# BIOMEDICAL ENGINEERING, B.S.

## Degree Requirements (130-142 hours)

See College of Engineering and Computing (https://academicbulletins.sc.edu/undergraduate/engineering-computing/) for progression requirements and special academic opportunities.

### Program of Study

| Requirements | Credit Hours |
|---|---|
| 1. Carolina Core Requirements | 34-46 |
| 2. College Requirements | 0 |
| 3. Program Requirements | 48 |
| 4. Major Requirements | 48 |

## 1. Carolina Core Requirements (34-46 hours)

### CMW – Effective, Engaged, and Persuasive Communication: Written (6 hours)

- ENGL 101 *must be passed with a grade of C or higher*
- ENGL 102

### ARP – Analytical Reasoning and Problem Solving (8 hours)

*must be passed with a grade of C or higher*

- MATH 141
- MATH 142

### SCI – Scientific Literacy (8 hours)

*must be passed with a grade of C or higher*

- BIOL 101
- BIOL 101L
- CHEM 111
- CHEM 111L

### GFL – Global Citizenship and Multicultural Understanding: Foreign Language (0-6 hours)

Score two or better on foreign language placement test; or complete the 109 and 110 courses in FREN, GERM, LATN or SPAN; or complete the 121 course in another foreign language.

- CC-GFL courses (https://academicbulletins.sc.edu/undergraduate/carolina-core-courses/)

### GHS – Global Citizenship and Multicultural Understanding: Historical Thinking (3 hours)

- any CC-GHS course (https://academicbulletins.sc.edu/undergraduate/carolina-core-courses/)

### GSS – Global Citizenship and Multicultural Understanding: Social Sciences (3 hours)

- any CC-GSS course (https://academicbulletins.sc.edu/undergraduate/carolina-core-courses/)

### AIU – Aesthetic and Interpretive Understanding (3 hours)

- any CC-AIU course (https://academicbulletins.sc.edu/undergraduate/carolina-core-courses/)

### CMS – Effective, Engaged, and Persuasive Communication: Spoken Component [1] (0-3 hours)

- any overlay or stand-alone CC-CMS course (https://academicbulletins.sc.edu/undergraduate/carolina-core-courses/)

### INF – Information Literacy [1] (0-3 hours)

- any overlay or stand-alone CC-INF course (https://academicbulletins.sc.edu/undergraduate/carolina-core-courses/)

### VSR – Values, Ethics, and Social Responsibility [1] (0-3 hours)

- any overlay or stand-alone CC-VSR course (https://academicbulletins.sc.edu/undergraduate/carolina-core-courses/)

[1] **Carolina Core Stand Alone or Overlay Eligible Requirements** — Overlay-approved courses offer students the option of meeting two Carolina Core components in a single course. A maximum of two overlays is allowed. The total Carolina Core credit hours for this program must add up to a minimum of 34 hours.

## 2. College Requirements (0 hours)

*No college-required courses for this program.*

## 3. Program Requirements (48 hours)

### Supporting Courses (48 hours)

#### Foundational Courses (33 hours)

Complete all of the following:

| Course | Title | Credits |
|---|---|---|
| CHEM 112 | General Chemistry II (must be passed with a grade of C or higher) | 3 |
| CHEM 112L | General Chemistry II Lab (must be passed with a grade of C or higher) | 1 |
| CHEM 333 | Organic Chemistry I (must be passed with a grade of C or higher) | 3 |
| CHEM 334 | Organic Chemistry II (must be passed with a grade of C or higher) | 3 |
| CHEM 550 | Biochemistry | 3 |
| or BIOL 541 | Biochemistry | |
| MATH 241 | Vector Calculus (must be passed with a grade of C or higher) | 3 |
| MATH 242 | Elementary Differential Equations (must be passed with a grade of C or higher) | 3 |
| PHYS 211 | Essentials of Physics I (must be passed with a grade of C or higher) | 3 |
| PHYS 211L | Essentials of Physics I Lab (must be passed with a grade of C or higher) | 1 |

