

# BME-Biomedical Engineering

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## **BME 520. Implant-Tissue Interactions. 3 Hours.**

An overview of implant biocompatibility including tissue histology, histopathology of implant response and the regulatory process for medical devices.

## **BME 524. Current Topics in Stem Cell Engineering. 3 Hours.**

This course is designed for students interested in the field of stem cells, regenerative medicine, and tissue engineering using stem cells and stem cell derived cells. The course will introduce the role of stem cells in tissue growth and development, the theory behind the design and in vitro construction of tissue and organ replacements, and the applications of biomedical engineering principles to the treatment of tissue-specific diseases. Students will have hands on experience on culturing and analyzing stem cells, stem cell differentiation, analysis of functional and physiological properties of differentiated cells, and fabricating basic engineered-tissues.

## **BME 535. Tissue Engineering. 3 Hours.**

Principles underlying strategies for regenerative medicine such as stem cell based therapy, scaffold design, proteins or genes delivery, roles of extracellular matrix, cell-materials interactions, angiogenesis, tissue transplantation, mechanical stimulus and nanotechnology.

## **BME 543. Medical Image Processing. 3 Hours.**

Fundamental topics of medical image processing to practical applications using conventional computer software.

## **BME 550. Computational Neuroscience. 3 Hours.**

This course examines the computational principles used by the nervous system. Topics include: biophysics of axon and synapse, sensory coding (with an emphasis on vision and audition), planning and decision-making, and synthesis of motor responses. There will be an emphasis on a systems approach throughout. Homework includes simulations.

## **BME 561. Bioelectric Phenomena. 3 Hours.**

Quantitative methods in the electrophysiology of neural, cardiac and skeletal muscle systems.

## **BME 562. Cardiac Electrophysiology. 3 Hours.**

Experimental and computational methods in cardiac electrophysiology, ionic currents, action potentials, electrical propagation, the electrocardiogram, electromechanical coupling, cardiac arrhythmias, effects of electric fields in cardiac tissue, defibrillation, and ablation.

## **BME 571. Continuum Mechanics of Solids. 3 Hours.**

Matrix and tensor mathematics, fundamentals of stress, momentum principles, Cauchy and Piola-Kirchoff stress tensors, static equilibrium, invariance, measures of strain, Lagrangian and Eulerian formulations, Green and Almansi strain, deformation gradient tensor, infinitesimal strain, constitutive equations, finite strain elasticity, strain energy methods, 2-D Elasticity, Airy Method, viscoelasticity, mechanical behavior of polymers.

## **BME 572. Industrial Bioprocessing and Biomanufacturing. 3 Hours.**

This course will introduce students to the growing industries related to biomedical, biopharmaceutical and biotechnology. It is targeted to offer the students marketable skills to work in a vital area of economic growth and also convey some of the challenges and opportunities awaiting.

## **BME 590. Special Topic in Biomedical Engineering. 1-3 Hour.**

Special Topic in Biomedical Engineering.

## **BME 591. Individual Study in Biomedical Engineering. 1-6 Hour.**

Individual Study in Biomedical Engineering.

## **BME 601. Seminar in Biomedical Engineering. 1 Hour.**

Current topics in biomedical engineering technology and applications.

## **BME 617. Engineering Analysis. 3 Hours.**

Advanced ordinary differential equations, transform techniques, scalar and vector field theory, partial differential equations (heat, wave, Laplace).

**Prerequisites:** MA 750 [Min Grade: C]

## **BME 623. Skin and Bone Regeneration. 3 Hours.**

Study of principles of healing, methods to enhance, and clinical applications.

## **BME 630. Engineering Design and Commercialization. 3 Hours.**

The purpose of this course is to introduce students to the process of innovating medical technologies and better prepare them for a career in the medical technology industry. Students will learn aspects of biomedical product development from needs finding, invention, intellectual property, and regulatory processes.

## **BME 643. Biomedical Imaging-Oncology. 3 Hours.**

Advanced and quantitative medical imaging and image processing to understand biological processes related to cancer biology. Medical imaging technology will include molecular, functional and anatomical imaging related to the hallmarks of cancer.

