BIOMEDICAL ENGINEERING (GRADUATE GROUP)

College of Engineering

Blaine Christiansen, Ph.D., Chairperson of the Group

Group Office

2306B Genome & Biomedical Sciences Facility; 530-752-2611; Biomedical Engineering Graduate Group (https://bmegg.ucdavis.edu/); Faculty (https://bmegg.ucdavis.edu/faculty/)

Graduate Study

The Biomedical Engineering Graduate Group (BMEGG) offers programs of study and research leading to M.S. and Ph.D. degrees. The programs of study prepare students for professional work in the effective integration of engineering with medical and biological sciences. Research strengths lie in the areas of: bioelectricity & neuroengineering; biomaterials & devices; biomechanics & mechanobiology; bioimaging & biophotonics; computational & synthetic biology; and molecular, cellular & tissue engineering. Each student, together with an advisor, defines a specific course of study suited to individual goals.

Preparation

The BMEGG curriculum requires strong competence in mathematics, engineering, and biology for successful completion of study. Prior course work in these areas is emphasized in the evaluation of applications, though some undergraduate training can be acquired after admission to the BMEGG.

Courses

See Biomedical Engineering (https://catalog.ucdavis.edu/courses-subject-code/bim/).

Advising

See BMEGG Advising & Administration (https://bmegg.ucdavis.edu/advising-administration/).

- Biomedical Engineering, Master of Science (https://catalog.ucdavis.edu/departments-programs-degrees/biomedical-engineering-graduate-group/biomedical-engineering-ms/)
- Biomedical Engineering, Doctor of Philosophy (https://catalog.ucdavis.edu/departments-programs-degrees/biomedical-engineering-graduate-group/biomedical-engineering-phd/)

Biomedical Engineering (BIM)

BIM 201 — Scientific Communication for Biomedical Engineers (1 unit)

Course Description: Designed to improve the written and oral communication skills of first-year graduate students through writing fellowship proposals, analyzing data, and critically reviewing research papers.
Prerequisite(s): Consent of instructor.
Learning Activities: Lecture/Discussion 1 hour(s).
Grade Mode: Satisfactory/Unsatisfactory only.

BIM 202 — Cell & Molecular Biology for Engineers (4 units)

Course Description: Preparation for research and critical review in the field of cell and molecular biology for biomedical or applied science engineers Emphasis on biophysical and engineering concepts intrinsic to specific topics including receptor-ligand dynamics in cell signaling and function, cell motility, DNA replication and RNA processing, cellular energetics and protein sorting. Modern topics in bioinformatics and proteomics.
Prerequisite(s): BIS 104 or MCB 121.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 204 — Physiology for Bioengineers (5 units)

Course Description: Basic human physiology of the nervous, muscular, cardiovascular, respiratory, and renal systems and their interactions; Emphasis on the physical and engineering principles governing these systems, including control and transport processes, fluid dynamics, and electrochemistry.
Prerequisite(s): BIS 001A; or equivalent; graduate standing or consent of instructor.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 208Y — Towards Well-Being (2 units)

Course Description: Mental health issues, key elements in collaboration and team science, and select coping skills to deal with common graduate school stressors. Self-efficacy, resilience, problem-solving, conflict resolution, self-compassion, and role of psychosocial factors in well-being. Wellness topics in art therapy, interaction with nature, soothing sound/music, cooking, and walking. Mind-body activities. Extensive small group discussion.
Learning Activities: Web Electronic Discussion 1 hour(s); Lecture/Discussion 1 hour(s).
Grade Mode: S/U only.

BIM 209 — Scientific Integrity for Biomedical Engineers (2 units)

Course Description: Scientific integrity and ethics for biomedical engineers, with emphasis and discussion on mentoring, authorship and peer review, use of humans and animals in biomedical research, conflict of interest, intellectual property, genetic technology and scientific record keeping.
Learning Activities: Lecture 1 hour(s), Discussion 1 hour(s).
Enrollment Restriction(s): Open to Biomedical Engineering majors only.
Grade Mode: Satisfactory/Unsatisfactory only.

