BIOMEDICAL ENGINEERING (BME)

BME 5000. Physiological Systems I. (3 Credits)
Eleven major human organ systems are covered in this course, including: integumentary, endocrine, lymphatic, digestive, urinary, reproductive, circulatory, respiratory, nervous, skeletal, and muscular.
Enrollment Requirements: Recommended preparation: BME 3100.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205000)

BME 5010. Research Methods in Biomedical Engineering. (3 Credits)
Inquiry into the nature of research with emphasis on the spirit, logic, and components of the scientific methods. Health related research literature is used to aid the student in learning to read, understand, and critically analyze published materials. The preparation of research proposals and reports is emphasized.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205010)

BME 5020. Clinical Engineering Fundamentals. (3 Credits)
Provides the fundamental concepts involved in managing medical technology, establishing and operating a clinical engineering department, and the role of the clinical engineering designing facilities used in patient care. Topics covered include managing safety programs, technology assessment, technology acquisition, the design of clinical facilities, personnel management, budgeting and ethical issues of concern to the clinical engineer.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205020)

BME 5030. Human Error and Medical Device Accidents. (3 Credits)
Basic principles needed to analyze medical devices, medical device users, medical device environments and medical device accidents. It particularly focuses on human factors engineering as an important step to minimizing human error. The role of medical device manufacturers, medical device regulators and medical device owners are examined to identify their role in reducing medical device use errors and medical device accidents. The nature and types of human error as well as a taxonomy of medical device accidents are presented. Investigative techniques involving root cause analysis and failure modes and effects analysis are taught and applied to industrial and medical device accidents. Operating room fires, electrosurgical and laser burns, anesthesia injuries, infusion device accidents, catheters and electrode failures and tissue injury in the medical environment are in detail. A semester project will require the student to employ these tools and techniques to analyze a medical device accident.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205030)

BME 5040. Medical Instrumentation in the Hospital. (3 Credits)
This course will examine current major technologies in use by healthcare practitioners. It will review the physiological principles behind each technology, the principles of operation, major features, methods for testing and evaluating each technology and will highlight available versions of the devices on the market today. Technologies to be covered will be selected from anesthesia equipment, surgical and ophthalmic lasers, cardiac assist devices, surgical and endoscopic video systems, radiographic and fluoroscopic devices, CT, MRI, ultrasound imaging equipment, radiation therapy, nuclear medicine, clinical chemistry analyzers, spectrophotometers and hematology analyzers. Course is based on one text, selected manufacturers training documents as well as journal articles from current medical publications. Grading will be based on exams, quizzes, a semester project and class participation. Several classes will take place on site in Hartford area hospitals in order to observe and examine the equipment being discussed.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205040)

BME 5050. Engineering Problems in the Hospital. (3 Credits)
Covers engineering solutions to problems that are found in the healthcare environment. Includes a wide variety of topics such as electrical power quality of and the reliable operation of high tech medical equipment, electrical safety in the patient care environment, electromagnetic compatibility of various medical devices and electromagnetic interference, radiation shielding and radiation protection, medical gas systems, medical ventilation systems and indoor air quality, fire protection systems required in the hospital, project management, functionality and design implications of emerging technologies, and hospital architecture and the design of patient care facilities.
Enrollment Requirements: Instructor consent; open to students in the M.S. Biomedical Engineering Clinical Engineering Internship Program or the M.Eng. Clinical Engineering Program.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205050)

BME 5060. Clinical Engineering Rotations I. (3 Credits)
Associated with the clinical engineering rotations that interns experience in hospitals, such as surgeries, CT, MRI, ICU, clinical laboratory and physical therapy.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205060)

BME 5061. Clinical Engineering Rotations II. (3 Credits)
Associated with the clinical engineering rotations that interns experience in hospitals, such as surgeries, CT, MRI, ICU, clinical laboratory and physical therapy.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205061)

BME 5070. Clinical Systems Engineering. (3 Credits)
Primarily covers medical device connectivity and interoperability. This includes connecting medical devices to the hospital computer network to pass data to the patient medical record or to other medical devices for the purpose of feedback and control. The course will cover basic networking concepts, hospital network architecture, medical systems security and risk management, the role of interconnecting middleware, HL7 and DICOM data standards, moving data on the network, clinical information systems, digital imaging and image storage systems, medical device plug-and-play concepts, and a medical device integration project walkthrough.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205070)