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|---|---|---|
| PHYS 212 | Essentials of Physics II | 3 |
| PHYS 212L | Essentials of Physics II Lab | 1 |
| STAT 509 | Statistics for Engineers | 3 |
| Select one of the following: | | 3 |
| ECHE 320 | Chemical Engineering Fluid Mechanics | |
| ENCP 360 | Fluid Mechanics | |
| EMCH 360 | Fluid Mechanics | |
| **Total Credit Hours** | | **33** |

## Biomedical Engineering Electives (6 hours)

Students must take 6 credit hours of Biomedical Engineering electives. Of these 6 credit hours, at most 3 credit hours may come from BMEN 499. A list of acceptable Biomedical Engineering electives is maintained in the Biomedical Engineering office and on its website. These include the following:

| Course | Title | Credits |
|---|---|---|
| BMEN 342 | Infectious Disease & Immunology for Biomedical Engineers | 3 |
| BMEN 346 | Medical Microbiology for Biomedical Engineers | 3 |
| BMEN 389 | Special Topics in Biomedical Engineering for Undergraduates | 1-3 |
| BMEN 392 | Fundamentals of Biochemical Engineering | 3 |
| BMEN 499 | Independent Research | 1-3 |
| BMEN 546 | Delivery of Bioactive Agents | 3 |
| BMEN 547 | Immunoengineering | 3 |
| BMEN 548 | Cardiovascular System: From Development to Disease | 3 |
| BMEN 565 | Advanced Biomechanics | 3 |
| BMEN 572 | Tissue Engineering | 3 |
| BMEN 589 | Special Topics in Biomedical Engineering | 1-3 |
| EMCH 580 | Mechanics of Solid Biomaterials | 3 |
| EXSC 335 | Biomechanics of Human Movement | 3 |
| **Total Credit Hours** | | **33-39** |

## Engineering Elective (3 hours)

Students must take 3 credit hours of engineering electives. The engineering elective within the Biomedical Engineering Program may be satisfied by any CSCE course at a 200 level and above, as well as any ECHE, ELCT, or EMCH course at a 300 level and above with the following exceptions: CSCE 205, ECHE 310, ECHE 311, ECHE 320 and EMCH 360.

Additionally, all courses approved as Biomedical Engineering Electives may be used as an Engineering Elective.

## Technical Electives (6 hours)

Students must take 6 credit hours of technical electives. A listing of acceptable technical electives is maintained in the Biomedical Engineering office and on its website. Technical Electives include all Biomedical Engineering Electives, all Engineering Electives and the following:

| Course | Title | Credits |
|---|---|---|
| BIOL 102 | Biological Principles II | 3 |
| BIOL 102L | Biological Principles II Laboratory | 1 |
| BIOL 250 | Microbiology | 3 |
| BIOL 250L | Microbiology Laboratory | 1 |
| BIOL 301 | Ecology and Evolution | 3 |
| BIOL 302L | Cell and Molecular Biology Laboratory | 1 |
| BIOL 303 | Fundamental Genetics | 3 |
| BIOL 415 | Comparative Vertebrate Anatomy | 4 |
| BIOL 460 | Advanced Human Physiology | 3 |
| BIOL 505 | Developmental Biology | 3 |
| BIOL 530 | Histology | 4 |
| BIOL 531/ ENHS 661/EPID 661 | Parasitology | 4 |
| BIOL 534 | Animal Behavior | 3 |
| BIOL 541L | Biochemistry Laboratory | 1 |
| or CHEM 550L | Biochemistry Laboratory | |
| BIOL 553 | Genomics | 3 |
| BIOL 610 | Hallmarks of Cancer | 3 |
| BIOL 612 | Virology - Classical and Emerging Concepts | 3 |
| BIOL 620 | Immunobiology | 3 |
| BIOL 635 | Neurophysiology | 4 |
| BIOL 653 | Bioinformatics | 3 |
| BIOL 655 | Biotechnology | 3 |
| BIOL 656 | Experimental Biotechnology | 4 |
| BIOL 662 | Signal Transduction and Pathogenesis | 3 |
| BIOL 665 | Human Molecular Genetics | 3 |
| BIOL 667 | Molecular and Genetic Mechanisms of Disease Pathogenesis | 3 |
| BIOL 690 | Ultramicroscopy | 3 |
| CHEM 321 | Quantitative Analysis | 3 |
| CHEM 321L | Quantitative Analysis Laboratory | 1 |
| CHEM 322 | Analytical Chemistry | 3 |
| CHEM 331L | Essentials of Organic Chemistry Laboratory I | 1 |
| or CHEM 333L | Comprehensive Organic Chemistry Laboratory I | |
| CHEM 332L | Essentials of Organic Chemistry Laboratory II | 1 |
| or CHEM 333L | Comprehensive Organic Chemistry Laboratory I | |
| CHEM 340 | Elementary Biophysical Chemistry | 3 |
| CHEM 541 | Physical Chemistry | 3 |
| CHEM 542 | Physical Chemistry | 3 |
| CHEM 545 | Physical Biochemistry | 3 |
| CHEM 550L | Biochemistry Laboratory | 1 |
| EXSC 330 | Exercise Physiology | 3 |
| EXSC 562 | Impairments of the Human Motor System | 3 |
| MATH 344 | Applied Linear Algebra | 3 |
| or MATH 526 | Numerical Linear Algebra | |
| MATH 374 | Discrete Structures | 3 |
| MATH 520 | Ordinary Differential Equations | 3 |
| MATH 524 | Nonlinear Optimization | 3 |
| MATH 544 | Linear Algebra | 3 |
| MATH 546 | Algebraic Structures I | 3 |
| MATH 547 | Algebraic Structures II | 3 |
| MATH 550 | Vector Analysis | 3 |
| MATH 552 | Applied Complex Variables | 3 |
| PHYS 514 | Optics, Theory, and Applications | 4 |
| PHYS 515 | Mathematical Physics I | 3 |
| PHYS 516 | Mathematical Physics II | 3 |
| PHYS 517 | Computational Physics | 3 |

