BIOENGINEERING (BE-GY)

BE-GY 871X Guided Studies in Biomedical Engineering (3-6 Credits)
Typically offered Fall, Spring, and Summer terms
Under faculty supervision, students study selections, analyses, solutions and presentations of biomedical engineering reports for problems in products, processes or equipment design, or other fields of biomedical-engineering practices. Conferences are scheduled. Master's degree candidates are required to submit three unbound copies of their reports to advisers one week before the last day of classes. | Prerequisite: degree status.
Grading: Grad Poly Graded
Repeatable for additional credit: Yes

BE-GY 873X Research in Biomedical Engineering (3-6 Credits)
Typically offered Fall, Spring, and Summer terms
Supervised by faculty, this course examines engineering fundamental or applied research in biomedical engineering. Conferences are scheduled. Master's degree candidates are required to submit three unbound copies of their reports to advisers one week before the last day of classes. | Prerequisite: Degree status.
Grading: Grad Poly Graded
Repeatable for additional credit: Yes

BE-GY 997X MS THESIS IN BIOMEDICAL ENGINEERING (3-9 Credits)
Typically offered Fall, Spring, and Summer terms
The thesis for the master's degree in biomedical engineering should report the results of an original investigation of problems in biomedical engineering or application of physical, chemical or other scientific principles to biomedical engineering. The thesis may involve experimental research, theoretical analyses or process designs, or combinations of them. Master's degree candidates are required to submit four unbound copies to advisers before the seventh Wednesday before commencement. Registration of at least 9 credits required. | Prerequisite: Degree status.
Grading: Satisfactory/Unsatisfactory
Repeatable for additional credit: Yes

BE-GY 998X Research in Biomedical Engineering (3-9 Credits)
Typically offered occasionally
Students will be allowed to pursue for academic credit arranged, original experimental or theoretical research, undertaken under the guidance of a CBE or approved faculty member, that may serve as the basis for the PhD degree before passing their doctoral qualifying examinations in Biomedical Engineering [BME]. The student will only be allowed to register for 3 up to a maximum of 9 credits. Upon passing their qualifying exam these credits will be counted as part of the dissertation credit requirement for the BME PhD degree. | Prerequisites: Admission into BME PhD degree program and approval of PhD program director and thesis advisor.
Grading: Satisfactory/Unsatisfactory
Repeatable for additional credit: Yes

BE-GY 999X PHD DISSERTATION IN BIOMEDICAL ENGINEERING (3-9 Credits)
Typically offered Fall, Spring, and Summer terms
Theses for the PhD degree must give results of independent investigations of problems in biomedical engineering and may involve experimental or theoretical work. Theses must show ability to do creative work and must show that original contributions, worthy of publication in recognized journals, are made to biomedical engineering. Candidates are required to take oral examinations on thesis subjects and related topics. Doctoral-degree candidates must submit five unbound thesis copies to advisers before or on the seventh Wednesday before commencement. | Prerequisite: Passing grade in RE-GY 9990 Phd Qualifying Exam, and Adviser's approval
Grading: Satisfactory/Unsatisfactory
Repeatable for additional credit: Yes
Prerequisites: RE-GY 9990 AND Restriction: (Academic Plan = OR PHD Biomedical Engineering-PHD).

