Biomedical Engineering (BME)

Courses

BME 101. Introduction to Biomedical Engineering. 3 hours.
Principles, practice, and the role of biomedical engineers in science, engineering, and commercialization of medical products. Professional ethics, career paths, introduction to graphical design tools and instrumentation. Course Information: Credit is not given for BME 101 if the student has credit in BIOE 101. Previously listed as BIOE 101.

BME 102. Biomedical Engineering Freshman Seminar. 1 hour.
Exposure to biomedical engineering research through attendance of graduate student seminars followed by faculty-mediated discussion. Writing seminar summaries, student shadowing, articulating long-term goals, and planning an academic trajectory. Course Information: Satisfactory/Unsatisfactory grading only. Previously listed as BIOE 102. Restricted to first year Biomedical Engineering students (freshmen or transfer students).

BME 194. Special Topics in Biomedical Engineering I. 1-5 hours.
Special topics to be arranged. Course topics aimed at first-year students. Course Information: May be repeated. Students may register in more than one section per term.

BME 205. Biomedical Engineering Thermodynamics. 3 hours.
Introduction to equilibrium and non-equilibrium thermodynamics, with emphasis on non-equilibrium (living) systems. Applications include thermodynamics of living cells and the lung, molecular energy exchange, and energy exchange in exercise. Course Information: Previously listed as BIOE 205. Credit is not given for BME 205 if the student has credit in BIOE 205 or CHE 201 or ME 205. Prerequisite(s): PHYS 141.

BME 240. Modeling Physiological Data and Systems. 3 hours.
Computational tools and techniques for models and statistics used to describe, interpret and analyze physiological data and systems. Time series, image and population data types. Course Information: Previously listed as BIOE 240. Credit is not given for BME 240 is students have credit for BIOE 240. Prerequisite(s): BIOS 110; and MATH 180; and CS 109.

BME 250. Clinical Problems in Biomedical Engineering. 3 hours.
Examination of three current problems in biomedical engineering. Student teams work with a faculty facilitator toward each solution. Problem identification, strategic planning, brainstorming, information gathering, and reporting. Course Information: Credit is not given for BME 250 if the student has credit in BIOE 250. Previously listed as BIOE 250. Prerequisite(s): Credit or concurrent registration in BIOE 101 and Credit or concurrent registration in BIOE 102; or Credit or concurrent registration in BME 101 and Credit or concurrent registration in BME 102.

BME 294. Special Topics in Biomedical Engineering II. 1-5 hours.
Special topics to be arranged. Course topics aimed at second-year students. Course Information: May be repeated. Students may register in more than one section per term.

BME 310. Biological Systems Analysis. 3 hours.
Modeling of physiological system dynamics using frequency and Laplace domain methods, as well as their computational implementation in Matlab. Measurement of physiological system dynamics. Course Information: Previously listed as BIOE 310. Credit is not given for BME 310 if the student has credit in BIOE 310 or ECE 310 or ME 312.Prerequisite(s): MATH 220 and MATH 310; and BIOE 240 or BME 240.

BME 325. Biotransport. 3 hours.
Transport phenomena in biomedical engineering and living systems, specifically processes vital to the design of medical devices for artificial clinical intervention. Topics include circulatory system dynamics and modeling of physiological systems. Course Information: Previously listed as BIOE 325. Credit is not given for BME 325 if students have credit in BIOE 325. Prerequisite(s): BIOS 110 and MATH 220 and BME 205; and Credit or concurrent registration in MATH 310.

BME 332. Bioinstrumentation and Measurements I. 3 hours.
Theory and application of instrumentation used for physiological and medical measurements. Characteristics of physiological variables, signal conditioning devices and transducers. Course Information: Previously listed as BIOE 430. Prerequisite(s): BIOS 110 and ECE 210; and Credit or concurrent registration in BME 310.

BME 333. Bioinstrumentation and Measurement Laboratory I. 2 hours.
Practical experience in the use of biomedical instrumentation for physiological measurements. Course Information: Previously listed as BIOE 431. Prerequisite(s): Credit or concurrent registration in BME 332.

