



## Program of Study

### Degree Requirements (130 hours)

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

- a. **CMW** (6 hours)
  - i. ENGL 101 - Critical Reading and Composition –*must be passed with a grade of C or higher*
  - ii. ENGL 102 - Rhetoric and Composition
- b. **ARP** (8 hours) –*must be passed with a grade of C or higher*
  - i. MATH 141 - Calculus I
  - ii. MATH 142 - Calculus II
- c. **SCI** (8 hours) –*must be passed with a grade of C or higher*
  - i. BIOL 101 - Biological Principles I
  - ii. BIOL 101L - Biological Principles I Laboratory
  - iii. CHEM 111 - General Chemistry I
  - iv. CHEM 111L - General Chemistry I Laboratory
- d. **GFL** (0-6 hours): Students in the College of Engineering and Computing are required to demonstrate proficiency in one foreign language equivalent to the 121 course by 1) a score of two or better on the foreign language placement test; or 2) completion of the 109 and 110 courses in FREN, GERM, LATN, or SPAN or completion of the 121 course in another foreign language.
- e. **GHS** (3 hours): any approved CC-GHS course
- f. **GSS** (3 hours): any approved CC-GSS course
- g. **AIU** (3 hours): any approved CC-AIU course

#### **Carolina Core Stand Alone or Overlay Eligible Requirements:**

Up to two of these requirements may be met in overlay courses. At least one of these requirements must be satisfied by a course not applied elsewhere in general education. (3-9 Hours)

- h. **CMS** (3 hours): any approved overlay or stand-alone CC-CMS course
- i. **INF** (0-3 hours): any approved overlay or stand-alone CC-INF course
- j. **VSR** (0-3 hours): any approved overlay or stand-alone CC-VSR course

#### 2. College Requirements: No college-required courses for this program.

#### 3. Program Requirements (48 hours)

- a. **Supporting Courses** (48 hours)
  - i. CHEM 112 - General Chemistry II –*must be passed with a grade of C or higher*
  - ii. CHEM 112L - General Chemistry II Laboratory –*must be passed with a grade of C or higher*
  - iii. CHEM 333 - Organic Chemistry I –*must be passed with a grade of C or higher*
  - iv. CHEM 334 - Organic Chemistry II –*must be passed with a grade of C or higher*
  - v. CHEM 550 - Biochemistry or BIOL 541 - Biochemistry
  - vi. MATH 241 - Vector Calculus –*must be passed with a grade of C or higher*
  - vii. MATH 242 - Elementary Differential Equations –*must be passed with a grade of C or higher*
  - viii. PHYS 211 - Essentials of Physics I –*must be passed with a grade of C or higher*
  - ix. PHYS 211L - Essentials of Physics I Lab –*must be passed with a grade of C or higher*
  - x. PHYS 212 - Essentials of Physics II
  - xi. PHYS 212L - Essentials of Physics II Lab
  - xii. STAT 509 - Statistics for Engineers
  - xiii. ECHE 320 - Chemical Engineering Fluid Mechanics or ENCP 360 - Fluid Mechanics or EMCH 360 - Fluid Mechanics