BME 5080. Medical Device Cybersecurity. (3 Credits)
Today's medical devices are increasingly complex, integrated, and ubiquitous. However, these same characteristics increasingly expose medical devices to a growing number of cyber security risks. Compounding the challenge, safeguards that are appropriate for traditional IT equipment cannot easily be applied to medical devices. This course is designed to provide health technology professionals with an overview of the challenges and foundational knowledge on the topic of medical device security. The course will also offer specific guidance, skill sets, and tools appropriate for those professionals that can be used in mitigating security risks that exist in the expanding medical device ecosystem.
Enrollment Requirements: Instructor consent.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205080)

BME 5099. Independent Study. (1-3 Credits)
Individual exploration of special topics as arranged by the student with an instructor of his or her choice.
May be repeated for a total of 18 credits
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205099)

BME 5100. Physiological Modeling. (3 Credits)
Unified study of engineering techniques and basic principles in modeling physiological systems. Focuses on membrane biophysics, biological modeling, and systems control theory. Significant engineering and software design is incorporated in homework assignments using MATLAB and SIMULINK.
Enrollment Requirements: Recommended preparation: BME 3100 and 3400 (or equivalent).
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205100)

BME 5320. Biosensors and Nanodevices for Biomedical Applications. (3 Credits)
Current and emerging technologies in biosensors for biomedical applications. Topics include principles of molecular and bio/chemical sensing, techniques for sensor integration, nano/micro electro mechanical systems (NEMS/MEMS) technologies used in biosensors, and commercial/clinical applications of biosensors.
Enrollment Requirements: Open only to Biomedical Engineering majors, others by instructor consent. Not open for credit to students who have passed BME 3320, 4985 or 6086 when taught as "Biosensors and Nanodevices for Biomedical Applications."
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205320)

BME 5410. Systems Biology of Cells and Tissues. (3 Credits)
A broad systems level overview of how cells and tissues interact with each other at different physical scales to create complex physiological outcomes. In addition, a variety of techniques and experimental models in biology, as well as introducing examples to observe cells and tissues at multiple scales.
Enrollment Requirements: Recommended preparation: Graduate student in Biomedical Engineering.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205410)

BME 5500. Clinical Instrumentation Systems. (3 Credits)
Analysis and design of transducers and signal processors; measurements of physical, chemical, biological, and physiological variables; special purpose medical instruments, systems design, storage and display, grounding, noise, and electrical safety. These concepts are considered in developing devices used in a clinical or biological environment.
Enrollment Requirements: Recommended preparation: ECE 2001W; BME 3400 and 3500.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205500)

BME 5520. Developing Mobile Apps for Healthcare. (3 Credits)
Mobile apps for smartphones and tablets are changing the way doctors and patients approach health care. This course will cover the basic elements of apps development on Android platforms, including XML, Java, UI amongst others. Topics include how to handle data in the cloud using HIPAA-Compliant web service and how to integrate machine learning models in app development. No previous programming experience is needed.
Enrollment Requirements: Recommended preparation: A laptop with at least 8G memory is needed for the class.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205520)

BME 5600. Human Biomechanics. (3 Credits)
Applies principles of engineering mechanics in the examination of human physiological subsystems such as the musculoskeletal system and the cardiovascular system. Topics drawn for biosolid mechanics, biofluids, and biodynamics, the viscoelastic modeling of muscle and bone, non-Newtonian fluid rheology, blood flow dynamics, respiratory mechanics, biomechanics of normal and impaired gait, and sport biomechanics.
Enrollment Requirements: Recommended preparation: BME 3600W.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205600)

BME 5630. Multiphysics Finite Element Analysis. (3 Credits)
Fundamentals of the finite element method (FEA) via hands-on experience of solving typical design problems in the multidisciplinary field of biomedical engineering, including mechanical structures, heat transfer, fluid flow and electrical field distribution. Emphasizes basic mathematical and physical principles underlying the FEA, general procedure of identifying and solving engineering problems using COMSOL Multiphysics FEA software, interpretation of FEA analysis results and evaluation of the quality of the numerical solution. Students are expected to demonstrate a basic understanding of the concepts and mathematical formulation of FEA, and possess the ability to apply FEA procedures in biomedical problems and technology development.
Enrollment Requirements: BME 3600 or instructor consent. Recommended preparation: Course is designed for BME juniors and seniors who have taken BME 3600, and for graduate students with generic background in mechanics.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205630)