BME 339. Biostatistics I. 3 hours.
Statistical treatment of data and model estimation treated in a framework of biological experiments, and attributes of data generated from such experiments. Experimental design is included. Course Information: Credit is not given for BME 339 if the student has credit in BIOE 339. Previously listed as BIOE 339. Extensive computer use required. Prerequisite(s): MATH 210; and BME 240. Recommended background: Excel and MATLAB.

BME 391. Biomedical Engineering Practicum. 1 hour.
Provides students with the opportunity to apply the skills and knowledge gained in previous engineering courses within a professional, working environment. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. A maximum of 3 hours awarded toward degree requirements. Prerequisite(s): Approval of the Department.

BME 394. Special Topics in Biomedical Engineering III. 1-5 hours.
Special topics to be arranged. Course topics aimed at third-year students. Course Information: May be repeated. Students may register in more than one section per term.

BME 396. Senior Design I. 3 hours.
Design considerations for biomedical devices emphasizing traditional engineering design concepts. Course Information: Previously listed as BIOE 396. Credit is not given for BME 396 if the student has credit in BIOE 396. Prerequisite(s): Credit or concurrent registration in BME 332 and Credit or concurrent registration in BME 333 and Credit or concurrent registration in BME 339; and BME 250.

BME 397. Senior Design II. 3 hours.
Application of principles of engineering and engineering design methodology to the solution of a large scale biomedical engineering design problem. Course Information: Credit is not given for BME 397 if the student has credit in BIOE 397. Previously listed as BIOE 397. Prerequisite(s): BME 396; and BME 332 and BME 333 and BME 339.

BME 398. Undergraduate Research. 0-5 hours.
Research under the close supervision of a faculty member. Course Information: May be repeated. Students may register in more than one section per term. Prerequisite(s): Consent of the instructor.

BME 399. Professional Development for Biomedical Engineers. 0 hours.
Career options, career planning, and job search skills relevant to bioengineers. Formal and informal networking, on-line resources, resume and portfolio preparation, interview skills. Special issues relevant to international students. Course Information: Satisfactory/Unsatisfactory grading only. Previously listed as BIOE 399. Prerequisite(s): Open only to juniors; or consent of the instructor.

BME 402. Medical Technology Assessment. 2 or 3 hours.
Assessment of medical technology in the context of commercialization. Objectives, competition, market share, funding, pricing, manufacturing, growth, and intellectual property; many issues unique to biomedical products. Course Information: Previously listed as BIOE 402. Prerequisite(s): BIOE 250 or BME 250; and junior standing or above.

BME 403. Quality Assurance for Medical Products. 2 or 3 hours.
Requirements for current good manufacturing practices and quality assurance in the design and manufacture of medical devices. Course Information: 2 undergraduate hours. 3 graduate hours. Previously listed as BIOE 403. Prerequisite(s): BIOE 250 or BME 250; and junior standing or above.

BME 407. Pattern Recognition I. 3 or 4 hours.
The design of automated systems for detection, recognition, classification and diagnosis. Parametric and nonparametric decision-making techniques. Applications in computerized medical and industrial image and waveform analysis. Course Information: Same as ECE 407. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ECE 341 or BME 339 or IE 342 or STAT 381.

BME 408. Medical Product Development. 2 or 3 hours.
Bioentrepreneur course. Major stages of medical product development (investigative, feasibility, development, commercialization, maturation and growth), regulatory issues, product performance, failure mode and effect analysis, hazard analysis. Course Information: 2 undergraduate hours. 3 graduate hours. Previously listed as BIOE 408. Prerequisite(s): Prerequisite(s): BIOE 250 or BME 250; and junior standing or above.

BME 410. FDA and ISO Requirements for the Development and Manufacturing of Medical Devices. 3 or 4 hours.
FDA Performance Standard for General Medical Devices for manufacturing and development engineers. Product requirement definition, design control, hazard analysis, failure mode and effect analysis, regulatory submission, product tests, ISO 9001. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 410. Prerequisite(s): BIOE 250 or BME 250; and junior standing or above.