BIM 210 — Introduction to Biomaterials (4 units)

Course Description: Mechanical and atomic properties of metallic,ceramic, and polymeric implant materials of metallic, ceramic, and polymeric implant materials; corrosion, degradation, and failure of implants; inflammation, wound and fracture healing, blood coagulation; properties of bones, joints, and blood vessels; biocompatibility of orthopaedic and cardiovascular materials.
Prerequisite(s): ENG 045 or ENG 045Y; or consent of instructor.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 211 — Design of Polymeric Biomaterials & Biological Interfaces (4 units)

Course Description: Design, selection and application of polymeric biomaterials. Integration of the principles of polymer science, surface science, materials science and biology.
Prerequisite(s): ENG 045 or ENG 045Y; or consent of instructor.
Learning Activities: Lecture 4 hour(s).
Enrollment Restriction(s): Open to upper division undergraduates or graduate students.
Grade Mode: Letter.

BIM 212 — Biomedical Heat & Mass Transport Processes (4 units)

Course Description: Application of principles of heat and mass transfer to biomedical systems related to heat exchange between the biomedical system and its environment, mass transfer across cell membranes and the design and analysis of artificial human organs.
Prerequisite(s): EME 165; EBS 125; ECH 153; or equivalent.
Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).
Cross Listing: MAE 212.
Grade Mode: Letter.

BIM 213 — Principles & Applications of Biological Sensors (4 units)

Course Description: Biological sensors based on principles of electrochemical, optical and affinity detection. Methods for integration of sensing elements (e.g. enzymes) into biosensors and miniaturization of biosensors.
Prerequisite(s): CHE 002C.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 214 — Continuum Biomechanics (4 units)

Course Description: Continuum mechanics relevant to bioengineering. Concepts in tensor calculus, kinematics, stress and strain, and constitutive theories of continua. Selected topics in bone, articular cartilage, blood/circulation, and cell biomechanics will illustrate the derivation of appropriate continuum mechanics theories.
Prerequisite(s): BIM 141; ENG 102; or equivalent.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 216 — Advanced topics in Cellular Engineering (4 units)

Course Description: Advanced research strategies and technologies used in the study of immune function and inflammation. Static and dynamic measurements of stress, strain, and molecular scale forces in blood and vascular cells, as well as genetic approaches to the study of disease.
Prerequisite(s): BIM 214; or consent of instructor.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 217 — Mechanobiology in Health & Disease (4 units)

Course Description: Principles by which biomechanical forces affect cell and tissue function to impact human health and disease. Emphasis on cardiovascular system: structure and function, biofluid mechanics and mechanotransduction, disease mechanisms and research methods. Cartilage, bone and other systems; current topics discussed.
Prerequisite(s): BIM 106; BIS 101; NPB 101; or equivalents.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 221 — Drug Delivery Systems (4 units)

Course Description: Fundamental engineering and biotechnology principles critical for the formulation and delivery of therapeutic agents, including peptide/protein drugs and small molecules.
Prerequisite(s): BIM 204 recommended but not required.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 222 — Cytoskeletal Mechanics (4 units)

Course Description: Current topics in cytoskeletal mechanics including physical properties of the cytoskeleton and motor proteins, molecular force sensor and generator, cytoskeletal regulation of cell motility and adhesion.
Prerequisite(s): BIM 202.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 223 — Multibody Dynamics (4 units)

Course Description: Coupled rigid-body kinematics/dynamics; reference frames; vector differentiation; configuration and motion constraints; holonomicity; generalized speeds; partial velocities; mass; inertia tensor/theorems; angular momentum; generalized forces; comparing Newton/Euler, Lagrange's, Kane's methods; computer-aided equation derivation; orientation; Euler; Rodrigues parameters.
Prerequisite(s): ENG 102.
Learning Activities: Lecture 4 hour(s).
Cross Listing: MAE 223.
Grade Mode: Letter.

