Spring 2022 BME Courses

BME 275 Biomechanics (Prof. Seth Donahue), T/Th 11:30am-12:45pm

This course introduces the fundamental principles of biomechanics as used in the field of biomedical engineering. Students will realize how mechanical engineering fundamentals can be applied to analyses of the tissues and systems in the human body. Specific topics covered in this course include the mechanical behavior of bone and passive soft tissue, the mechanical behavior of neutrally stimulated skeletal muscle, the application of statics and dynamics to analyzing muscle and joint forces, the biomechanics of gait, orthopaedic biomechanics, and sport biomechanics.

BME 297M Strength of Materials (Prof. Scott Civjan), M/W/F 10:10am-11:00am (offered through Civil Engineering, lab not required)*

Analysis and design of structural members subjected to axial loads, torsion and bending deflection of beams, behavior of columns and transformation of stress and strain.

*BME sub for MIE 211 Strength of Materials, please register for the BME course!

BME 310 Intro to Lab Techniques (Prof. Stacyann Bailey), W 9:05am-9:55am (lecture)

Lab sections (in-person) – 01LL Th 9:00am-12:00pm, 01LM F 9:00am-12:00pm

This course provides an introduction to laboratory techniques in biomedical engineering. Laboratory exercises and demonstrations will explore topics, such as data acquisition, whole body monitoring, cell culture technique, microscopy, and material property characterization of biological materials. Students will learn proper handling of laboratory chemicals, operate common analytical instruments, describe the theory and applications of various analytical instruments, and practice laboratory safety.

BME 320 Bioinstrumentation (Prof. Yu Chen, Dr. Qianbin Wang), M/W 2:30pm-3:45pm (lecture)

Lab sections – W 9:05am-9:55am, 10:10am-11:00am, 11:15 am-12:05 pm

This course is intended to provide biomedical engineering students with an understanding of the principles and devices of biomedical instrumentation with emphases on analog and digital electronic circuits, transducers, instruments, and measurements for obtaining information from human body and/or biological systems.

BME 330 Quantitative Physiology (Prof. Cathal Kearney), T/Th 2:30pm-3:45pm

This course covers a quantitative description of the function and control of organ systems. Mathematical models are derived to describe physical principles and physiologic mechanisms.
BME 415 Senior Design II (Dr. Sam Wojda, Dr. Martin Hunter, Dr. Qianbin Wang), T/Th 1:00pm-2:15pm

Lab sections – M 1:00pm-2:30pm, 2:30pm-4:00pm; T 10:30am-12:00pm, 2:30pm-4:00pm; W 1:00pm-2:30pm; Th 10:30am-12:00pm, 2:30pm-4:00pm
*Note: Student groups will sign up for 1.5 hour lab sections with their project group; Overrides may be needed if enrolling in classes directly before/after lab. Strongly suggested to register for tech electives first, then request override for Senior Design if needed.

This is the second semester of biomedical engineering capstone design sequence. The scope of biomedical engineering design and development encompasses a wide variety of scientific and engineering fields. This is a project based course utilizing fundamental concepts involved in biomaterials, biomechanics, bioinstrumentation to solve biomedical engineering problems. In this course students will build upon their capstone design project from Senior Design I with engineering analysis and design optimization of their selected design concept, prototyping, testing, reporting and oral presentations.

BME 597G/697G Intro to Gene Therapy (Dr. Qianbin Wang), M/W 4:00pm-5:15pm

This course is offered to junior or senior undergraduate students and graduate students to introduce them to the field of engineered gene therapy. It covers how gene therapy works, the type of vectors used, and why/when certain vectors are employed. The course also includes how to make viral vectors and introduces some non-viral tools for gene therapy.

Lecture Topics:

- Basic principles for transferring genetic material into cells
- How to effectively use genome editing tools
- Viral vectors for gene therapy
- Steps to make viral vectors
- Non-viral tools for gene therapy

BME 597K/697K Biotransport (Prof. Chase Cornelison), T/Th 10:00am-11:15am

An introduction to transport phenomena in biological systems covering fundamental principles of fluid mechanics and mass transfer at the cellular, tissue, and organ levels. Topics include macroscopic and microscopic mathematical descriptions of physiological fluid mechanics in circulation and tissue and mass transport related to convection and diffusion in biological systems; transmembrane and transvascular transport; biochemical interactions; mass separations; and kinetics of biochemical reactions. Course material will be reinforced using examples in drug delivery, tissue engineering, bioengineered systems, and tumorigenesis.

Updated: 10/28/2021
BME 597N/697N Neuroengineering (Prof. Siyuan Rao), T/Th 11:30am-12:45pm

This course seeks to build a foundation of physical principles underlying neuroengineering techniques, including electrical, optical, and magnetic approaches to neural recording and stimulation. We will discuss neural recording probes and materials considerations that influence the quality of the signals and longevity of the probes in the brain. This will be accompanied by the discussion of evolution of neural probes from microwires in the 1950s, to Utah arrays in the 1980s, to modern Neuropixels, meshes, and fibers. We will then consider physical foundations for optical recording and modulation approaches. Materials physics of optical fibers, GRIN lenses, light-emitting devices, and photodetectors will be discussed and followed by the in-depth review of devices and systems involved in optogenetics, photometry, and endoscopy. Finally, the course will deliver an introduction to magnetism in the context of biological systems. We will focus on magnetic neuromodulation methods including transcranial magnetic stimulation and nanomaterials based approaches to remote control of neural activity. Students enrolled in the course will be tasked with 3 team projects that will be focused on designing electrical, optical, or magnetic neural interface platforms for specific neuroscience questions.

BME 597P/697P Intro to Biophotonics (Dr. Martin Hunter), MWF 11:15am-12:05pm

This course covers basic concepts in electromagnetism and light-matter interactions of biomedical significance. Topics covered include: optical properties of biological cells, tissues and biomaterials; visible and near-infrared light absorption, scattering and fluorescence spectroscopy; advanced microscopy techniques, optical coherence tomography, vibrational spectroscopy, photoacoustic imaging, photodynamic therapy and their relevance to human disease diagnostic and therapeutic applications.

BME 597T/697T Tissue Engineering (Dr. Sam Wojda), MWF 12:20pm-1:10pm

An introduction to tissue engineering and regenerative medicine.

Potential* Technical Electives in other Departments: *student responsible for instructor approval / meeting prerequisites

- Kin 272 – Anatomy & Physiology II
- Chem 261/262 – Organic Chemistry I/II
- MIE 458 – Connections in Medicine, Biology & Engineering
- MIE 497R – Mechatronics
- Biochem 320 – Elementary Biochemistry
- ChemEng 510 – Immunoengineering
- ChemEng 535 – Microfluidics & Microscale Analysis in Materials and Biology
- ChemEng 589 – Nanostructured Biomaterials
- Bio 311/Biochem311/AnimlSci 311 – General Genetics
- ICONS 390B – Integrated Discovery Lab in Biomedicine
- MIE 460 – Human Factors Engineering
- ECE 210 – Circuits & Electronics I
- ECE 213 – Continuous-Time Signals & Systems
- Microbio 310 – General Microbiology

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