BE-GY 6003 PRIN OF BIOLOGICAL SYSTEMS (3 Credits)
Typically offered not typically offered
Physiology is defined as the science that deals with the functions of the body. It logically follows, therefore, that a sound, comprehensive knowledge of human physiology should occupy a significant part of the academic training of personnel in medicine and related fields. The emphasis is on normal functions, but also considers the consequences of disease and injury, and deal with the body's potential for recovery and for compensation. Behavioral responses to environmental conditions are considered, but in this area our chief concern will be with the regulation and control of fundamental reflexes or neuro-endocrine mechanisms. Prerequisite: none, although some background of biochemistry and gross and cellular anatomy would be helpful.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6013 Molecular Immunology (3 Credits)
Typically offered occasionally
This course familiarizes students with the body of research that underpins the present understanding of the molecular basis and the cellular interactions that regulate the immune responses. The principal learning tool is the reading and discussion of research papers in immunology by a small group of students supervised by a faculty member, who is active in the specific research area. Topics covered include antibody structure, B-cell development, T-cell structure and development, T-cell-MHC interaction, MHC structure and antigen processing, complement chemistry, complement and Fc receptor structure and function, transplantation immune-genetics, mucosal immunology and allergic reactions. | Prerequisite: Undergraduate biochemistry.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6015 GUIDED STUDIES IN BIOENGR (1.5 Credits)
Typically offered occasionally
Under faculty supervision, students study selections, analyses, solutions and presentations of biomedical engineering reports for problems in products, processes or equipment design, or other fields of biomedical-engineering practices. Conferences are scheduled. Masters degree candidates are required to submit three unbound copies of their reports to advisers one week before the last day of classes.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6023 Cellular and Molecular Neuroscience (3 Credits)
Typically offered not typically offered
This course provides a comprehensive overview of cellular neuroscience and consists of 20 lectures and two exams. The course is divided into three parts: (1) the physiology and biophysics of neurons; (2) neuronal signal transduction, gene expression and transport of RNA and protein; and (3) synaptic transmission and plasticity. The textbook is Fundamental Neuroscience by Zigmond, Bloom, Landis, Roberts and Squire. Supplementary readings are from other textbooks and journal articles. | Prerequisites: CM-GY 9506 or its equivalent and undergraduate biochemistry.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6103 ANATOMY, PHYSIOLOGY, & BIOPHYSICS I (3 Credits)
Typically offered Fall
Anatomy and Physiology are the sciences that identify body structures and how they function and interact, respectively. Therefore, academic training for biomedical engineering must include a sound, comprehensive knowledge of human anatomy and physiology. While the course emphasizes normal functions, it also considers the consequences of disease and injury and deals with the body's potential for recovery and compensation. The Biophysics' component examines the underlying physical principles of organ function. Part I of this two-part sequence focuses on Cell Physiology and Homeostasis, Cardiac, Nervous, and Respiratory systems. The course will be taught using a "systems engineering" approach and introduce the design considerations for artificial organs. The material includes hands-on demonstration of technology to measure EEGs, EKG and respiratory function.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6113 ANATOMY, PHYSIOLOGY, & BIOPHYSICS II (3 Credits)
Typically offered Spring
Part II of this sequence focuses on the muscular, skeletal, renal and endocrine systems and includes discussions on skin and basic oncology. This part is taught using a "systems" approach and link concepts from BE-GY 6013. The material includes hands-on demonstration of technology to measure EMG. | Prerequisites: BE-GY 6013.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6203 Biomedical Imaging I (3 Credits)
Typically offered Fall
This course introduces the physics, instrumentation and signal-processing methods used in X-ray imaging (projection radiography), X-ray computed tomography, nuclear medicine (SPECT/PET), ultrasound imaging and magnetic resonance imaging. Also listed under: EL-GY 6813 Prerequisites: Undergraduate level courses in multivariable calculus (MA-UY 2112 & MA-UY 2122 or MA-UY 2114), physics (PH-UY 2033), probability (MA-UY 3012), signals and systems (EE-UY 3054). Students who do not have prior courses in signals ans systems must take EL-GY 6113 / BE-GY 6403 - Digital Signal Processing I as a prerequisite or must obtain instructor's approval; EL-GY 6123 - Image and Video Processing is also recommended but not required.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6213 Biomedical Imaging II (3 Credits)
Typically offered occasionally
This course introduces the mechanisms and concepts related to image acquisition and subsequent image processing and image formation in biomedical imaging modalities. Building on material covered in Biomedical Imaging I, these courses focus on advanced topics such as functional magnetic resonance imaging (MRI), ultrasound imaging, biomagnetic imaging and optical tomographic imaging (OTI). Co-listed as EL-GY 6823. | Prerequisite: BE-GY 6203 (Biomedical Imaging 1, B).
