Biomedical Engineering Optional Tracks

Catalog Years: 2018, 2019, 2020, 2021

You can select electives in the Biomedical Engineering program to broaden your background, to emphasize subfields within the discipline, or some of both.

Biomedical Engineering students seeking a broad background can select any electives that are listed in the Undergraduate Bulletin requirements for their catalog year. For the catalog year listed above, the electives include the following categories:

- Biomedical Engineering Electives: 2 courses (6 hours)
- Engineering Elective: 1 course (3 hours)
- Technical Electives: 2 courses (6 hours)

Students seeking to specialize their program of study can do so by selecting specific courses that satisfy the requirements outlined above. Some possible course selections are described below. It is important to know that it is not necessary to take all the courses within a track to increase expertise in a particular area. Tracks are not a formal part of the degree and are not listed on transcripts or diplomas.

- Medical Track
- Biomechanics Track
- Biomolecular Track
- Biomaterials Track
- Bioinformatics Track
- Biosensing Track

Medical Track

Our medical track is designed so that you can complete the requirements for medical school admission and at the same time receive an engineering education. You will learn about the anatomy and physiology of the human body and its systems with an engineering perspective. There may be an easier way to become a physician or health professional, but the critical thinking and problem-solving skills you develop as an engineer can make you a better doctor.

Recommended Courses

Category	Recommended Courses
Biomedical Engineering Electives	BMEN 342 – Infectious Diseases & Immunology for BME (3 credits) BMEN 346 – Medical Microbiology (3 credits) BMEN 499 – Independent Study (1-3 credits) BMEN 546 – Delivery of Bioactive Agents (3 credits) BMEN 547 – Immunoengineering (3 credits) BMEN 548 – Cardiovascular System: From Development to Disease (3 credits) BMEN 589 – Developmental Principles of Regenerative Medicine (3 credits)
Engineering Elective	Replace with another Biomedical Engineering Elective of your choice (see above)
Technical Electives	BIOL 102 – Biological Principles II (3 credits) Select three from: BIOL 102L – Biological Principles II Lab (1 credit) CHEM 331L – Essentials Organic Chem I Lab (1 credit) CHEM 332L – Essentials Organic Chem II Lab (1 credit) CHEM 550L/ BIOL 541L – Biochemical Lab (1 credit)

Biomechanics Track

Our biomechanics track provides you with expertise to apply principles from engineering mechanics to the study of living systems. It includes, amongst other fields, the study of material properties, biofluid mechanics in the cardiovascular and respiratory systems, heat and mass transfer into biological tissues, as well as statics and dynamics of human movement, and interactions of medical implants with the human body.

Category	Recommended Courses
Biomedical Engineering Electives	BMEN 548 – Cardiovascular System: From Development to Disease (3 credits) BMEN 565 – Advanced Biomechanics (3 credits) EXSC 335 – Biomechanics of Human Movement (3 credits)
Engineering Elective	CSCE 211 – Digital Logic Design (3 credits) EMCH 308 – Introduction to Finite Element Stress Analysis (3 credits) EMCH 371 – Materials (3 credits)
Technical Electives	CSCE 206 – Scientific Applications Programming (3 credits) EMCH 111 – Introduction to Computer-Aided Design (3 credits) EXSC 330 – Exercise Physiology (3 credits) EXSC 562 – Impairments of the Human Motor System (3 credits) PHYS 521 – Biophysics (3 credits)

Biomolecular Track

Our biomolecular track combines biology and engineering concepts to model and predict biomolecular interactions that will lead to the design of new therapeutic agents and new platforms for delivery of these therapies. In our program, you will learn how to apply engineering principles such as transport, thermodynamics, kinetics, and computational modeling to biomolecular systems to prepare you for a career working in the design, development, and manufacture of new drug technologies.

