
<tr>
<td>MEEN 441</td>
<td>Design of Mechanical Components and Systems</td>
</tr>
<tr>
<td>MEEN 442</td>
<td>Computer Aided Engineering</td>
</tr>
<tr>
<td>MEEN 444</td>
<td>Finite Element Analysis in Mechanical Engineering</td>
</tr>
</tbody>
</table>

**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 471 Numerical Methods in Biomedical Engineering
  - or BIOL 350 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/ VTPP 401 History of Human and Veterinary 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/](http://catalog.tamu.edu/undergraduate/course-descriptions/bmen/))