BME 5700. Biomaterials and Tissue Engineering. (3 Credits)
(Also offered as MEDS 5313.) A broad introduction to the field of biomaterials and tissue engineering. Presents basic principles of biological, medical, and material science as applied to implantable medical devices, drug delivery systems and artificial organs.
Enrollment Requirements: Recommended preparation: BME 3700.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%205700)

BME 6086. Special Topics In Biomedical Engineering. (1-6 Credits)
Classroom and/or laboratory courses in special topics as announced in advance for each semester.
May be repeated for a total of 30 credits
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206086)

BME 6094. BME Graduate Seminar. (1 Credit)
Presentations will be given by invited speakers from outside, faculty members, and student presenters on current research topics in biomedical engineering.
May be repeated for a total of 10 credits
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206094)

BME 6100. Neural Prostheses. (3 Credits)
Advanced microelectrode technologies are well-positioned to drive the next generation neuromodulation and neural prostheses for treatment of neurological diseases such as profound hearing loss, spinal cord injury, brain-machine interfaces, and Parkinson's disease. This course discusses key technical issues related to implantable neural prostheses, in particular, 3D microelectrode arrays that interface with individual neurons directly, in various stages of development, from proof-of-concept to translation toward clinical approval. Students will also learn to critique journal articles and to write their own NIH research proposal.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206100)

BME 6120. Neuronal Information Processing and Sensory Coding. (3 Credits)
Processing, transmission, and storage of information in the central and peripheral nervous systems. Mechanisms of signal generation, transmission and coding by neurons and dendrites. Analysis of invertebrate and vertebrate visual and auditory systems, including: mechanisms of neurosensory transduction, coding, and signal-to-noise ratio enhancement. Neural spatio-temporal filters for feature extraction and pattern recognition. Information theoretic analysis of signal encoding and transmission in the nervous system. This course assumes a background in linear systems and feedback control system.
Enrollment Requirements: BME 5100. This course and ECE 6311 may not both be taken for credit.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206120)

BME 6125. Digital Image Processing. (3 Credits)
(Also offered as ECE 6125.) Problems and applications in digital image processing, two-dimensional linear systems, shift invariance, 2-D Fourier transform analysis, matrix Theory, random images and fields, 2-D mean square estimation, optical imaging systems, image sampling and quantization, image transforms, DFT, FFT, image enhancement, two-dimensional spatial filtering, image restoration, image recognition, correlation, and statistical filters for image detection, nonlinear image processing, and feature extraction.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206125)

BME 6126. Fundamentals of Optical Imaging. (3 Credits)
(Also offered as ECE 6126.) Learning optical imaging fundamentals. Topics include: review of two-dimensional linear system theory; scalar diffraction theory, wave optics, Fresnel and Fraunhofer diffraction; imaging properties of lenses; image formation; optical resolution in imaging, frequency analysis of optical imaging systems; imaging with coherent and incoherent sources, coherent transfer function; optical transfer function, point spread function, fundamentals of microscopy, two-dimensional spatial filtering; coherent optical information processing; frequency-domain spatial filter synthesis; holography.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206126)

BME 6170. Nanomedicine: From Concepts to Applications. (3 Credits)
Teaches students competency and practical skills in applying nanotechnology to solve problems in medicine. Upon completion of the course, the students will be able to understand the basic concept of Nanomedicine and have an overview of the Nanomedicine field; understand principles and experimental methods in designing, generating, charactering and evaluating nanotechnology-enabled therapeutics; understand how Nanomedicine is translated from scientific innovation to clinical applications; understand how Nanomedicine is applied in the cutting-edge breakthroughs of biotechnology and medicine; develop critical thinking and independent learning skills; and design a successful Nanomedicine project.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206170)

