BIOMEDICAL ENGINEERING - BS

The curriculum in biomedical engineering involves the development and application of engineering science and technology for living and medical systems. Although there have been individuals working in biomedical engineering for centuries, today's modern educational programs are specifically designed to prepare engineers for this challenging field. The curriculum described is broadly based around a basic core of courses developed to prepare students for team involvement with other engineers and with physicians and life scientists in working 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 medical school can meet admission prerequisites through slight modifications and additions to the curriculum.

Program Requirements

The freshman year is identical for degrees in aerospace engineering, biomedical engineering, civil engineering, computer engineering, computer science, electrical engineering, electronic systems engineering technology, industrial distribution, industrial 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 in that students take CHEM 101/CHEM 111 or CHEM 107/CHEM 117 and CHEM 102/CHEM 112. Biomedical Engineering also requires a two semester sequence of chemistry courses consisting of CHEM 101/CHEM 111 or CHEM 107/CHEM 117 and CHEM 102/CHEM 112. 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

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>CHEM 107</td>
<td>General Chemistry for Engineering Students</td>
<td>3</td>
</tr>
<tr>
<td>Fall</td>
<td>CHEM 117</td>
<td>General Chemistry for Engineering Students Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Fall</td>
<td>ENGL 103 or ENGL 104</td>
<td>Introduction to Rhetoric and Composition</td>
<td>3</td>
</tr>
<tr>
<td>Fall</td>
<td>ENGR 102</td>
<td>Engineering Lab I - Computation</td>
<td>1</td>
</tr>
<tr>
<td>Fall</td>
<td>MATH 151</td>
<td>Engineering Mathematics I</td>
<td>2</td>
</tr>
<tr>
<td>Fall</td>
<td>University Core Curriculum (<a href="http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum">http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum</a>)</td>
<td></td>
<td>3</td>
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Second Year

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

Notes:
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 18 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), 6 from American history and 6 from government/political science. The required 6 hours from international and cultural diversity may be met by courses satisfying the creative arts, social and behavioral sciences and American history requirements if they are also on the approved list of international and cultural diversity courses.
4. BMEN, CHEN and MSEN require 8 hours of freshman chemistry, which may be satisfied by CHEM 101/CHEM 111 or CHEM 107/CHEM 117 and CHEM 102/CHEM 112; Credit by Examination (CBE) for CHEM 101/CHEM 111 or CHEM 107/CHEM 117 plus CHEM 102/CHEM 112; or 8 hours of CBE for CHEM 101/CHEM 111 or CHEM 107/CHEM 117 and CHEM 102/CHEM 112. BMEN, CHEN and MSEN should take CHEM 102/CHEM 112 second semester freshman year. CPSC students may take CHEM 101/CHEM 111 or CHEM 107. CHEM 102/CHEM 112 will substitute for CHEM 107.
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.
### Third Year

#### Fall
- BMEN 305  Bioinstrumentation  1
- BMEN 321  Biomedical Electronics  3
- BMEN 341  Biofluid Mechanics  3
- BMEN 343  Introduction to Biomaterials  3
- BMEN 350  Statistics for Biomedical Engineering  3
- University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum)  3

#### Technical electives  
- Select from the following:  
  0-9 credits
  - BMEN 291 Research
  - or BMEN 491 Research

#### Semester Credit Hours
- 17

### Fourth Year

#### Fall
- BMEN 452  Mass and Energy Transfer in Biosystems  3
- BMEN 453  Analysis and Design Project I  2
- BMEN 465  Biomechanics Experiential Learning Lab  1
- Technical electives  
  - Select from the following:  
  3-6 credits
  - BMEN 291 Research
  - or BMEN 491 Research

#### Semester Credit Hours
- 17

### Spring
- BMEN 450  Case Studies  
  - Select from the following:  
  8 credits
  - BMEN 291 Research
  - or BMEN 491 Research

#### Technical electives  
- Select from the following:  
  6 credits
- University Core Curriculum (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum)  3

#### Semester Credit Hours
- 15

#### Total Semester Credit Hours
- 96

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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.

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.

Writing intensive course.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CHEM 466</td>
<td>Polymer Chemistry</td>
</tr>
<tr>
<td>CHEM 451</td>
<td>Introduction to Polymer Engineering</td>
</tr>
<tr>
<td>MEEN 458</td>
<td>Processing and Characterization of Polymers</td>
</tr>
<tr>
<td>MSEN 410</td>
<td>Materials Processing</td>
</tr>
<tr>
<td>MSEN 420</td>
<td>Polymer Science</td>
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</tbody>
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### Biomechanics

Select from the following: 12-15

- BMEN 291 Research
- BMEN 481 Research
- BMEN 432 Molecular and Cellular Biomechanics
- BMEN 457 Orthopedic Biomechanics
- BMEN 458 Motion Biomechanics
- BMEN 461 Cardiac Mechanics
- 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
- BMEN 481 Research
- BMEN 471 Numerical Methods in Biomedical Engineering
- or BIOL 3 or 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

- BMEN 400/ History of Human and Veterinary Medicine in Europe
- VTPP 401 Medicine in Europe
- BMEN 404 FDA Good Laboratory and Clinical Practices
- BMEN 406 Medical Device Path to Market
- BMEN 469 Entrepreneurial Pathways in Medical Devices
- ENGR 181 Engineering Honors Seminar I

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