## **BME 664. Neural Computation. 3 Hours.**

This course examines the principal theoretical underpinnings of computation in neural networks. Emphasis will be placed on understanding the relationship between the different approaches: dynamical systems, statistical mechanics, logic, Kalman filters, and likelihood/Bayesian estimation.

## **BME 665. Computational Vision. 3 Hours.**

This course approaches the study of biological and artificial vision from a theoretical perspective beginning with a comparative survey of visual systems and then examining vision algorithms and architectures.

## **BME 670. Quantitative Physiology. 3 Hours.**

Study of physiological problems using advanced mathematical techniques. Topics covered include: mechanics, fluid dynamics, transport, electrophysiology of cell membranes, and control systems.

**Prerequisites:** BME 517 [Min Grade: C] or ME 661 [Min Grade: C] or ME 761 [Min Grade: C]

## **BME 672. Cellular Therapy. 3 Hours.**

Introduction to research in cellular therapy, its clinical applications, and its potential for commercialization. Students will learn fundamental mechanisms, become familiar with the progress of several successful therapies that use human T cells and stem cells, and learn the challenges and opportunities for future biopharmaceutical and biotechnology industries.

## **BME 673. Lab Rotation. 3 Hours.**

Entering BME graduate students will work in the laboratories of 2 or 3 potential research mentors. The duration of each rotation period will be by mutual agreement between student and faculty but must be at least 4 weeks. The goal is for students to match with their primary research mentor by the end of the course.

**BME 680. Biomolecular Modeling. 3 Hours.**

Molecular modeling principles and applications. Students will perform hands-on exercises using molecular modeling tools and software. Students will learn the critical relationships among structure, function, and thermodynamic driving forces in structural biology and become able to utilize molecular modeling techniques to explore biological phenomena at the molecular level.

**BME 690. Special Topics in Biomedical Engineering. 1-6 Hour.**

Special Topics in Biomedical Engineering.

**BME 691. Individual Study in Biomedical Engineering. 1-6 Hour.**

Individual Study in Biomedical Engineering.

**BME 693. Internship in Biomedical Engineering. 1-6 Hour.****BME 697. Journal Club. 1-3 Hour.**

Journal Club.

**BME 698. Non-Thesis Research. 1-12 Hour.****BME 699. Thesis Research. 1-12 Hour.**

**Prerequisites:** GAC M

**BME 701. Seminar in Biomedical Engineering. 1 Hour.**

Current topics in biomedical engineering technology and applications.

**BME 717. Engineering Analysis. 3 Hours.**

Advanced ordinary differential equations, transform techniques, scalar and vector field theory, partial differential equations (heat, wave, Laplace).

**Prerequisites:** MA 750 [Min Grade: C]

**BME 723. Skin and Bone Regeneration. 3 Hours.**

Study of principles of healing, methods to enhance, and clinical applications.

**BME 764. Neural Computation. 3 Hours.**

This course examines the principal theoretical underpinnings of computation in neural networks. Emphasis will be placed on understanding the relationship between the different approaches: dynamical systems, statistical mechanics, logic, Kalman filters, and likelihood/Bayesian estimation.

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Study of physiological problems using advanced mathematical techniques. Topics covered include: mechanics, fluid dynamics, transport, electrophysiology of cell membranes, and control systems.

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**BME 780. Biomolecular Modeling. 3 Hours.**

Molecular modeling principles and applications. Students will perform hands-on exercises using molecular modeling tools and software. Students will learn the critical relationships among structure, function, and thermodynamic driving forces in structural biology and become able to utilize molecular modeling techniques to explore biological phenomena at the molecular level.

**BME 790. Special Topics in Biomedical Engineering. 1-6 Hour.**

Special Topics in Biomedical Engineering.

**BME 791. Individual Study in Biomedical Engineering. 1-6 Hour.**

Individual Study in Biomedical Engineering.

**BME 793. Internship in Biomedical Engineering. 1-6 Hour.****BME 797. Journal Club. 1-3 Hour.**

Journal Club.

**BME 798. Non-Dissertation Research. 1-12 Hour.****BME 799. Dissertation Research. 1-12 Hour.**

**Prerequisites:** GAC Z