- xiv. **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 - Independent Research. A list of acceptable Biomedical Engineering electives is maintained in the Biomedical Engineering office and on its website. These include the following:
1. BMEN 342 - Infectious Disease and Immunology for Biomedical Engineers
  2. BMEN 389 - Special Topics in Biomedical Engineering for Undergraduates
  3. BMEN 392 - Fundamentals of Biochemical Engineering
  4. BMEN 499 - Independent Research
  5. BMEN 546 - Delivery of Bioactive Agents
  6. BMEN 572 - Tissue Engineering
  7. BMEN 589 - Special Topics in Biomedical Engineering
  8. EMCH 580 - Mechanics of Solid Biomaterials
  9. EXSC 535 - Biomechanics of Human Movement
  10. PSYC 507 - Cognitive Neuroscience
- xv. **Engineering Elective** (3 hours): Students must take 3 credit hours of engineering electives. A listing of acceptable engineering electives is maintained in the Biomedical Engineering office and on its website. Engineering electives include all Biomedical Engineering Electives and the following:
1. CSCE 204 - Program Design and Development /MGSC 298 - Program Design and Development
  2. CSCE 206 - Scientific Applications Programming
  3. CSCE 215 - UNIX/Linux Fundamentals
  4. CSCE 240 - Introduction to Software Engineering
  5. CSCE 317 - Computer Systems Engineering
  6. CSCE 330 - Programming Language Structures
  7. CSCE 350 - Data Structures and Algorithms
  8. CSCE 355 - Foundations of Computation
  9. CSCE 500 - Computer Programming and Applications
  10. CSCE 551 - Theory of Computation /MATH 562 - Theory of Computation
  11. CSCE 555 - Algorithms in Bioinformatics
  12. CSCE 561 - Numerical Analysis /MATH 527 - Numerical Analysis
  13. CSCE 563 - Systems Simulation
  14. ECHE 300 - Chemical Process Principles
  15. ECHE 321 - Heat-Flow Analysis
  16. ECHE 322 - Mass Transfer
  17. ECHE 372 - Introduction to Materials
  18. ECHE 430 - Chemical Engineering Kinetics
  19. ECHE 440 - Separation Process Design
  20. ECHE 456 - Computational Methods for Engineering Applications
  21. ECHE 550 - Chemical-Process Dynamics and Control
  22. ECHE 567 - Process Safety, Health, and Loss Prevention
  23. ECHE 572 - Polymer Processing
  24. ECHE 573 - Next Energy
  25. ECIV 350 - Introduction to Environmental Engineering
  26. ECIV 521 - Numerical Methods in Mechanics
  27. ELCT 220 - Electrical Engineering for Non-Majors
  28. ELCT 321 - Digital Signal Processing
  29. ELCT 331 - Control Systems
  30. ELCT 361 - Electromagnetics
  31. ELCT 363 - Introduction to Microelectronics
  32. ELCT 350 - Computer Modeling of Electrical Systems
  33. ELCT 540 - Nanotechnology
  34. EMCH 111 - Introduction to Engineering Graphics and Visualization
  35. EMCH 308 - Introduction to Finite Element Stress Analysis

36. EMCH 327 - Design of Mechanical Elements
  37. EMCH 330 - Mechanical Vibrations
  38. EMCH 332 - Kinematics and Dynamics of Machines
  39. EMCH 354 - Heat Transfer
  40. EMCH 371 - Engineering Materials
  41. EMCH 497 - Design of Thermal Systems
  42. EMCH 501 - Engineering Analysis I
  43. EMCH 502 - Engineering Analysis II
  44. EMCH 507 - Computer-Aided Design
  45. EMCH 508 - Finite Element Analysis in Mechanical Engineering
  46. EMCH 516 - Control Theory in Mechanical Engineering
  47. EMCH 528 - Product Safety Engineering
  48. EMCH 529 - Sustainable Design and Development
  49. EMCH 532 - Intermediate Dynamics
  50. EMCH 535 - Robotics in Mechanical Engineering
  51. EMCH 554 - Intermediate Heat Transfer
  52. EMCH 555 - Instrumentation for Nuclear Engineering
  53. EMCH 557 - Introduction to Radiation Shielding and Sources
  54. EMCH 560 - Intermediate Fluid Mechanics
  55. EMCH 571 - Mechanical Behavior of Materials
  56. EMCH 575 - Adaptive Materials and Smart Structures
  57. EMCH 580 - Mechanics of Solid Biomaterials
  58. EMCH 584 - Advanced Mechanics of Materials
  59. EMCH 585 - Introduction to Composite Materials
  60. EMCH 586 - Experimental Stress Analysis
- xvi. **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:
1. BIOL 102 - Biological Principles II
  2. BIOL 102L - Biological Principles II Laboratory
  3. BIOL 250 - Microbiology
  4. BIOL 250L - Microbiology Laboratory
  5. BIOL 301 - Ecology and Evolution
  6. BIOL 302 - Cell and Molecular Biology
  7. BIOL 302L - Cell and Molecular Biology Laboratory
  8. BIOL 303 - Fundamental Genetics
  9. BIOL 415 - Comparative Vertebrate Anatomy
  10. BIOL 460 - General Physiology
  11. BIOL 505 - Developmental Biology
  12. BIOL 530 - Histology
  13. BIOL 531 - Parasitology /ENHS 661/EPID 661
  14. BIOL 534 - Animal Behavior
  15. BIOL 541L - Biochemistry Laboratory or CHEM 550L - Biochemistry Laboratory
  16. BIOL 553 - Genomics
  17. BIOL 610 - Hallmarks of Cancer
  18. BIOL 612 - Virology - Classical and Emerging Concepts
  19. BIOL 620 - Immunobiology
  20. BIOL 635 - Neurophysiology
  21. BIOL 653 - Bioinformatics
  22. BIOL 655 - Biotechnology
  23. BIOL 656 - Experimental Biotechnology
  24. BIOL 662 - Signal Transduction and Pathogenesis