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6253 Biosensors (3 Credits)
Typically offered not typically offered
This course discusses various biosensors, which consist of bio-recognition systems, typically enzymes or binding proteins such as antibodies immobilized onto the surface of physico-chemical transducers. Immuno-sensors, which use antibodies as their biorecognition system, are also discussed. Other bio-recognition systems covered are nucleic acids, bacteria and whole tissues of higher organisms. Specific interactions between the target analyte and the complementary bio-recognition layer that undergoes a physicochemical change are ultimately detected and measured by the transducer. Various transducers, which can take many forms depending upon the parameters measured (electrochemical, optical, mass and thermal changes) are also covered. | Prerequisite: CM-UY 1004, CM-UY 2214, CM-UY 2614 and CM-GY 9413.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6303 Bio-optics (3 Credits)
Typically offered Fall
Recent growth in using optics technology for biomedical research and health care has been explosive. New applications are made possible by emerging technologies in lasers, optoelectronic devices, fiber optics, physical and chemical sensors and imaging—all of which are now applied to medical research, diagnostics and therapy. This sequence course on optics for biomedical students combines fundamental knowledge of the generation and interaction of electromagnetic waves with applications to the biomedical field. The goal is for this approach is to provide tools for researchers in bio-physics and to familiarize researchers, technologists and premed students with cutting-edge approaches. | Prerequisite(s): An undergraduate course in physics that includes electricity, magnetism and waves such as PH-UY 2023, an undergraduate course in physics that includes electricity, magnetism and waves such as PH-UY 2023 and multivariable calculus such as MA-UY 2122 and MA-UY 2122.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6353 Special Topics in Biomedical Engineering (3 Credits)
Typically offered occasionally
Topics of special interest in Biomedical Engineering are announced before the semester in which they are offered. | Prerequisite: adviser's approval.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6403 Digital Signal Processing I (3 Credits)
Typically offered Fall and Spring
Discrete and continuous-time linear systems. Z-transform. Fourier transforms. Sampling. Discrete Fourier transform (DFT). Fast Fourier transform (FFT). Digital filtering. Design of FIR and IIR filters. Windowing. Least squares in signal processing. Minimum-phase and all-pass systems. Digital filter realizations. Matlab programming exercises.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6453 Probability and Stochastic Processes (3 Credits)
Typically offered Fall and Spring
Continuous and discrete random variables and their joint probability distribution and density functions; Functions of one random variable and their distributions; Independent random variables and conditional distributions; One function of one and two random variables; Two functions of two random variables and their joint density functions; Jointly distributed discrete random variables and their functions; Characteristic functions and higher order moments; Covariance, correlation, orthogonality; Jointly Gaussian random variables; Linear functions of Gaussian random variables and their joint density functions. Stochastic processes and the concept of Stationarity; Strict sense stationary (SSS) and wide sense stationary (WSS) processes; Auto correlation function and its properties; Poisson processes and Wiener processes; Stochastic inputs to linear time-invariant (LTI) systems and their input-output autocorrelations; Input-output power spectrum for linear systems with stochastic inputs; Minimum mean square error estimation (MMSE) and orthogonality principle; Auto regressive moving average (ARMA) processes and their power spectra. Co-listed as EL-GY 6303. | Prerequisites: Graduate status
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6463 Statistics for Biomedical Engineers (3 Credits)
Typically offered Fall and Spring
This course reviews various methods of analysis for biomedical data. Contents: population and sample, confidence interval, hypothesis test, Bayesian logic, correlation, regression, design of studies, t test, chi-square test, analysis of variance, multiple regression, survival curves. Multivariable Calculus knowledge required; Probability Theory knowledge is preferred.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6473 APPLIED MATHEMATICS AND STATISTICS FOR BIOMEDICAL ENGINEERING (3 Credits)
Typically offered Fall
This course introduces applied mathematics and advanced statistical methods commonly encountered in biomedical engineering, while covering probability theory to bridge between mathematics and statistics. The topics include: generalized linear mixed models, discrete-time models, stochastic processes, elements of information theory, time-series analysis, causality analysis, and rudiments of probability theory. Beyond structured learning in class, students will work on the analysis of real datasets from the biomedical fields. | Prerequisite: Basic knowledge of calculus
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6483 Digital Signal Processing Laboratory (3 Credits)
Typically offered Fall and Spring
