

# BIOMEDICAL ENGINEERING

Department Website ([https://www.sc.edu/study/colleges\\_schools/engineering\\_and\\_computing/departments/biomedical\\_engineering/](https://www.sc.edu/study/colleges_schools/engineering_and_computing/departments/biomedical_engineering/))

Biomedical Engineering degree programs at the University of South Carolina were designed and developed to train students to initiate, to integrate, to imagine and to invent new processes and new products in order to improve human health. The students who enter our programs are among the very best in the University and in the nation. Our existing faculty members, as well as faculty who we are recruiting for the programs, are all committed to helping students develop the intellectual, technological and personal skills that will allow them to thrive in academia, medicine, or industry. We anticipate that our graduates will utilize their unique education and research experience to excel in positions ranging from professors in top-ranked universities to executives in new medical device or large pharmaceutical companies.

## Fields of Specialization

Research interests of the BME faculty cover a broad field of study in the areas of biomechanics, image processing, computational medicine, medical techniques and genetic engineering. The BME program incorporates these disciplines to equip students with knowledge and technical skills needed for a lifelong career in various areas of biomedical engineering.

## Admission Requirements

Requirements for admission to graduate degree programs in biomedical engineering (M.S., M.E., Ph.D.) include the general admission requirements of The Graduate School as well as more stringent program requirements. In general, the admissions process is highly competitive. Admissions decisions are based on the quality of the applicant's previous university-level academic work (as reflected by grade point average, or GPA), letters of recommendation (at least two letters are required for evaluation), GRE scores, and other evidence of past accomplishments. Admission to graduate studies is granted by the Graduate School, in consultation with the Biomedical Engineering program.

More information about admissions is available from the Biomedical Engineering program.

## Programs

- Biomedical Engineering, M.E. (<https://academicbulletins.sc.edu/graduate/engineering-computing/biomedical-engineering/biomedical-engineering-me/>)
- Biomedical Engineering, M.S. (<https://academicbulletins.sc.edu/graduate/engineering-computing/biomedical-engineering/biomedical-engineering-ms/>)
- Biomedical Engineering, Ph.D. (<https://academicbulletins.sc.edu/graduate/engineering-computing/biomedical-engineering/biomedical-engineering-phd/>)

## Courses

### BMEN 532 - Micro/nanofluidics and Lab-on-a-Chip (3 Credits)

Basic fluid mechanics, capillary, drop and micro/nanoparticle, electrokinetics; micropump, mixer, preconcentrator, electrophoresis, microactuator and particle manipulator; sensors for pressure, velocity, concentration, temperature in environmental monitoring/biodefence, clinical diagnostics, drug discovery/delivery.

**Prerequisites:** D or better in CHEM 112 and CHEM112L or CHEM 142.

**Cross-listed course:** EMCH 562

### BMEN 537 - Bio Nano/Micro Electro-Mechanical Systems (3 Credits)

Fundamentals of nano- and microfabrication, metrology and their applications in biomedical engineering and science. The fabrication covers photolithography, nano/microfabrication for nano/microstructures, etching and additive techniques, MEMS integration and packaging, etc. Metrology focuses on characterization of nanostructures with imaging technologies.

**Prerequisites:** D or better in CHEM 112 and CHEM 112L or CHEM 142.

**Cross-listed course:** EMCH 567

### BMEN 546 - Delivery of Bioactive Agents (3 Credits)

Routes of administration; mechanisms of drug absorption and biological barriers; pharmacokinetic modeling of drug distribution; drug excretion and biotransformation; design and evaluation of controlled release systems, targeted release systems, and responsive release systems.

**Prerequisites:** D or better in BMEN 345.

### BMEN 547 - Immunoengineering (3 Credits)

Engineering approaches to study and control immune reactions and their applications in therapy and diagnostics for infectious disease, cancer, allergy, autoimmunity, and transplantation.