25. BIOL 665 - Human Molecular Genetics
26. BIOL 667 - Molecular and Genetic Mechanisms of Disease Pathogenesis
27. BIOL 690 - Electron Microscopy
28. CHEM 321 - Quantitative Analysis
29. CHEM 321L - Quantitative Analysis Laboratory
30. CHEM 322 - Analytical Chemistry
31. CHEM 331L - Essentials of Organic Chemistry Laboratory I or CHEM 333L - Comprehensive Organic Chemistry Laboratory I
32. CHEM 332L - Essentials of Organic Chemistry Laboratory II or CHEM 333L - Comprehensive Organic Chemistry Laboratory I
33. CHEM 340 - Elementary Biophysical Chemistry
34. CHEM 541 - Physical Chemistry
35. CHEM 542 - Physical Chemistry
36. CHEM 545 - Physical Biochemistry
37. CHEM 550L - Biochemistry Laboratory
38. EXSC 530 - The Physiology of Muscular Activity
39. EXSC 562 - Impairments of the Human Motor System
40. MATH 344 - Applied Linear Algebra or MATH 526 - Numerical Linear Algebra
41. MATH 374 - Discrete Structures
42. MATH 520 - Ordinary Differential Equations
43. MATH 524 - Nonlinear Optimization
44. MATH 544 - Linear Algebra
45. MATH 546 - Algebraic Structures I
46. MATH 547 - Algebraic Structures II
47. MATH 550 - Vector Analysis
48. MATH 552 - Applied Complex Variables
49. PHYS 514 - Optics, Theory, and Applications
50. PHYS 515 - Mathematical Physics I
51. PHYS 516 - Mathematical Physics II
52. PHYS 517 - Computational Physics
53. PHYS 521 - Biophysics
54. STAT 516 - Statistical Methods II
55. STAT 518 - Nonparametric Statistical Methods
56. STAT 519 - Sampling
57. STAT 520 - Forecasting and Time Series /MGSC 520
58. STAT 523 - Financial Mathematics II
59. STAT 525 - Statistical Quality Control /MGSC 525
60. STAT 528 - Environmental Statistics
61. STAT 530 - Applied Multivariate Statistics and Data Mining
62. STAT 582 - Bayesian Networks and Decision Graphs /CSCE 582

#### 4. Major Requirements (48 hours)

##### a. Major Courses (48 hours)

- i. BMEN 101 - Introduction to Biomedical Engineering
- ii. BMEN 211 - Computational Tools for Modeling Biomedical Systems *—must be passed with a grade of C or higher*
- iii. BMEN 212 - Fundamentals of Biomedical Systems *—must be passed with a grade of C or higher*
- iv. BMEN 240 - Cellular and Molecular Biology with Engineering Applications *—must be passed with a grade of C or higher*
- v. BMEN 263 - Introduction to Biomechanics *—must be passed with a grade of C or higher*
- vi. BMEN 271 - Introduction to Biomaterials
- vii. BMEN 290 - Thermodynamics of Biomolecular Systems *—must be passed with a grade of C or higher*

- viii. BMEN 303 - Professional Development and Ethics in Biomedical Engineering
- ix. BMEN 321 - Biomonitoring and Electrophysiology
- x. BMEN 345 - Human Anatomy and Physiology for Biomedical Engineers
- xi. BMEN 354 - Biotransport
- xii. BMEN 363 - Biomedical Instrumentation
- xiii. BMEN 381 - Biomedical Engineering Laboratory I
- xiv. BMEN 382 - Biomedical Engineering Laboratory II
- xv. BMEN 391 - Kinetics in Biomolecular Systems
- xvi. BMEN 427 - Senior Biomedical Engineering Design I
- xvii. BMEN 428 - Senior Biomedical Engineering Design II

### **Program GPA**

Program GPA requirement policies are described in the College of Engineering and Computing section of this bulletin. For the purpose of these policies, the following courses are used to determine the Program GPA for the Biomedical Engineering B.S. program: all Biomedical Engineering Major courses, all courses used to satisfy a Biomedical Engineering Elective, all courses used to satisfy an Engineering Elective, and ECHE 320 or equivalent.