BME 6190. Bioelectrical Signals in Neuronal Tissues. (3 Credits)
Neuronal tissues react to trigger signals such as electrical, mechanical, or chemical energy by generating action potentials, i.e., depolarization and repolarization of their membrane electrical potentials within ~1/1000 second. What underlies this rapid electrical event is the intricate timing of the opening and closing of ion channels, i.e., pore-forming transmembrane proteins that allow charged ions to pass through the lipid bilayer membrane. The overarching objective of this course is to help engineering students establish a top-down theoretical understanding of the nervous system, which are targets for biomedical devices like neuromodulators and stimulators to manage disease conditions. This course teaches the fundamentals of neuronal tissues by introducing the experimental observations and the integration of experimental evidence with quantitative modeling. The course is designed for BME seniors and for graduate students with a generic background in neuroscience and neurophysiology. Students are expected to demonstrate the ability to apply basic bioelectrical theories to solving relevant biomedical problems via engineering design and analysis.
Enrollment Requirements: MATH 1132Q, 2410Q, or instructor consent.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206190)

BME 6420. Medical Imaging Systems. (3 Credits)
This course covers imaging principles and systems of x-ray, ultrasound, optical tomography, magnetic resonance imaging, positron emission tomography.
Enrollment Requirements: BME 5500 or BME 6500.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206420)

BME 6450. Optical Microscopy and Bio-imaging. (3 Credits)
(Also offered as MEDS 6450.) Presents the current state of the art of optical imaging techniques and their applications in biomedical research. The course materials cover both traditional microscopies (DIC, fluorescence etc.) that have been an integrated part of biologists' toolbox, as well as more advance topics, such as single-molecule imaging and laser tweezers. Four lab sessions are incorporated in the classes to help students to gain some hand-on experiences. Strong emphasis will be given on current research and experimental design.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206450)

BME 6500. Biomedical Instrumentation I. (3 Credits)
Origins of bioelectric signals; analysis and design of electrodes and low noise preamplifiers used in their measurement. Statistical techniques applied to the detection and processing of biological signals in noise, including the treatment of nerve impulse sequences as stochastic point processes. Methods of identifying the dynamic proper ties of biosystems. Assumes a background in linear systems and electronics.
Enrollment Requirements: BME 5500 or consent of the instructor.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206500)

BME 6520. Biosensors. (3 Credits)
Principles and design of acoustic imaging transducers, and force, pressure and hearing sensors. Covers also optical biosensors including oxygen monitoring sensors, glucose sensors and optical sensors used in imaging.
Enrollment Requirements: BME 5500 or consent of the instructor.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206520)

BME 6701. Biomedical Materials and Implants. (3 Credits)
This advanced course will enable students to further expand their knowledge in various aspects of biomaterials science, engineering and applications. The course will focus on the strategies to improve cell-material and tissue-implant interaction. A emphasis is placed on the biomaterial innovations and technologies that integrate bioactivity, functionality to improve the performance of the implants. The course will also provide an overview of the FDA regulatory pathways for biomaterial and implant approvals.
Enrollment Requirements: BME 3700 or equivalent. Open only to BME students. Not open for credit to students who have passed MSE / BME 4701 or BME 6086 when taught as Advance Biomaterials.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206701)

BME 6720. Drug Delivery. (3 Credits)
Introduction to drug delivery systems that provide pharmaceutical agents at target tissues, the mechanism of pharmacokinetic regulation, the basics, technology, and applications of drug delivery systems. Emphasis on understanding the principles of pharmacokinetics and drug delivery systems to improve clinical efficacy as well as to reduce side effects.
Enrollment Requirements: BME 3700 or equivalent; open only to BME students, others with consent. Not open for credit to students who have passed BME 3720 or BME 4985 / 6086 when taught as Drug Delivery.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206720)

BME 6810. Machine Learning Methods for Biomedical Signal Analysis. (3 Credits)
Acquire the basic machine learning concepts and tools that are necessary in modern biomedical engineering to model, analyze, and classify physiological time series. Specific focus is on multivariate data and time series extracted from multiple physiological sources, including (but not limited to) ECG, EEG, and EMG. Through a mix of lectures and hands-on laboratory experiences, the students will learn how to design and implement machine learning projects and how to use advanced statistical tools and methods to classify data, infer predictions, and validate data-driven predictive models.
Enrollment Requirements: Instructor consent; CSE 1010 and STAT 3025Q or equivalent. Not open for credit to students who have passed BME 4810.
View Classes (https://catalog.uconn.edu/course-search/?details&code=BME%206810)