This course includes hands-on laboratory experiments, lectures and projects relating to real-time, digital signal processing (DSP) systems using a DSP microprocessor. Students gain experience in implementing common algorithms used in a variety of applications and learn tools and functions important for designing DSP-based systems. Students are required to complete a project and give an oral presentation. This course is suitable for students interested in DSP and Embedded Systems. Co-listed with EL-GY 6183. | Prerequisites: EL-GY 6113 or Equivalent, C/C++.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6503 BIOMEDICAL INSTRUMENTATION (3 Credits)
Typically offered Spring
This course gives an overview on the theory, design and application of biomedical instrumentation used for dagnosis, monitoring, treatment and scientific study of physiological systems. The objective of this course is to enable students to design, build and test useful circuits, and to interface them with a computer using a data acquisition system for further signal analysis and processing. Cross-listed with BE-GY 6503. | Prerequisite: EE-UY 2024 or equivalent course in circuits, programming experience.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6513 BIOMEDICAL DEVICE DESIGN AND DEVELOPMENT (3 Credits)
Typically offered Fall
This course aims to provide the essential knowledge in the biomedical product development (e.g. material properties, fabrication processes and design techniques for different applications) in order to provide ways to speed up the product development cycle. This course is multidisciplinary and covers the principles in mechanical, chemical, biological, and physiological aspects. Students can learn the techniques to apply the acquired knowledge of biomedical device design, prototyping, and manufacturing for particular applications they are interested. | Prerequisite: Advisor's Approval
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6523 BIOMEMS AND MICROFLUIDICS (3 Credits)
Typically offered Fall
This course targets to: (1) introduce fundamental design and microfabrication concepts of BioMEMS, microfluidics and lab-on-chip systems, (2) expose students to the relevant biomedical and biological applications. The course is divided into four main sections: (i) BioMEMS/Microfluidic materials and microfabrication, (ii) Statistics and modeling for BioMEMS, (iiI) BioMEMS sensors and actuators, and (iv) Microfluidic and Lab-on-chip systems. | Prerequisites: Adviser's approval
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6601 INTRODUCTION TO DRUG DELIVERY (1.5 Credits)
Typically offered not typically offered
This course introduces drug-delivery science focusing on the historical development of delivery methods, pharmacokinetics and pharmacodynamics of drug-delivery systems, routes of administration, devices for drug delivery and, briefly, on various targeting methods and delivery of gene- and protein-based therapeutics. | Prerequisite: BTE-GY 6013 Biotechnology and the Pharmaceutical Industry or adviser's approval.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6603 Drug Delivery (3 Credits)
Typically offered Fall
The course provides an integrated approach to the basic and clinical science of drug delivery. Topics: the history drug delivery; kinds of drugs to be delivered, including genes and proteins; various targeting mechanisms; transport phenomena and thermodynamic concepts; pharmacokinetics and pharmacodynamics of drug delivery, polymeric drug-delivery systems; various devices developed for controlled delivery. | Prerequisite: calculus with ordinary diff. eq.; undergraduate courses in biology, chemistry and physiology (minimum grade B).
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6653 Principles of Chemical and Biochemical Systems (3 Credits)
Typically offered not typically offered
This is an introductory course that is restricted for graduate students who have not had any undergraduate chemistry courses. It focuses on fundamental knowledge of chemical and biochemical reactions. Students learn structure and function of biological molecules such as proteins, carbohydrates and DNA. They master basic concepts of structure-property relationships of macromolecules. Chemistries critical to biosensor technologies such as linking biological molecules to various supports, is described. Students appreciate and understand the wide range of chemical and biological molecules critical to living systems. | Prerequisite: Instructor's permission.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6723 Natural Polymers and Materials (3 Credits)
Typically offered occasionally
The course introduces natural and biomimetic polymers. It is taught with an interdisciplinary view of biology, chemistry and macromolecular science. Topics covered include natural building blocks and methods by which nature carries out polymer synthesis and modification reactions, DNA, structural proteins, plant proteins, polysaccharides, polyesters, biosurfactants, polymers built from natural monomers and a wide variety of renewable resources, uses of these polymers as fibers, films, rheological modifiers, flocculants, foams, adhesives and membranes, and special applications of natural polymers in medicine and as biodegradable plastics. | Co-listed as CM-GY 7923. Prerequisite: CM-UY 1004 and BMS-UY 1004.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6753 Orthopedic Biomechanics and Biomaterials (3 Credits)
Typically offered Spring