BME 415. Biomechanics. 3 or 4 hours.
Continuum mechanics of cells, tissues and organs. Statics and force balances; stress, strain and constitutive relations; equilibrium, universal solutions and inflation; finite deformation; nonlinear problems; finite element methods. Course Information: 3 undergraduate hours. 4 graduate hours. Credit is not given for BME 415 if the student has credit in BIOE 415. Previously listed as BIOE 315. Prerequisite(s): BIOE 310 or BME 310.

BME 421. Biomedical Imaging. 3 or 4 hours.
Introduction to engineering and scientific principles associated with X-ray, magnetic resonance, ultrasound, computed tomographic and nuclear imaging. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 421. Credit is not given for BME 421 if the student has credit in BIOE 421. Prerequisite(s): MATH 220 and MATH 310.

BME 422. Magnetic Resonance Imaging: Theory and Practice. 3 or 4 hours.
Fundamental priciples of magnetic resonance imaging (MRI) from a signal processing perspective. Focus on image acquisition, formation, and analysis. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 422. Prerequisite(s): BIOE 310 or BME 310 or ECE 310.

BME 423. Biomedical Imaging Laboratory. 2 hours.
Acquisition and processing of biomedical imaging data. Relaxation time-based magnetic resonance imaging, motion sensitive magnetic resonance imaging, computed tomography, ultrasound, nuclear medicine imaging and optical imaging. Course Information: Previously listed as BIOE 423. Extensive computer use required. Prerequisite(s): Credit or concurrent registration in BIOE 421 or BME 421.

BME 432. Bioinstrumentation and Measurements II. 3 or 4 hours.
Principles of bioinstrumentation for the assessment of physiological function and therapeutic intervention. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 432. Prerequisite(s): BME 332.

BME 433. Bioinstrumentation and Measurements II Laboratory. 1 hour.
Laboratory experiments using instruments to assess physiological function. Course Information: Previously listed as BIOE 433. Prerequisite(s): Credit or concurrent registration in BME 432.

BME 439. Biostatistics II. 4 hours.
Statistical treatment of data, model estimation, and inference are treated in a framework of biological experiments and attributes of data generated from such experiments. Course Information: Credit is not given for BME 439 if the student has credit for BSTT 400. Previously listed as BIOE 439. Extensive computer use required. Prerequisite(s): BIOE 339 or BME 339. Recommended background: Knowledge of MATLab.

BME 450. Molecular Biophysics of the Cell. 4 hours.
Introduction to force, time energies at nanometer scales; Boltzmann distribution; hydrodynamic drag; Brownian motions; DNA, RNA protein structure and function; sedimentation; chemical kinetics; general aspects of flexible polymers. Course Information: Prerequisite(s): PHYS 245 or the equivalent; or approval of the department.

BME 452. Biocontrol. 3 or 4 hours.
Considers the unique characteristics of physiological systems using the framework of linear systems and control theory. Static and dynamic operating characteristics, stability, and the relationship of pathology to control function. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 452. Prerequisite(s): BIOE 310 or BME 310.

BME 455. Introduction to Cell and Tissue Engineering. 3 or 4 hours.
Foundation of cell and tissue engineering covering cell technology, construct technology, and cell-substrate interactions. Emphasis in emerging trends and technologies in tissue engineering. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 455. Prerequisite(s): BIOE 460 or BME 460; and BIOS 320 or BIOS 343 or BIOS 452.

BME 456. Cell & Tissue Laboratory. 2 hours.
Includes polymer scaffold fabrication, microstamping biomolecules, cellular adhesion and proliferation assays, and immo/fluorescent tagging. Course Information: Previously listed as BIOE 456. Prerequisite(s): Credit or concurrent registration in BIOE 455 or Credit or concurrent registration in BME 455; or consent of the instructor.

BME 460. Materials in Biomedical Engineering. 3 or 4 hours.
Analysis and design considerations of problems associated with prostheses and other implanted biomedical devices. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 460. Prerequisite(s): CME 260; and BIOS 220 or BIOS 222 or BIOS 286 or BIOS 340 or PSCH 262 or CHEM 232.