BIM 225 — Spatial Kinematics & Robotics (4 units)

Course Description: Spatial kinematics, screw theory, spatial mechanisms analysis and synthesis, robot kinematics and dynamics, robot workspace, path planning, robot programming, real-time architecture and software implementation.
Prerequisite(s): BIM 222; C Language.
Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).
Cross Listing: MAE 225.
Grade Mode: Letter.

BIM 228 — Skeletal Muscle Mechanics: Form, Function, Adaptability (4 units)

Course Description: Basic structure and function of skeletal muscle examined at the microscopic and macroscopic level. Muscle adaptation in response to aging, disease, injury, exercise, and disuse. Analytic models of muscle function are discussed.
Prerequisite(s): ENG 035; (ENG 045 or ENG 045Y); MAT 021D; basic background in biology, physiology, and engineering; NPB 101 recommended.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 232 − Skeletal Tissue Mechanics (3 units)

Course Description: Overview of the mechanical properties of the various tissues in the musculoskeletal system, the relationship of these properties to anatomic and histologic structure, and the changes in these properties caused by aging and disuse.
Prerequisite(s): Engineering 104B.
Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).
Cross Listing: MAE 232.
Grade Mode: Letter.

BIM 233 − Soft Tissue Mechanics (4 units)

Course Description: Presentation of structure and function of musculoskeletal soft tissues: cartilage, tendon, ligament, meniscus, and intervertebral disc. Instruction in engineering principals governing the mechanical behavior of these tissues: viscoelasticity, quasilinear viscoelasticity, and biphasic theory.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 239 − Advanced Finite Elements & Optimization (4 units)

Course Description: Introduction to advanced finite elements and design optimization methods, with application to modeling of complex mechanical, aerospace and biomedical systems. Application of states of the art in finite elements in optimum design of components under realistic loading conditions and constraints.
Prerequisite(s): ENG 180 or MAT 128C or EAD 115.
Learning Activities: Lecture 4 hour(s).
Cross Listing: MAE 239.
Grade Mode: Letter.

BIM 240 − Computational Methods in Nonlinear Mechanics (4 units)

Course Description: Deformation of solids and the motion of fluids treated with state-of-the-art computational methods. Numerical treatment of nonlinear dynamics; classification of coupled problems; applications of finite element methods to mechanical, aeronautical, and biological systems.
Prerequisite(s): MAT 128B or ENG 180 or EAD 115.
Learning Activities: Lecture 4 hour(s).
Cross Listing: MAE 240.
Grade Mode: Letter.

BIM 241 − Introduction to Magnetic Resonance Imaging (4 units)

Course Description: Basic hardware, acquisition, and reconstruction of MRI. Basic and advanced pulse sequences, MRI sequence design and sampling requirements, and image reconstruction strategies. Clinical applications of MRI.
Prerequisite(s): BIM 108; PHY 009D.
Learning Activities: Lecture 3 hour(s), Project.
Grade Mode: Letter.

BIM 242 − Introduction to Biomedical Imaging (4 units)

Course Description: Basic physics and engineering principles of image science. Emphasis on ionizing and nonionizing radiation production and interactions with the body and detectors. Major imaging systems: radiography, computed tomography, magnetic resonance, ultrasound, and optical microscopy.
Prerequisite(s): PHY 009D; EEC 106 or consent of instructor.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 243 − Radiation Detectors for Biomedical Applications (4 units)

Course Description: Radiation detectors and sensors used for biomedical applications. Emphasis on radiation interactions, detection, measurement and use of radiation sensors for imaging. Operating principles of gas, semiconductor, and scintillation detectors.
Prerequisite(s): PHY 009D; MAT 021D; MAT 022B.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 246 − Magnetic Resonance Technology (3 units)

Course Description: Covers MRI technology at an advanced level with emphasis on mathematical descriptions and problem solving. Topics include spin dynamics, signal generation, image reconstruction, pulse sequences, biophysical basis of T1, T2, RF, gradient coil design, signal to noise, image artifacts.
Prerequisite(s): PHY 009D; MAT 022B.
Learning Activities: Lecture 3 hour(s).
Grade Mode: Letter.