The course provides fundamental knowledge of the relevant background science, theory, practice and materials required to provide modern orthopedic and trauma care. Students learn about biomaterials used in orthopedics and how materials engineering has made them increasingly sophisticated. The course covers important clinical applications as well as fundamental concepts in biomechanics of bone and other tissues; materials used; wear and corrosion during use; dental implants; joint-replacement devices; stress-strain analysis, beam theory; introduction to finite element analysis design for prosthesis; and more. | Prerequisite: Calculus with ordinary diff. eq.; BE-GY 6703 Materials in Medicine.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6763 REHABILITATION ENGINEERING (3 Credits)
Typically offered Spring
This course will provide the student with fundamental knowledge of theory and practice in rehabilitation engineering. Based on an understanding of the pathophysiological processes that lead to disability, students will be introduced to medical, physiological, and psychological considerations in the design of rehabilitative interventions and learn to implement analytical methods for the evaluation of human performance in rehabilitation medicine applications. | Prerequisites: Basic knowledge of human anatomy, physiology, statics and dynamics, and adviser's approval
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6783 BIOMECHANICS FOR BIOMEDICAL ENGINEERS (3 Credits)
Typically offered Spring
Biomechanics offers contemporary topics on applications of linear and nonlinear solid mechanics to biological tissues, biomedical device design and intervention. The course will be composed of two parts: (1) theoretical aspects of biomechanics including kinematics, stress, and elastic material models that are related to modeling of biological tissue behavior; 2) review and discussion of clinical and engineering journal papers related to disease treatment and modeling. | Prerequisites: Undergraduate biomechanics course or instructor's consent
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 6803 Biomaterials: Engineering Principles and Design Consideration (3 Credits)
Typically offered Fall
This course will provide the student with an overview of the techniques used to evaluate and design with materials used in biomedicine in the context of reconstructing, repairing, replacing or augmenting diseased or injured tissue or organs in the human body. | Prerequisites: Calculus I, Calculus II and Ordinary Differential Equations. Course objective: 1. Introduce the concepts of CAD/FEA used with the design of non-orthopedic devices that interface to the neurologic and cardiovascular systems. 2. To present the various classes of biomaterials such as metals, ceramics, man-made polymers and those derived from nature. 3. To simulate and identify the pertinent interactions between materials and composites with living tissue and their durability. 4. To give specific examples for the design of an artificial organ, i.e. artificial heart.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 8103 SYSTEMS & COMPUTATIONAL SIMULATION FOR BIOMEDICAL ENGINEERING (3 Credits)
This course provides an introduction to numerical methods commonly used in biomedical engineering to simulate various systems and processes. Students will learn to apply computational methods to solve problems encountered in various areas, such as biomechanics, computational physiology, drug delivery, tissue engineering, medical imaging, and biomedical signal processing. The course emphasizes hands-on implementation and practical applications to solve real-world biomedical engineering problems.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 8203 Biomedical Modeling, Estimation and Control (3 Credits)
Typically offered Spring
The introductory course provides the mathematical basis for modeling biomedical systems using state-space methods for analysis and design of biomedical systems with feedback loops. Mathematical tools will be developed to analyze and design biomedical systems expressed as coupled ordinary linear differential equations. State-space methods enable us to analyze and design multi- input/multi-output systems in time domain. The focus will be on the properties of state-space equations for stability analysis, estimator, and control design to be utilized for biomedical applications and brain-machine interfaces. The course will mostly concentrate on linear systems. This is a graduate class and knowledge of Probability theory, Signal processing (ECE-UY 3054: Signals and Systems or equivalent), linear algebra, and MATLAB are prerequisites. | Prerequisites: Graduate students; Adviser's approval
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 9433 PROTEIN ENGINEERING (3 Credits)
Typically offered occasionally
This course introduces the modern protein engineering techniques that allow researchers to understand protein structure and function and to create new proteins for many purposes. This new field is at the interface of chemistry, biology and engineering. The first part of the course discusses the protein composition and structure, various genetic, biochemical and chemical techniques required to engineer proteins, which is followed by specific topics. Topics include designing proteins that are highly structured; that are active at high temperatures and in non-aqueous solvents; that interact selectively with other proteins, small molecules and nucleic acids for therapeutic purposes; and that catalyze new reactions. | Prerequisite: CM-GY 9413 or adviser's approval.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 9443 Tissue Engineering (3 Credits)
Typically offered Fall
