

Biomedical Engineering

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The Department of Biomedical Engineering (BME) offers an undergraduate degree program that combines math, chemistry, and physics, as well as biology and physiology to form a unique engineering discipline. The first two years build a strong foundation of basic sciences and liberal arts, with introductory engineering. In the next two years, courses and labs build on the basic sciences and math to provide a focus of integrative courses in Biomedical Engineering. The BME courses span a range of subspecialties, including biomechanics, biomaterials, biosignals, biomeasurements, and biotransport. Within these courses, topics may address problems in areas like cardiology, orthopedics, neurobiology, biology, or psychology. Students develop research and design skills in courses and laboratories throughout the curriculum, but the senior project provides a culminating experience by focusing on a specific yearlong problem that may be done individually or in teams.

The undergraduate degree program offers considerable flexibility, allowing time for electives within and outside the Department. The curriculum is designed for students whose post-baccalaureate career plans are graduate school, industry, or professional schools. The courses and laboratory experiences provide a broad fundamental preparation for any of the three career paths. At the same time, students can choose advanced courses, senior project, and lab experience to define their specific areas of interest. For students seeking an even broader engineering experience, the Department offers an Interdisciplinary Engineering degree that combines the fundamentals of engineering with a variety of enrichment areas selected by the student in consultation with the faculty mentor.

Program Mission

The mission of the Department of Biomedical Engineering is to prepare students for careers in health care delivery, ranging from fundamental

research to the direct application of knowledge, to problem solving and improving the quality of life for humanity.

Program Educational Objectives

The undergraduate program is designed to meet the following specific objectives in order to fulfill the Departmental and Institutional missions.

- 1: Graduates will have established themselves as practicing engineers in biomedical engineering and health related positions in industry, government and academia.
- 2: Graduates will have acquired advanced degrees or be engaged in advanced study in biomedical engineering or other fields related to their long term career goals.
- 3: Graduates will attain a major milestone in their career development within the first five to seven years.

Program Outcomes

Graduates of the BME program at Saint Louis University will demonstrate:

- a) an ability to apply knowledge of mathematics, science, and engineering;
- b) an ability to design and conduct experiments, as well as to analyze and interpret data;
- c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- d) an ability to function on multi-disciplinary teams;
- e) an ability to identify, formulate, and solve engineering problems;
- f) an understanding of professional and ethical responsibility;
- g) an ability to communicate effectively;
- h) the broad education necessary to understand the impact of engineering solutions in a global and societal context;
- i) a recognition of the need for, and an ability to engage in life-long learning;
- j) a knowledge of contemporary issues;
- k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
- l) an understanding of biology and physiology, and the capability to apply advanced

mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology;

m) an ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.

Biomedical Engineering (B.S.)

The Biomedical Engineering curriculum satisfies the SLU and Parks College requirements, and includes the flexibility, through electives, to tailor the curriculum for each individual student.

All BME courses with the exception of BME 1000 have prerequisites that require a “C-” or better. The prerequisites for BME courses are available in the Department office. Any waiver of a specified prerequisite for a course must be approved by the BME Faculty member offering that course.

The minimum curriculum includes:

Basic Science & Math

CHEM1110 General Chemistry I	3
CHEM1115 General Chemistry I Lab	1
CHEM1120 General Chemistry II	3
CHEM1125 General Chemistry II Lab	1
BIOL 1240/1245 Biology I & Lab	4
PHYS 1610 Engineering Physics I	3
PHYS 1620 Engineering Physics I Lab	1
PHYS 1630 Engineering Physics II	3
PHYS 1640 Engineering Physics II Lab	1
MATH1510 Calculus I	4
MATH1520 Calculus II	4
MATH2530 Calculus III	4
MATH3550 Differential Equations	3
MATH3850 Foundations of Statistics	3

Basic Engineering

BME 3200 Mechanics	3
ECE 2001 Electrical & Computer Eng	3
ECE 2002 Electrical & Computer Eng Lab	1
MENG2011 Engineering Shop Practice	1
ESCI2300 Engineering Thermodynamics	3

Communications

ENGL 1900 Adv Strategies of Rhet & Research	3
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One credit of the four credit Parks College Core requirement for written and oral communication will be satisfied by BME 1000 Orientation, BME 1010 Intro, or CMM 2200 Small Group Presentations.

Liberal Arts

THEO 1000 Theological Foundations	3
PHIL 2050 Ethics	3
Humanities	3
Cultural Diversity	3
Social & Behavioral Sciences	3
Non-Technical Elective	3

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core above for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 2020-2750, 3190-3740, 4130-4890), History, American Studies, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include:

Anthropology, Communication (CMM 1000, 2000, 2800), Communication Disorders (CSDI 1000, 4700), Economics, Education (EDF 4240, EDI 3620, EDSP4310), Political Science, Psychology, Social Work (SWRK 1000, 2100, 3100, 3200), Sociology, Criminal Justice, and Public Policy Studies (excludes field service courses).

Non-Technical Elective shall be chosen from:

Philosophy, Theology, Humanities, or Social & Behavioral Sciences.

Biomedical Engineering Core

BME 1000 BME Orientation	1
BME 1010 BME Introduction	1
BME 2000 BME Computing	3
BME 2200 Applied Physiology for Engineers	3
BME 3100 Signals	3
BME 3300 Transport Fundamentals	3
BME 3400 Materials Science	3
BME 3840 Junior Lab	1
BME 3150 Biomedical Instrumentation	3
BME 4950/4960 Senior Project I & II	6

Required Related Courses:

Students must take 18 credits from the Advanced Biomedical Engineering area and an additional 9 credits among BME-Related General Electives.

A. Advanced Biomedical Engineering

BME 4100 Biomedical Signals	3
BME 4200 Biomechanics	3
BME 4300 Biotransport	3
BME 4310 Advanced Topics in Biotransport	3
BME 4400 Biomaterials	3
1 BME 4410 Tissue Engineering	3

BME 4500 Numerical Methods in BME	3
BME 4600 Quantitative Physiology I	3
BME 4650 Quantitative Physiology II	3
BME 4980 Independent Research	3

B. BME-Related General Electives

BME-Related general electives should be selected in accordance with the student's long-term educational and career goals. Often, students use these credits for advanced work in math, science, and engineering.

However, students may also select courses designed to broaden their education in areas such as liberal arts or business. In all cases the permission of the academic advisor and Department Chairperson is required. Under no circumstances can prerequisite courses be used as general electives, *e.g.*, Pre-Calculus (MATH 1400) or The Process of Composition (ENGL 1500).

Minimum BS Credits (BME) 124

Minor in Biomedical Engineering

The Minor in Biomedical Engineering requires 18 credits of coursework including a course in physiology (*e.g.*, BIOL 2600, PPY 2540 Human Physiology or BME 2200) and at least five BME courses. At least three of the BME courses must be selected at the 4000-level, *i.e.*, from the Advanced BME courses. The grades in all BME courses must be C or better.

To initiate a Minor in BME, a student should file a "Minor in BME" plan with the BME Department after meeting with a BME Faculty member to discuss the minor courses and their prerequisites. The "Minor in BME" form serves as a planning tool and that will be on file in the BME Department and with the student's academic advisor in the major area. The completion of a Minor in BME must be certified by the Chair of the BME Department as part of the graduation check.