BIM 248 − Multi-modal Neuroimaging Techniques (4 units)

Course Description: Neuroimaging techniques including magnetic resonance imaging (MRI) and positron emission tomography (PET) and their multi-modal applications in neuroscience and neurological disorders. Imaging methods and brain biomarkers. Software and coding experience to analyze imaging datasets of brain structure, function, and pathology.
Prerequisite(s): BIM 108; BIM 142.
Learning Activities: Lecture 3 hour(s), Project.
Grade Mode: Letter.

BIM 251 − Medical Image Analysis (4 units)

Course Description: Techniques for assessing the performance of medical imaging systems. Principles of digital image formation and processing. Measurements that summarize diagnostic image quality and the performance of human observers viewing those images. Definition of ideal observer and other mathematical observers that may be used to predict performance from system design features. Obtain hands-on experience in computer vision by completing individual Matlab assignments that they select from topics in the course.
Prerequisite(s): EEC 106.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 252 — Computational Methods in Biomedical Imaging (4 units)

Course Description: Analytic tomographic reconstruction from projections in 2D and 3D; model-based image reconstruction methods; maximum likelihood and Bayesian methods; applications to CT, PET, and SPECT.
Prerequisite(s): (BIM 105 or STA 120); (BIM 108 or EEC 150A).
Learning Activities: Lecture 4 hour(s).
Cross Listing: EEC 205.
Grade Mode: Letter.

BIM 254 — Statistical Methods in Genomics (4 units)

Course Description: Statistical approaches to problems in computational molecular biology and genomics; formulation of questions via probabilistic modeling, statistical inference methods for parameter estimation, and interpretation of results to address biological questions; application to high-impact problems in functional genomics and molecular biology.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 255 — Nanoscale Imaging for Molecular Medicine (3 units)

Course Description: Current and emerging technologies to visualize biological structures and processes at size scales = 100 nanometers – and their application towards the advancement of molecular medicine. Technologies include superresolution optical microscopy, electron microscopy and tomography. Emphasis on quantitative imaging.
Prerequisite(s): BIM 202 highly recommended; graduate standing.
Learning Activities: Lecture/Discussion 3 hour(s).
Cross Listing: BPH 255.
Grade Mode: Letter.

BIM 257 — Fundamentals of Tissue Optics & Biomedical Applications (5 units)

Course Description: Fundamentals of optical properties of tissue. Range of optical technologies and their applications to tissue characterization and diagnostics.
Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).
Grade Mode: Letter.

BIM 258 — Advanced Biophotonics & Bioimaging (4 units)

Course Description: Quantitative basis for biophotonics and bioimaging, with an emphasis on the physical and mathematical description of optics, light propagation, and light-tissue interactions. Advantages and limitations of various optical imaging and sensing technologies. Illustrative applications in diagnostics, basic research, and therapy.
Prerequisite(s): BIM 108; PHY 108; or an equivalent undergraduate optics course to PHY 108.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 260 — Techniques in Molecular & Cellular Mechanics (4 units)

Course Description: Physical techniques used to visualize and manipulate mechanical processes in cells. Biophysical techniques used to characterize cellular and molecular mechanics, with a particular emphasis on single molecule technologies.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 262 — Cell & Molecular Biophysics for Bioengineers (4 units)

Course Description: Introduction to fundamental mechanisms governing the structure, function, and assembly of bio-macromolecules. Emphasis is on a quantitative understanding of the nano-to-microscale interactions between and within individual molecules, as well as of their assemblies, in particular membranes.
Prerequisite(s): BIM 284; or equivalent; graduate standing; undergraduate students by consent of instructor.
Learning Activities: Lecture 4 hour(s).
Credit Limitation(s): Not open for credit to students who have completed BIM 162.
Cross Listing: ECH 269.
Grade Mode: Letter.