BME 462. Introduction to Dental Clinical Research and Technology. 3 or 4 hours.
Dental implants, biomaterials, biomechanics, tissue engineering, oral surgery, orthodontics, endodontics, nanomedicine, simulators and ADEA certifications, digital dentistry, virtual and augmented reality. Course Information: 3 undergraduate hours. 4 graduate hours. Extensive computer use required. Prerequisite(s): CME 260; or consent of the instructor.

BME 470. Biomedical Optics. 3 or 4 hours.
Physical principles and instrumentation relevant to the use of light in biomedical research. Several current and developing clinical applications are explored. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 470. Prerequisite(s): PHYS 142.

BME 471. Biomedical Optical Imaging. 3 or 4 hours.
Fundamentals of light-matter interactions, geometric optics, nonlinear optics, ultra-fast lasers, photodetectors, light microscopy, supper-resolution imaging, photoacoustic tomography, optical coherence tomography, functional optical imaging. Course Information: 3 undergraduate hours. 4 graduate hours. Credit is not give for BME 471 if the student has credit in BIOE 471. Previously listed as BIOE 471. Prerequisite(s): PHYS 142 and BIOS 110.

BME 472. Models of the Nervous System. 3 or 4 hours.
Mathematical models of neural excitation and nerve conduction, stochastic models and simulation of neuronal activity, models of neuron pools and information processing, models of specific neural networks. Course Information: 3 undergraduate hours. 4 graduate hours. Credit is not given for BME 472 if students have credit in BIOE 472. Previously listed as BIOE 472. Prerequisite(s): BIOE 310 or BME 310; and Credit or concurrent registration in BIOS 484.

BME 475. Neural Engineering I: Introduction to Hybrid Neural Systems. 3 or 4 hours.
Modeling and design of functional neural interfaces for in vivo and in vitro applications, electrodes and molecular coatings, neural prostheses and biopotential control of robotics. Course Information: Same as BIOS 475. 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 475. Prerequisite(s): BIOE 472 or BME 472.

BME 476. Neural Engineering I Laboratory. 2 hours.
Hands-on experience with computational and experimental models of engineered neural systems, with emphasis on neuroprostheses and biosensors. Course Information: Previously listed as BIOE 476. Animals used in instruction. Prerequisite(s): Credit or concurrent registration in BIOE 475 and BIOE 430 and BIOE 431; or Credit or concurrent registration in BME 475 and BME 332 and BME 333.

BME 479. Wearables and Nearables Technology Laboratory. 3 or 4 hours.
Practical experience in design and development of wearable and nearable devices. Acquisition and processing of sensors data. Design and development of user-friendly user interface. Course Information: Same as CS 479. 3 undergraduate hours; 4 graduate hours. Extensive computer use required. Prerequisite(s): BME 240; or CS 251; or consent of the instructor. Recommended background: ECE 210 and CS 109.

BME 480. Intro to Bioinformatics. 3 or 4 hours.
Computational analysis of genomic sequences and other high throughput data. Sequence alignment, dynamic programming, database search, protein motifs, cDNA expression array, and structural bioinformatics. Course Information: 3 undergraduate hours. 4 graduate hours. Credit is not given for BME 480 if the student has credit in BIOE 480. Prerequisite(s): BME 339 and MATH 310; and BIOS 220 or BIOS 222 or CHEM 232; or consent of the instructor.

BME 481. Bioinformatics Laboratory. 2 hours.
Teaches students how to use bioinformatics tools, including sequence alignment methods such as Blast, Fasta, and Pfam, as well as structural bioinformatics tools, such as Rasmol and CastP. Course Information: Extensive computer use required. Previously listed as BIOE 481. Credit is not given for BME 481 if the student has credit in BIOE 481. Prerequisite(s): Credit or concurrent registration in BME 480 or Credit in BIOE 480; and senior standing or above.

BME 483. Molecular Modeling in Bioinformatics. 3 or 4 hours.
Basic structural and dynamics tools in protein structure prediction, structure comparison, function prediction, Monte Carlo and molecular dynamics simulations. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 483. Prerequisite(s): Grade of B or better in BIOE 480 or Grade of B or better in BME 480.

