

Biomedical Engineering

BE 2100 - Undergraduate Biomedical Engineering Seminar

An overview of biomedical engineering designed especially for freshmen and sophomores that includes presentations by faculty, members of the community and other guest lecturers. Topics ranging from clinical engineering through basic biomedical engineering research are covered.

Credits: 1.0; Graded Pass/Fail Only

Lec-Rec-Lab: (1-0-0)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Level(s): Graduate;

May not be enrolled in one of the following Class(es): Junior, Senior

BE 2110 - Statistical Methods for Biomedical Engineering

Topics include descriptive statistics, sampling methods, probability, statistical inference, causality, elementary design of experiments, statistical process improvement methods including Six-Sigma techniques, clinical trial methodology, and variance analysis.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall, Summer

Pre-Requisite(s): MA 1135 or MA 1160 or MA 1161

BE 2400 - Biology for Engineers I

General principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Class(es): Senior

BE 2500 - Introduction to Biostatistics

Topics include collection of data, presentation of data, statistical inference, causality, basic probability, basic epidemiology, design of clinical trials, regulation in the health industry, and an overview of the health science research culture.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: On Demand

Pre-Requisite(s): MA 1020 or MA 1032

BE 2600 - Introduction to Biomedical Engineering

Covers basis concepts of Biomedical Engineering including statistical distributions, physiological modeling, medical imaging, biomechanics, biomaterials, and biomedical instrumentation. It serves as the starting point for more advanced courses in biomedical engineering and to give students a broad yet quantitative overview of the field.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following Class(es):

Sophomore, Junior

Pre-Requisite(s): ENG 1102

BE 3500 - Biomedical Materials

An overview of biomaterials in three basic classes: metals, ceramics, and polymers. Topics include biomaterials used in special medical applications (such as tissue replacement, absorbable and non-absorbable sutures, and soft tissue replacements) as well as discussion of tissue, body, and blood response to implants (bio-compatibility).

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): (BL 1040 or BE 2400 or BL 2400) and MY 2100 and (MEEM 2150(C) or ENG 2120(C)) and BE 2600

BE 3600 - Biomedical Instrumentation

Introduction to theory of measurement and analysis from biological systems. Covers the use of transducers, data recording and analysis systems and signal processing techniques. Laboratory includes measurements of physiological quantities from living systems.

Credits: 4.0

Lec-Rec-Lab: (3-0-2)

Semesters Offered: Spring

Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering

Pre-Requisite(s): EE 3010 and BL 2020 and BL 2021 and BE 2600

BE 3750 - Human Biomechanics

Introduction to the analysis of anatomical structures, movements, and mechanics of the musculoskeletal system, including properties and strength of materials. Includes application of Newtonian mechanics, statics, and strength of materials of bone, muscle, tendon, and other biologic materials.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering

Pre-Requisite(s): BL 2010 and (MEEM 2150 or ENG 2120) and BE 2600

BE 4000 - Independent Study

Students undertake an independent study under the guidance of a Biomedical Engineering faculty member. The course of study may either be research or academic and is decided upon between the student and faculty member.

Credits: variable to 6.0; Repeatable to a Max of 12

Semesters Offered: Fall, Spring, Summer

Restrictions: Permission of instructor and department required

BE 4100 - Cell and Tissue Mechanics

Focuses on mechanical behavior and adaptation of musculoskeletal tissues including material properties, viscoelasticity, fatigue and failure. Includes the role of mechanical forces in the development, growth and adaptation of musculoskeletal tissues; cell biology and cellular mechanotransduction.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year

Pre-Requisite(s): BE 3750

BE 4110 - Neuroengineering

Brief overview of neuroanatomy, neurophysiology, and neurobiology followed by introductions of more advanced topics including neural tissue engineering, neural/electrode interfaces, and functional electrical stimulation.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year

Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

Pre-Requisite(s): BE 2400 and BE 3500

BE 4200 - Biology for Engineers II

Covers, at an advanced level, the general principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

Pre-Requisite(s): BE 2400

BE 4300 - Polymeric Biomaterials

A specialized study of polymers used in biomedical engineering. Topics include: processing-structure-properties relationships for polymers, polymer fibers and composites, degradation of polymers, and medical applications for polymeric biomaterials.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year