BIM 263 — Optical Microscopy Hands-On (4 units)

Course Description: Informed use of an optical research microscope. Analysis of digitized images. Optical image formation and its limitations. Laboratories on modern microscope usage and videomicroscopy techniques including optimization of recorded images and quantification of microscopic distances and displacements.
Prerequisite(s): Consent of instructor.
Learning Activities: Lecture/Discussion 2 hour(s), Laboratory 4 hour(s).
Grade Mode: Letter.

BIM 264 — Synthetic & Systems Engineering of Cells (4 units)

Course Description: Introduction to the design, engineering, and control of biological systems for biotechnological applications and biological studies.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 265 — NanoEngineering (4 units)

Course Description: Inorganic and organic nanomaterials and their technological applications in medicine, imaging, energy harvesting, and computing. Fundamentals and applications of methods to fabricate, image, and analyze materials and devices that are structured at the nanometer scale. Intermolecular forces between atoms and molecules and how these forces give rise to exploitable phenomena at the nanoscale.
Prerequisite(s): BIM 109 or BIM 120.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 272 — Tissue Engineering (3 units)

Course Description: Based on morphogenetic signals, responding stem cells and extracellular matrix scaffolding. Design and development of tissues for functional restoration of various organs damaged/lost due to cancer, disease and trauma. Fundamentals of morphogenetic signals, responding stem cells and extracellular matrix scaffolding.
Prerequisite(s): BIS 104 or MCB 121.
Learning Activities: Lecture/Discussion 3 hour(s).
Grade Mode: Letter.

BIM 273 — Integrative Tissue Engineering & Technologies (4 units)

Course Description: Engineering principles to direct cell and tissue behavior and formation. Contents include controlled delivery of macromolecules, transport within and around biomaterials, examination of mechanical forces of engineered constructs, and current experimental techniques used in the field.
Prerequisite(s): BIM 202; BIM 204; or equivalent; strongly encourage completion of BIM 272 although not a prerequisite.
Learning Activities: Lecture/Discussion 4 hour(s).
Enrollment Restriction(s): Restricted to graduate standing.
Grade Mode: Letter.

BIM 280 — Neural Signals & Machine Learning Tools for Neural Data (4 units)

Course Description: Select and use machine learning tools to analyze neural data. Knowledge of the definitions and fundamental principles of data analytics related to neural data including field potentials (EEG, iEEG, local field potentials, EMG) and single neuron or muscle action potentials. Neural decoding/encoding, how to apply classifiers, regression and dimension reduction techniques, factor analysis and dynamic modeling.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

BIM 281 — Acquisition & Analysis of Biomedical Signals (4 units)

Course Description: Basic concepts of digital signal recording and analysis; sampling; empirical modeling; Fourier analysis, random processes, spectral analysis, and correlation applied to biomedical signals.
Prerequisite(s): ENG 100; STA 130A.
Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).
Enrollment Restriction(s): Restricted to upper division engineering.
Grade Mode: Letter.

BIM 283 — Advanced Design of Experiments for Biomedical Engineers (4 units)

Course Description: Provides biomedical engineering graduate students with the tools to properly design experiments, collect and analyze data, and extract, communicate and act on information generated.
Learning Activities: Lecture 4 hour(s).
Enrollment Restriction(s): Open to graduate students only.
Credit Limitation(s): Not open for credit to students who have taken EBS 265.
Grade Mode: Letter.

BIM 284 — Mathematical Methods for Biomedical Engineers (4 units)

Course Description: Theoretical applications of linear systems, ordinary and partial differential equations, and probability theory and random processes that describe biological systems and instruments that measure them. Students will be introduced to numerical solution techniques in MATLAB.
Prerequisite(s): MAT 022B; STA 130A; or consent of instructor; upper division biomedical engineering majors, and graduate students in sciences and engineering; priority given to Biomedical Engineering graduate students.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 286 — Nuclear Imaging in Medicine & Biology (4 units)

Course Description: Radioactive decay, interaction of radiation with matter, radionuclide production, radiation detection, digital autoradiography, gamma camera imaging, single photon emission computed tomography, positron emission tomography and applications of these techniques in biology and medicine.
Prerequisite(s): BIM 243; or consent of instructor.
Learning Activities: Lecture/Discussion 4 hour(s).
Grade Mode: Letter.