BME 485. Nanobiosensors. 3 or 4 hours.
Fabrication and principles of operation for nanostructures used for biological sensing and analysis. Optical and electrical properties, use of biomolecules as active sensing elements. Course Information: 3 undergraduate hours. 4 graduate hours. Previously listed as BIOE 485. Prerequisite(s): BIOE 205 or BME 205; and BIOS 220 or BIOS 222 or BIOS 286 or BIOS 340 or CHEM 232 or PSCH 262; and PHYS 142.

BME 489. Human Augmentics. 3 or 4 hours.
Study of technologies for augmentation of human capabilities; human limitations; implants and wearable technologies; implants; brain-computer interfaces; exoskeletons; sensors and networks. Includes project work. Course Information: Same as CS 489. 3 undergraduate hours. 4 graduate hours. Extensive computer use required. Prerequisite(s): Grade of C or better in CS 251; or consent of the instructor.

BME 494. Special Topics in Biomedical Engineering IV. 1-5 hours.
Special topics to be arranged. Course topics aimed at fourth-year undergraduate and graduate students. Course Information: May be repeated. Students may register in more than one section per term. Previously listed as BIOE 494.

BME 496. Undergraduate Senior Design Thesis I. 0-8 hours.
Applying engineering design methodology to a large scale biomedical engineering design problem. Technical reports and presentations, literature survey and undergraduate thesis. Course Information: May be repeated. Credit only given to non-degree students. Extensive computer use required. Previously listed as BIOE 496. Prerequisite(s): Approval of the Department.

BME 497. Undergraduate Senior Design Thesis II. 0-8 hours.
Applying engineering design methodology to a large scale biomedical engineering design problem. Technical reports and presentations, literature survey and undergraduate thesis. Course Information: Credit only give to non-degree students. Previously listed as BIOE 497. Extensive computer use required. Prerequisite(s): Approval of the Department.

BME 504. Emerging Medical Technologies. 3 hours.
Investigates new and emerging medical technologies following the technical due diligence process, a methodical evaluation of strengths, weaknesses, opportunities and threats of the identified technology. Course Information: Previously listed as BIOE 504. Prerequisite(s): BIOE 410 or BIOE 402 or BIOE 403; or BME 410 or BME 402 or BME 403; or BIOE 494 or BME 494 or the equivalent.

BME 505. NanoBioTechnology. 4 hours.
Nanotechnology theory and applications in biology and medicine. Molecular simulations, combinatorial chemistry. Nanoscale structures, molecular building blocks, integrated nano-bio complexes. Positional and self-assembly, self-replication. Course Information: Recommended background: Engineering or physical sciences.

BME 514. Advanced Biotransport. 4 hours.
Diffusion and flow in living systems. Blood rheology and flow. Microcirculation, oxygen transport, diffusive transport across membranes. Membrane structure; water, and ion flows, active transport. Course Information: Same as CHE 514. Previously listed as BIOE 514. Prerequisite(s): BIOE 325 or equivalent or consent of the instructor.

BME 520. Elastography. 4 hours.
Theoretical foundations of elastography, viscoelasticity, propagation of mechanical waves, elastographic imaging techniques. Magnetic resonance imaging to magnetic resonance elastography data transformation, viscoelastic parameter reconstruction. Course Information: Same as ME 520. Extensive computer use required. Recommended background: BME 421 and BME 422 and BME 423.

BME 523. Mechanical Wave Motion in Medical Diagnostics and Imaging. 4 hours.
Mechanical (acoustical) wave theory in fluids and solids as applied to medical diagnostic and imaging methods that are governed by it. Auscultation, dynamic elastography, ultrasound imaging, photoacoustic imaging. Course Information: Extensive computer use required. Prerequisite(s): BME 421 or consent of the instructor.

BME 525. Phys & Cellular Biomech Forces. 4 hours.
Discuss how biomechanical forces are generated, the impact the forces have on cells and tissues, plus methods for studying them. Mechanisms by which cells may sense forces and transduce this information to the nucleus are also covered. Course Information: Credit is not given for BME 525 if the student has credit in BIOE 525. Previously listed as BIOE 525.