This courses teaches basic biological processes that occur during blood contact with artificial surfaces; how to critically read and review literature on tissue engineering; how to anticipate biocompatibility issues with a variety of implant devices students may later encounter; current approaches directed toward the engineering of cell-based replacements for various tissue types. | Prerequisite: Adviser's approval.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 9453 ENGINEERING TISSUE REGENERATION (3 Credits)
Typically offered Spring
This course presents engineering design principles for stimulation and control of tissue repair through regenerative mechanisms. Based on approaches for control of cell differentiation and growth, the application of engineering to the modeling and design of systems, agents, and processes to stimulate regenerative repair of tissues will be discussed. Example topics such as stem cell delivery and microenvironment design; drug and gene delivery; role of signaling pathway modulation; extracellular vesicle-mediated communication; signaling via electrical, mechanical, and fluid transport control will be discussed. | Prerequisites: Biochemistry highly recommended and adviser's approval
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 9503 ENZYME CATALYSIS IN ORGANIC SYNTHESIS (3 Credits)
Typically offered occasionally
Provides students with a working knowledge of how to use biotransformations as a tool in organic chemistry. Students will learn about general enzymatic reaction types that carry out the cleavage and formation of C-O bonds, P-O bonds, C-N bonds, C-C bonds, reduction reactions, oxidation reactions and isomerizations. In addition, students will be taught about advanced principles that are currently being applied to the engineering of catalytic proteins. Co-listed as CM-GY 9053. | Prerequisite: CM-UY 2214, CM-UY 2614 and CM-UY 3314.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 9603 Neural and Physiological Signal Processing (3 Credits)
Typically offered Fall
This advanced-topic course will present signal processing and statistical methods used to study neural systems and analyze pulsatile physiological signals. Core topics include state-space modeling, state-space estimation, Kalman filtering, theory of point processes, estimation of point processes, maximum likelihood estimation, expectation maximization, point process filtering and smoothing, and sparse signal processing. Emphasis on developing a firm conceptual understanding of advanced signal processing and statistical methods primarily through analysis of experimental data in form of a course project. Applications of these theoretical techniques include dynamic analyses of neural encoding, neural spike train decoding, and pulsatile physiological data analysis. This is an advanced graduate class and knowledge of Probability theory, Signal processing, and MATLAB are prerequisites. | Prerequisites: Graduate Students, advisor's approval
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 9730 Colloquium in Biomedical Engineering (0 Credits)
Typically offered Fall and Spring
Engineers and scientists from industry and academia present recent developments in biomedical engineering. Students will be required to attend the department colloquium series each semester.
Grading: Grad Poly Pass/Fail
Repeatable for additional credit: Yes

BE-GY 9740 Seminar in Biomedical Engineering (0 Credits)
Typically offered Fall and Spring
Students present research findings if engaged in MS or PhD thesis research, or make presentations from their critical analysis of recent biomedical-engineering publications. The seminar gives students the opportunity to prepare a scientific presentation on a biomedical-engineering topic of interest and to speak before their peers, who will question them. Two and four semesters are required for master's and PhD students, respectively.
Grading: Grad Poly Pass/Fail
Repeatable for additional credit: Yes

BE-GY 9753 BIOETHICS SEMINAR (3 Credits)
Typically offered Spring
This graduate-level seminar course discusses the ethical issues relevant to today's bioengineers and molecular and cell biologists. Topics include: Darwin's theory of evolution; science and religion in twentieth-century America; Intelligent Design Theory; social Darwinism and the concomitant rise of eugenics in Europe and the U.S., the ways in which molecular genetics has challenged historical categories of race; the ethical, social, and legal implications of the Human Genome Project (specifically genetic privacy and testing, human genes and intellectual property); argo-biotechnology and the science, ethics, and politics of genetically modified organisms (GMOs); and the science, politics, and ethics of human-embryonic-stem-cell research. The student is encouraged to think about the way in which debates concerning "nature versus nurture" have been framed historically, in order to understand current controversies over that distinction.
Grading: Grad Poly Graded
Repeatable for additional credit: No

BE-GY 9763 REGULATORY ISSUES SURROUNDING MEDICAL DEVICES (3 Credits)
Typically offered Fall and Spring
Medical devices are developed, manufactured, and distributed in a highly regulated environment. This course primarily concerns the processes for obtaining FDA marketing approval or clearance for biomedical devices. Prior to marketing a medical device in the US, a specific governmental approval or clearance is required depending on the type of device and the risk associated with the device. | Prerequisite: Instructor and adviser's approval.
Grading: Grad Poly Graded
Repeatable for additional credit: No