Category	Recommended Courses
Biomedical Engineering Electives	BMEN 546 – Delivery of Bioactive Agents (3 credits) BMEN 547 – Immunoengineering (3 credits) BMEN 572 – Tissue Engineering (3 credits)
Engineering Elective	ECHE 300 - Chemical Process Principles (3 credits) ECHE 456 - Computational Methods for Engineering Applications (3 credits) ECHE 521 – Computational Fluid Dynamics for Engineering Applications (3 credits)
Technical Electives	BIOL 655 – Biotechnology (3 credits) BIOL 656 – Experimental Biotechnology (3 credits) CHEM 321 – Quantitative Analysis (3 credits) CHEM 533 – Comprehensive Organic Chemistry III (3 credits) CSCE 206 – Scientific Applications Programming (3 credits)

Biomaterials Track

Our biomaterials track provides students witha deeper understanding of the materials side of Biomedical Engineering. Potential applications include the molecular basis of bioregenerative engineering; biomaterial design; biocompatibility assessment;, scaffold fabrication, and biofabrication; protein and gene delivery;;; applications of tissue engineering in regenerative medicine. Students can also focus on engineering approaches to study and control immune reactions and their applications in therapy and diagnostics for infectious disease, cancer, allergy, autoimmunity, and transplantation.

Category	Recommended Courses
Biomedical Engineering Electives	BMEN 547 – Immunoengineering (3 credits) BMEN 572 – Tissue Engineering (3 credits) BMEN 575 – Engineering of Soft Materials (3 credits) EMCH 580 – Mechanics of Solid Biomaterials (3 credits)
Engineering Elective	ECHE 372 – Introduction to Materials (3 credits) ECHE 572 – Polymer Processing (3 credits) EMCH 371 – Materials (3 credits)
Technical Electives	BIOL 620 – Immunobiology (3 credits) CHEM 322/L – Analytical Chemistry (4 credits) CHEM 340 – Elementary Biophysical Chemistry (3 credits) CHEM 545 – Physical Biochemistry (3 credits) EMCH 111 – Introduction to Computer-Aided Design (3 credits)

Bioinformatics Track

Combining Computer Science with Biomedical Engineering, the Bioinformatics track allows students to build on the theory and application of statistical methods to Biomedical Engineering and healthcare problems, including data mining, exploratory data analysis, data visualization, statistical analysis, and predictive modeling.

Category	Recommended Courses
Biomedical Engineering Electives	BMEN 589 - Advanced Statistical Methods for Biomedical Engineers (3 credits) BMEN 499 – Independent Study (computational focus; 3 credits)
Engineering Elective	CSCE 206 – Scientific Applications Programming (3 credits) CSCE 211 - Digital Logic Design (3 credits) CSCE 215 – UNIX/Linux Fundamentals (3 credits) CSCE 247 – Software Engineering (3 credits) CSCE 587 - Big Data Analytics (3 credits)
Technical Electives	BIOL 653 – Bioinformatics (3 credits) CSCE 145 – Algorithmic Design I (3 credits) CSCE 146 – Algorithmic Design II (3 credits) STAT 516 – Statistical Methods II (3 credits) STAT 518 – Nonparametric Statistical Methods (3 credits) STAT/MGSC 525 – Statistical Quality Control (3 credits)

Biosensing Track

This track offers students the opportunity to focus on the growing field of biosensing with in-depth views of materials, device design, and performance analysis. Specific topics emphasize materials science, biomedical applications, analytical methods, and translational research. Additionally, students will learn operating principles and design principles of bioelectric sensors and sensor systems for medical applications.

Category	Recommended Courses
Biomedical Engineering Electives	BMEN 537 – Bio Nano/Micro Electro/Mechanical Systems (3 credits) BMEN 589 – Biosensing Fundamentals and Applications (3 credits)
Engineering Elective	BMEN 532 – Micro/Nanofluidics and Lap-on-a-Chip (3 credits)
Technical Electives	ELCT 363 – Introduction to Microelectronics (3 credits) ELCT 541 – Sensor for Biomedicine (3 credits)