BIM 287 — Concepts in Molecular Imaging (4 units)

Course Description: Current techniques and tools for molecular imaging. Emphasis on learning to apply principles from the physical sciences to imaging problems in medicine and biology.
Prerequisite(s): CHE 002C; MAT 021C; PHY 009D; and consent of instructor.
Learning Activities: Lecture 2 hour(s), Lecture/Discussion 2 hour(s), Term Paper.
Grade Mode: Letter.

BIM 288 — Living Matter: Physical Biology of the Cell (3 units)

Course Description: Introduction to the origin, maintenance, and regulation of the dynamic architecture of the cell, including cellular modes of organization, dynamics and energy dissipation, molecular transport, motility, regulation, and adaptability.
Learning Activities: Lecture 3 hour(s).
Enrollment Restriction(s): Open to any student possessing general background in any disciplines of physical or biological sciences and engineering.
Cross Listing: EMS 288, BPH 288.
Grade Mode: Letter.

BIM 289A — Selected Topics in Biomedical Engineering: Cellular & Molecular Systems Engineering (1-5 units)

Course Description: Selected topics in Cellular and Molecular Systems Engineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable 1-5 hour(s).
Repeat Credit: May be repeated when topic differs.
Grade Mode: Letter.

BIM 289B — Selected Topics in Biomedical Engineering: Biomedical Imaging (1-5 units)

Course Description: Selected topics in Biomedical Imaging.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated when topic differs.
Grade Mode: Letter.

BIM 289C — Selected Topics in Biomedical Engineering: Computational Bioengineering (1-5 units)

Course Description: Selected topics in Computational Bioengineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated when topic differs.
Grade Mode: Letter.

BIM 289D — Selected Topics in Biomedical Engineering: Cell & Tissue Biomechanics (1-5 units)

Course Description: Selected topics in Cell and Tissue Biomechanics.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated when topic differs.
Grade Mode: Letter.

BIM 289E — Selected Topics in Biomedical Engineering: Analysis of Human Movement (1-5 units)

Course Description: Selected topics in Analysis of Human Movement.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated when topic differs.
Grade Mode: Letter.

BIM 290 — Seminar (1 unit)

Course Description: Seminar in biomedical engineering.
Learning Activities: Seminar 1 hour(s).
Grade Mode: Satisfactory/Unsatisfactory only.

BIM 290C — Graduate Research Conference (1 unit)

Course Description: Individual and/or group conference on problems, progress, and techniques in biomedical engineering research.
Prerequisite(s): Consent of instructor.
Learning Activities: Discussion 1 hour(s).
Repeat Credit: May be repeated.
Grade Mode: Satisfactory/Unsatisfactory only.

BIM 295 — Literature in Neuroengineering (2 units)

Course Description: Critical presentation and discussion of current literature in neuroengineering.
Learning Activities: Seminar 2 hour(s).
Enrollment Restriction(s): Open to graduate students only.
Repeat Credit: May be repeated.
Cross Listing: NSC 295.
Grade Mode: Satisfactory/Unsatisfactory only.

BIM 298 — Directed Group Study (1-5 units)

Course Description: Directed group study in Biomedical Engineering.
Learning Activities: Variable 1-5 hour(s).
Enrollment Restriction(s): Open to graduate students in the Biomedical Engineering Graduate Group, or consent of instructor.
Repeat Credit: May be repeated.
Grade Mode: Satisfactory/Unsatisfactory only.

BIM 299 — Research (1-12 units)

Course Description: Research.
Learning Activities: Variable.
Grade Mode: Satisfactory/Unsatisfactory only.