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|---|---|---|
| PHYS 521 | Biophysics | 4 |
| STAT 516 | Statistical Methods II | 3 |
| STAT 518 | Nonparametric Statistical Methods | 3 |
| STAT 519 | Sampling | 3 |
| STAT/MGSC 520 | Forecasting and Time Series | 3 |
| STAT 523 | Financial Mathematics II | 3 |
| STAT/MGSC 525 | Statistical Quality Control | 3 |
| STAT 528 | Environmental Statistics | 3 |
| STAT 530 | Applied Multivariate Statistics and Data Mining | 3 |
| STAT/CSCE 582 | Bayesian Networks and Decision Graphs | 3 |
| EMCH 111 | Introduction to Computer-Aided Design | 3 |
| CSCE 145 | Algorithmic Design I | 4 |
| MGMT 371 | Principles of Management | 3 |

# 4. Major Requirements (48 hours)

## Major Courses (48 hours)

| Course | Title | Credits |
|---|---|---|
| BMEN 101 | Introduction to Biomedical Engineering | 1 |
| BMEN 212 | Fundamentals of Biomedical Systems (must be passed with a grade of C or higher) | 3 |
| BMEN 240 | Cellular and Molecular Biology with Engineering Applications (must be passed with a grade of C or higher) | 4 |
| BMEN 263 | Introduction to Biomechanics (must be passed with a grade of C or higher) | 3 |
| BMEN 271 | Introduction to Biomaterials | 3 |
| BMEN 290 | Thermodynamics of Biomolecular Systems (must be passed with a grade of C or higher) | 3 |
| BMEN 302 | Professional Development and Ethics in Biomedical Engineering | 2 |
| BMEN 321 | Biomonitoring and Electrophysiology | 3 |
| BMEN 345 | Human Anatomy and Physiology for Biomedical Engineers | 4 |
| BMEN 354 | Biotransport | 3 |
| BMEN 363 | Biomedical Instrumentation | 3 |
| BMEN 381 | Biomedical Engineering Laboratory I | 2 |
| BMEN 382 | Biomedical Engineering Laboratory II | 2 |
| BMEN 391 | Kinetics in Biomolecular Systems | 3 |
| BMEN 411 | Modeling and Simulation of Biomedical Systems | 3 |
| BMEN 427 | Senior Biomedical Engineering Design I | 3 |
| BMEN 428 | Senior Biomedical Engineering Design II | 3 |
| **Total Credit Hours** | | **48** |