BME 530. Stats & Machine Learning. 4 hours.
Probability theory, parameter estimation, hypothesis testing, experimental design and power analysis for bioengineering problems. Supervised and unsupervised machine learning, dimensionality reduction, biological system model evaluation. Course Information: Credit is not given for BME 530 if the student has credit in BIOE 530. Previously listed as BIOE 530. Extensive computer use required. Prerequisite(s): MATH 310 or the equivalent. Recommended background: Programming skills with Matlab or R.

BME 532. Advanced Biological Systems Analysis. 4 hours.
Numerical integration, inversion, optimization, Markov chains, deconvolution and singular value decomposition applied to problems in conservation balances , diffusion and reaction networks, metabolic flux analysis, cell signaling, bio-image analysis. Course Information: Previously listed as BIOE 532. Extensive computer use required. Prerequisite(s: MATH 310; or consent of the instructor. Recommended background: Working knowledge of Matlab.

BME 534. Mathematical Foundations of Advanced Machine Learning. 4 hours.
Covers the mathematical foundations of important machine learning and data science methods commonly encountered in biomedical engineering (e.g. medical imaging, electrophysiological signal processing, and mobile/wearable sensing). Course Information: Extensive computer use required. Prerequisite(s): MATH 310; or consent of the instructor. Recommended background: BME 530.

BME 538. Numerical Analysis and Multiscale Modeling in Biological Systems. 4 hours.
Numerical approaches to systems of ordinary and partial differential equations in bioengineering. Advanced multiscale modeling techniques to bridge cellular and molecular scales with organ and tissue scales. Predictive models of biological function. Course Information: Extensive computer use required. Prerequisite(s): MATH 220 and MATH 310; and graduate standing; or consent of the instructor. Recommended background: Vector Calculus; Mechanics or Transport; and working knowledge of Matlab, or C, or Fortran programming.

BME 540. Biological Signal Analysis. 4 hours.
Analysis of signals of biological origin. Transient signals, stability and control, probabilities and stochastic processes, signal modeling, estimation and filtering, medical applications. Course Information: Credit is not given for BME 540 if the student has credit in BIOE 540. Previously listed as BIOE 440. Extensive computer use required.

BME 542. Quantitative Human Physiology. 4 hours.
Quantitative engineering approach to molecular and systems-level principles underlying major human organ systems. Cell transport, metabolism, excitable cells; cardiovascular, renal and respiratory physiology. Course Information: Prerequisite(s): Two courses in biology.

BME 548. Micro and Nanotechnology for Biomedical Applications. 4 hours.
Covers selected topics in micro- and nano-technology underlying biomedical applications; topics include: microfabrication and nanofabrication; microfluidic processes; neuroMEMS; nanoscale structures as functional bio-interfaces. Course Information: Previously listed as BIOE 548.

BME 562. Biomedical Implants in Orthopedics and Dentistry. 4 hours.
Advanced aspects of implant design, including biomaterials, surface coatings, biomechanics, corrosion, tribocorrosion, failure mechanisms, implant monitoring, clinical and regulatory concerns, critical review of current research. Course Information: Same as CME 562 and ME 562. Credit is not given for BME 562 if the student has credit in BIOE 562. Previously listed as BIOE 562. Prerequisite(s): BIOE 460 or BME 460.

BME 564. Advanced Biomaterials for Implants. 4 hours.
Biomaterials for implants that restore function. Performance and failure modes, biocompatibility, property retention following implantation. Applications include antimicrobial, drug delivery and sensor implants for a variety of tissues and organs. Course Information: Prerequisite(s): BME 460.

BME 568. Emerging Optical Imaging Technologies in Biomedicine. 1 hour.
Weekly discussion of new developments of biomedical optics technology and imaging instrumentation driven by recent published work. Course Information: May be repeated to a maximum of 4 hours.

