

# BIOMEDICAL ENGINEERING (BME)

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## **BME 201 Introduction to Biomedical Engineering (2 crs)**

Prerequisite: MATH 114

Introduction to the field of biomedical engineering and the role of bioengineers. The class will cover a number of human diseases and discuss biomedical engineering techniques that are being developed to improve healthcare.

Lecture Hours: 2

Lab/Studio Hours: 0

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## **BME 291 Special Topics in Biomedical Engineering (1-3 crs)**

Prerequisite: CHEM 105 or CHEM 115; PHYS 231; BME 201

Consent: Instructor Consent Required

- *Field trips optional. A total of no more than nine credits from BME 291 and BME 491 may be applied toward major or graduation.*

Lecture and possibly laboratory or field work in the study of current topics in Biomedical Engineering of special interest to students and faculty.

Repeat: Course may be repeated for a maximum of 9 credits

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## **BME 301 3D Printing in Medicine (3 crs)**

This course will introduce students to the emerging use of 3D Printing in medicine. Students will learn the process of taking medical imaging data to the production of physical anatomic models. The course will cover the basics of imaging, methods used to create 3D computer models from imaging data, the processing of imaging files with CAD software and the conversion into files that are compatible with 3D printing.

Lecture Hours: 2

Lab/Studio Hours: 2

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## **BME 320 Clinical Problems in Biomedical Engineering (3 crs)**

Prerequisite: BME 201, BIOL 221, and BIOL 314. BIOL 221 and BIOL 314 can be taken concurrently.

Lectures and discussions to investigate advances in the use of engineering approaches to address key clinical problems that exist in the medical field. Engineering topics will include: bioinstrumentation, medical imaging, biomaterials, biomechanics and medical devices. This course builds on the Engineering and Biology principles introduced in BME 201.

Lecture Hours: 3

Lab/Studio Hours: 0

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## **BME 330 Biomedical Engineering Instruments and Measurements w/lab (4 crs)**

Prerequisite: BME 320; PHYS 232; MATH 312

Principles and the application of instrumentation that are used for medical measurements and observing physiological variables. The class will focus on the detection of signals, data acquisition and processing, and display of signals. Topics will include; respiration, heart sounds, temperature, and blood pressure. Hands on practical experience with biomedical instrumentation will be included.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 2

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## **BME 340 Biomaterials (3 crs)**

Prerequisite: BME 320 (can be taken concurrently) or MSE 350

Introduction to the role of materials used in medicine such as polymers, metals, ceramics, hydrogels, and smart polymers. Discussions of key biological principals involved with using materials in humans will include cell adhesion, extracellular matrix, cell-biomaterial interactions, inflammation and rejection.

Lecture Hours: 3

Lab/Studio Hours: 0

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## **BME 370 Medical Imaging (3 crs)**

Prerequisite: BME 330, PHYS 240

Introduction to the engineering, scientific principles and computation associated with medical imaging technologies including; X-ray, computed tomographic, ultrasound, magnetic resonance, and nuclear imaging. A brief overview of optical technologies and biophotonic approaches will be covered.

Lecture Hours: 3

Lab/Studio Hours: 0

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## **BME 395 Directed Studies (1-3 crs)**

Prerequisite: Minimum 2.0 GPA in Biomedical Engineering

Consent: Department Consent Required

This course is designed to allow a single student or a group of students to pursue their educational goals and interests under the direction of a faculty member.

Repeat: Course may be repeated for a maximum of 3 credits

Grading Basis: A-F Grades Only

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## **BME 399 Independent Study - Juniors (1-3 crs)**

Prerequisite: Minimum junior standing.

Consent: Department Consent Required

This course provides junior-level students with research opportunities in Biomedical Engineering.

Repeat: Course may be repeated for a maximum of 6 credits

Grading Basis: A-F Grades Only

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**BME 430 Cell and Tissue Engineering w/lab (4 crs)**

Prerequisite: BME 320

Introduction to the principles and techniques of cell and tissue engineering. Labs will be focused on growing and manipulating human cell lines and conducting a range of cell biology assays. Experiments on creating 3D engineered scaffolds and associated assays will be conducted.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 2

**BME 450 Medical and Implantable Devices w/lab (5 crs)**

Prerequisite: BME 330; BME 340 (or concurrent)

Topics will include the theory and applications of therapeutic implantable devices such as pacemakers, defibrillators, artificial skin, and drug delivery systems. Discussion of the role of host reaction to biomaterials, inflammation, and wound healing. Biological testing of devices and prostheses; medical product development, quality assurance for medical products; FDA and ISO requirements for medical devices will also be included.

Lecture/Discussion Hours: 4

Lab/Studio Hours: 2

**BME 460 Biological Systems Analysis (3 crs)**

Prerequisite: MATH 312; BME 320; PHYS 240

Computational and mathematical modeling of biological processes (system dynamics and frequency-domain analysis). Topics covered will include population models, metabolic networks, biological oscillation, and dynamics of infectious diseases.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

**BME 486 BME Capstone I (2 crs)**

Prerequisite: MSE 256 or concurrent enrollment; BME 320; MSE 307; MSE 386 or departmental consent

First of a two-course capstone sequence. Hands-on, project-based experiences including engineering design, problem solving and Computer Aided Design (CAD).

Lab/Studio Hours: 0

Seminar Hours: 4

**BME 487 BME Capstone II (2 crs)**

Prerequisite: BME 486

Second of a two-course capstone sequence. Conclusion of student-designed projects accompanied by preparation of multiple technical documents.

Attributes: LE-11 Integration

Lab/Studio Hours: 0

Seminar Hours: 4

**BME 493 Collaborative Internship (1-3 crs)**

Prerequisite: 2.50 total GPA; minimum junior standing

Consent: Instructor Consent Required

This course provides students an opportunity to participate in collaborative projects that are performed on campus under the supervision of a faculty member.

Repeat: Course may be repeated for a maximum of 6 credits

Grading Basis: A-F Grades Only

**BME 494 Off-campus Biomedical Engineering Internship (1-3 crs)**

Prerequisite: 2.50 total GPA; minimum junior standing

Consent: Instructor Consent Required

Off-campus internship with a regional company or other partner, including professional development training and reflection.

Repeat: Course may be repeated for a maximum of 6 credits

Grading Basis: A-F Grades Only

**BME 499 Independent Study - Seniors (1-3 crs)**

Prerequisite: Minimum senior standing

Consent: Department Consent Required

This course provides senior-level students with research opportunities in Biomedical Engineering.

Repeat: Course may be repeated for a maximum of 6 credits

Grading Basis: A-F Grades Only