**Prerequisites:** C or better in BMEN 240.

### BMEN 548 - Cardiovascular System: From Development to Disease (3 Credits)

Survey of cardiovascular development, anatomy, physiology and pathology. Recent advances in our understanding of the basic mechanisms of congenital cardiovascular defects and cardiovascular disease. Engineering principles, detection and treatment of cardiovascular defects.

**Prerequisites:** D or better in BMEN 240.

### BMEN 565 - Advanced Biomechanics (3 Credits)

Mathematical and theoretical analysis of the mechanical properties and functions of soft biological tissues to include arterial vessels.

**Prerequisites:** D or better in BMEN 263.

### BMEN 572 - Tissue Engineering (3 Credits)

Molecular basis of bioregenerative engineering; biomaterial design; biocompatibility assessment; cell isolation and characterization; rapid prototyping, scaffold fabrication, and biofabrication; protein and gene delivery; bioreactor design; transport in biological tissues; applications of tissue engineering in regenerative medicine.

### BMEN 575 - Engineering of Soft Materials (3 Credits)

Introductory overview of fundamental concepts in science and engineering of soft materials; the relation between microstructure and macroscopic behavior in a variety of soft matter systems; key applications in chemical and biomedical engineering.

**Prerequisites:** D or better in ECHE 320, ENCP 360, EMCH 360, or ECIV 360.

**Cross-listed course:** ECHE 575

**BMEN 589 - Special Topics in Biomedical Engineering (1-3 Credits)**

Course content varies and will be announced in the schedule of classes by title. May be repeated as topic varies.

**BMEN 710 - Modeling and Simulation of Biomedical System (3 Credits)**

Analytical and quantitative techniques applied to engineering problems in biomedical transport, tissue mechanics, cellular and organ physiology, and control of medical devices.

**Prerequisites:** MATH 242.

**BMEN 713 - Human Cell and Molecular Biology for Biomedical Engineers (3 Credits)**

Advanced examination of the organization and function of the cell with emphasis on the biophysical and quantitative aspects of cellular function. Emphasis will be on the biomedical engineering applications of regulation of cell division, protein transcription and translation within the cell, cellular energetics, and intracellular networks for cell signaling and cell function.

**BMEN 720 - Transport Phenomena in Biomedical Systems (3 Credits)**

Conservation of momentum, energy, mass, physico-chemical properties of biofluids, blood rheology, circulation models and cardiovascular regulation, solute and oxygen transport in tissues, gas transport in lungs and respiratory gas exchange models, kinetics and compartmental modeling, modeling of artificial organs.

**Prerequisites:** D or better in BMEN 354.

**BMEN 723 - Anatomy and Physiology for Biomedical Engineers (3 Credits)**

An examination of human biological structure and function from an engineering perspective. Engineering principles will be used to analyze anatomical structures and physiological functions at the tissue, organ, and systems levels.

**Prerequisites:** EXSC 224 or BIOL 244.

**BMEN 795 - Biomedical Engineering Literature (1 Credit)**

Critical reading and literacy in the biomedical engineering discipline as it relates to students' research. Graduate Standing in the Biomedical Engineering Program.

**BMEN 797 - Biomedical Engineering Doctoral Research (1-12 Credits)**

Individual research to be arranged with the instructor. Graduate Standing in the Biomedical Engineering Program.

**BMEN 798 - Graduate Seminar in Biomedical Engineering (1 Credit)**

Graduate seminar on current topics in biomedical engineering. Instruction on critical analysis and communication in the discipline.

**BMEN 799 - Biomedical Engineering Masters Thesis Preparation (1-12 Credits)**

Thesis preparation for Masters Program. Graduate Standing in the Biomedical Engineering Program. Grading: Pass/Fail.

**BMEN 898 - Doctoral Seminar in Biomedical Engineering (1 Credit)**

Seminar for doctoral students on current biomedical engineering topics and instruction in professional preparation in the discipline. Graduate Standing in the Biomedical Engineering Program.

**BMEN 899 - Biomedical Engineering Doctoral Dissertation Preparation (1-12 Credits)**

Dissertation preparation for the Ph.D. Program. Graduate standing in the Biomedical Engineering program.