Pre-Requisite(s): BE 3500

BE 4510 - Cardiovascular Engineering

Fundamental cardiovascular pathology and the biomedical engineering approaches being developed and used toward problems resulting in significant cardiovascular deficiency such as myocardial infarction, chronic kidney disease, atherosclerosis, and heart valve disease.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year

Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

Pre-Requisite(s): BL 2020 or BE 2400

BE 4600 - Drug and Gene Delivery

Covers drug pharmacodynamics and pharmacokinetics. Provides a fundamental overview of the different drug delivery systems. Students will be introduced to polymers used to deliver therapeutics. Term project involves developing new technologies/therapeutics to treat diseases.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year

Pre-Requisite(s): BE 3500

BE 4660 - Active Implantable Devices

Implantable devices that are actively delivering therapy and acting as monitoring tools will be covered. Emphasis will be on the technology and its application. Devices include electrical stimulators, pumps & diagnostic instrumentations.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year

Pre-Requisite(s): BE 3600

BE 4700 - Biosensors: Fabrication & Applications

This course introduces the student to the fundamentals of biosensor development and applications. It provides an understanding of biological components, immobilization methods, transducers, and fabrication techniques.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

Pre-Requisite(s): BE 3600

BE 4770 - Biomedical Microcontrollers

The focus of this course is to provide biomedical engineering students the necessary skills to develop microcontroller-based devices. Provides basic knowledge on computer programming languages, microcontrollers, digital circuits, and microcontroller development kits. Students will design and fabricate a microcontroller-based device using a microcontroller development kit for a specific biomedical application.

Credits: 3.0

Lec-Rec-Lab: (1-0-2)

Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year

Pre-Requisite(s): BE 3600

BE 4800 - Biomaterials Interfaces

This course introduces the students to the effects of topography and texture on the performance of biomaterials. Special emphasis is placed on tissue engineering scaffolds and microfabrication and nanofabrication techniques. Some of the topics also include self-organization of biomembranes and supramolecular systems, bioactive materials, and the molecular basis for surface recognition and masking.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year

Pre-Requisite(s): BE 3500

BE 4880 - Principles and Analysis of Cellular Processes

Course includes an overview of organic chemistry, biochemical principles of DNA and protein structure, and analytical methods including micro-array chips, fluorescent methods of detection, and immunoassays as well as ISO-10,993 procedures for the evaluation of biological response to medical devices.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year

Pre-Requisite(s): BE 2600

BE 4900 - Biomedical Design Fundamentals

Design considerations and professional practice issues are addressed. Ethics, regulatory affairs, and intellectual property are addressed within the context of the biomedical engineering profession. Modern tools of biomedical design are presented and applied to current problems.

Credits: 1.0

Lec-Rec-Lab: (1-0-0)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

BE 4901 - Biomedical Design Project I

Team approach is used to resolve a defined problem in biomedical engineering. Projects are selected and undertaken with faculty guidance and sponsor input. Must be senior project ready, as defined by major, substitutes for prerequisites.

Credits: 2.0

Lec-Rec-Lab: (0-1-3)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Co-Requisite(s): BE 4900

Pre-Requisite(s): BE 3500(C) and BE 3600 and BE 3750

BE 4910 - Biomedical Design Project II

Continuation of Biomedical Design Project I (BE4901) under faculty guidance. Emphasizes design and testing of prototypes. Requires work project notebooks, oral and written reports, and presentations.

Credits: 3.0

Lec-Rec-Lab: (0-1-6)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Pre-Requisite(s): BE 4900 and BE 4901

BE 4930 - Biomedical Engineering Topics

Biomedical engineering courses will be offered on new or emerging technical subjects depending on student demand and faculty interest and expertise.

Credits: variable to 6.0; May be repeated

Semesters Offered: Fall, Spring, Summer

BE 4940 - Introduction to Tissue Engineering

Explores the application of engineering principles toward the construction/reconstruction of human tissue. Fundamental biological principles involved in tissue engineering are reviewed from an engineering perspective with examples of engineered tissues such as blood vessels, skin, liver, cartilage and bone.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

Pre-Requisite(s): (BL 1040 or BE 2400) and BL 2020