BME 571. Biological Physics I. 4 hours.
Soft matter concepts applied to molecular and cellular biophysics: self-assembly, electrostatics, mechanics of biopolymers, properties of membranes, correlation functions, experimental and computational methods. Course Information: Same as PHYS 571. Prerequisite(s): PHYS 450 and upper-level undergraduate course in thermal and statistical physics or approval of the department.

BME 574. Human Movement and Neural Control. 4 hours.
Musculoskeletal biomechanics and neural control of human movement. Measurement of activity (e. g. EEG, fMRI, EMG, force sensors, motion tracking). Engineering skills for rigid body dynamics, quantitative analysis, modeling, control theory, motor learning. Course Information: Same as ME 574. Extensive computer use required. One hands-on lab/homework project. Recommended background: Physiology; working knowledge of Matlab; system dynamics and frequency-domain analysis (e.g. BME 310, ECE 310, ME 312 or equivalent).

BME 575. Neural Engineering II - Neural Coding. 4 hours.
Analytical techniques and models used to assess and predict neural activity. Emphasis on information coding in sensory systems. Course Information: Credit is not given for BME 575 if the student has credit in BIOE 575. Previously listed as BIOE 575. Prerequisite(s): Consent of the instructor. Recommended background: Working knowledge of Matlab.

BME 576. Sensory Prostheses Engineering. 4 hours.
Existing and emerging prosthetic devices for sensory systems damaged by trauma or disease. Physiology, technology, and information flow in hybrid systems. Visual, auditory, neuromuscular, haptic, olfactory, sensory substitution. Course Information: Previously listed as BIOE 576. Prerequisite(s): BIOE 475 or BME 475; or consent of the instructor.

BME 580. Principles of Bioinformatics. 4 hours.
Bioinformatics analysis of sequence, phylogeny, and molecular structure. Focus on probabilistic models and algorithms, as well as structural analysis. Course Information: Previously listed as BIOE 580. Extensive computer use required. Prerequisite(s): BIOE 480 or BME 480; and graduate or professional standing; or consent of the instructor. Recommended background: Exposure to biochemistry, molecular biology, or evolution.

BME 582. Computational Functional Genomics. 4 hours.
Modern statistical and computational methods relevant to functional genomics. Cell function, gene regulation and protein expression. Microarray technology and use; cluster analysis; prediction of protein function. Course Information: Previously listed as BIOE 582. Prerequisite(s): BIOE 480 or BME 480. Recommended background: Basic knowledge of probability, statistics, vector algebra, calculus and cell biology.

BME 586. Topics in Computational Cell Biology. 4 hours.
Theoretical foundation and computational methods for modeling in cell biology. Emphasis on the methods for simulating the two elementary processes underlying all cellular processes: chemical reactions and diffusion process. Course Information: Extensive computer use required. Prerequisite(s): MATH 220; or consent of the instructor.

BME 590. Internship in Biomedical Engineering. 1-4 hours.
Current clinical practice experience in a health care setting culminating in a written and oral report. Course Information: Satisfactory/Unsatisfactory grading only. Previously listed as BIOE 590.

BME 594. Advanced Special Topics in Biomedical Engineering. 1-4 hours.
Systematic review of selected topics in bioengineering theory and practice. Subjects vary from year to year. Course Information: May be repeated. Students may register in more than one section per term. Previously listed as BIOE 594. Prerequisite(s): Consent of the instructor.

BME 595. Seminar on Biomedical Engineering. 1 hour.
Recent innovations in biomedical engineering theory and practice presented by invited speakers, faculty and graduate students. Students will present seminars and provide feedback. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Previously listed as BIOE 595.

BME 596. Independent Study. 0-5 hours.
Research on special problems not included in thesis research. Course Information: May be repeated. Students may register in more than one section per term. Previously listed as BIOE 596. Prerequisite(s): Consent of the instructor.

BME 598. Masters Thesis Research. 0-16 hours.
Research in M.S. thesis project. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Students may register in more than one section per term. Previously listed as BIOE 598.

BME 599. Ph.D. Thesis Research. 0-16 hours.
Research in Ph.D. thesis project. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Students may register in more than one section per term. Previously listed as BIOE 599.