BIOMEDICAL ENGINEERING (BME)

Courses

BME 5150. Nanobiomaterials. 3 Credits.
Covers the classes of nanomaterials used biomedically, the biological response, and material testing. Content includes applications of nanomaterials in drug delivery, nano-topography of surfaces, sensors, and imaging as well as the topic of nanotoxicity.

BME 5330. Advanced Biomedical Systems. 3 Credits.
Uses the study of lung mechanics as a vehicle for teaching a range of mathematical modeling and data analysis methods central to the study of physiological systems. Students will gain a detailed understanding of how the lung works as a mechanical system and various diseases that affect mechanical function. At the same time, they will learn about applications of a range of mathematical and signal processing techniques. Prerequisite: Graduate standing or Instructor permission.

BME 5350. Microbiome Engineering. 3 Credits.
Introduces the burgeoning field of microbiome engineering. Covers approaches to manipulate the structure and function of the human microbiome to treat diseases by surveying the primary literature. Develops computational and quantitative reasoning skills necessary to analyze the data that enable understanding of the microbiome. Prerequisite: Knowledge of Python and command-line coding is assumed.

BME 5360. Deep Learning in BME. 3 Credits.
Focuses on the application of advanced neural computing to biological data. Students develop the skills to implement and interpret models for (1) genomic sequences, (2) protein folding, and (3) imaging/microscopy applications. Covers the evolution of deep learning architectures (from simpler convolutional neural nets to more modern transformer-based architectures), the coding skills in Python, and the quantitative logic required to handle deep learning problems in a lab setting. Prerequisite: Experience with computer coding is recommended.

BME 5440. Biothermodynamics. 3 Credits.
Inter-disciplinary; guides the student through the thermodynamics of living organisms, comprised of the study of energy transformation in the life sciences. Designed for students from the STEM disciplines. Covers Gibbs free energy, statistical thermodynamics, binding equilibria, and reaction kinetics. Prerequisites: Successful completion of Materials and Mechanics Lab such as ME 2111, Thermo-Fluid Labs such as ME 2321, or Biomedical design such as BME 3600 is assumed; Graduate student or Instructor permission. Cross-listed with: ME 5440.

BME 5510. Rehabilitation Engineering. 3 Credits.
Introduces techniques and principles within the field of rehabilitation engineering, including accessibility, assistive technology, biological function analysis, functional replacement vs. functional restoration, rehabilitation technology assessment, and emerging technologies. Students develop the ability to identify and critique engineering solutions to improve the quality of life of people with disabilities. Application areas include transportation, recreation, human-computer interaction, and activities of daily living. Students demonstrate mastery of course material through a semester-long rehabilitation engineering project. Prerequisites: Knowledge of engineering statics, dynamics, and basic musculoskeletal biomechanics is recommended.

BME 5800. Clinical Devices & Instruments. 3 Credits.
Focuses on the development, design and adaptation of biomedical devices and instruments in exciting active areas of biomedical device development and applications at UVM and the UVM Medical Center (UVMMC). Includes lectures on commercialization and manufacturing. Team-taught by faculty in the Larner College of Medicine and the UVMMC. Credit not awarded for both BME 5800 and BME 3810. Prerequisites: Biomedical Engineering Graduate student or Instructor permission; Content knowledge in ANPS 1190, ANPS 1200, BME 2000, and BME 2050 is assumed.

BME 5990. Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.

BME 6010. Core Innovation I. 3 Credits.
Focuses on needs-driven innovation for healthcare solutions with strong potential for clinical impact developed through multidisciplinary collaboration via team-based problem solving. Covers design topics (data-driven needs finding, iterative concept generation and screening), professional skills (project management, intellectual property, regulatory pathways), and communication for different audiences (technical, clinical, investor). Prerequisite: Instructor permission.

BME 6020. Core Innovation II. 3 Credits.
Guides multidisciplinary teams in advancing healthcare innovations toward commercialization. Students develop technical feasibility, market analysis, reimbursement strategies, commercialization plans, regulatory pathways, and financial planning, while strengthening grant writing and communication skills. Culminates in a comprehensive report and a symposium presentation. Prerequisite: BME 6010.

BME 6391. Master's Thesis Research. 1-18 Credits.
Research for the Master's Thesis.

BME 6710. Brain-Computer Interfaces. 3 Credits.
Includes writing Python software to analyze data from the human brain and decode it to develop brain-computer interfaces (BCIs) that can predict a person's response/intent from brain activity alone. Includes work with real examples of neural data, particularly non-invasive electroencephalography (EEG) recordings. Discusses the design and ethics of real-world BCIs. Prerequisites: At least 2 semesters of coding, at least 1 of these semesters in Python or Matlab.

BME 6990. Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.

BME 6993. Independent Study. 1-18 Credits.
A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 6995. Graduate Independent Research. 1-18 Credits.
Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 7491. Doctoral Dissertation Research. 1-18 Credits.
Research for the Doctoral Dissertation.

BME 7990. Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.

BME 7993. Independent Study. 1-18 Credits.
A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 7995. Graduate Independent Research. 1-18 Credits.
Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.