Bioengineering Graduate Courses and Technical Electives
Fall 2019

ENGR 225, Current Topics in Bioengineering Seminar series highlighting current topics and advances in bioengineering presented by UCSB faculty or visiting scientists providing context and motivation for bioengineering learning, introducing students to concepts outside of their primary research specialty, and promoting interdisciplinary thinking and research collaboration. 1 unit. R 2:00 pm - 3:15 pm

BMSE 201A, Protein Structure and Function Traces the physical interactions by which sequence-specific polypeptides attain a unique, functional native state. Fold design, fold prediction, and protein folding kinetics are also discussed. 2 units. T R 11:00 am - 12:15 pm

BMSE 201B, Chemistry and Structure of Nucleic Acids Primary, secondary, and higher-order structures of DNA and RNA, thermodynamic stability and folding, protein-nucleic acid interactions, ribozymes, applications to gene regulation, RNA world evolution. 2 units. T R 12:00 pm - 1:45 pm

BMSE 205A, Biochemical Techniques Practical theory and application of basic biochemical techniques. Topics include SDS-PAGE, buffers, centrifugation, antibody methods, spectroscopy and fluorescence techniques. 1 unit. T R 8:00 am - 9:50 am

BMSE 229, Protein Biochemistry Discussion topics relevant to structure-function relationships in proteins including the chemical reactivity of amino acid side chains, posttranslational modifications, and the covalent and noncovalent interactions of multimeric structures. Case studies involve recent advances in structure-function relationships of mechanoproteins. 2 units. M W F 10:00 am - 10:50 am

BMSE 265, BMSE Seminar Discussion Group A weekly seminar discussion group to review, in advance, relevant literature of participating BMSE seminar guests. 1 unit. T 3:00 pm - 4:00 pm
BMSE 290A, Group Studies: Biomolecular Materials Synthesis
Presentation and discussion of current research, to be selected from the following list: A. Biomolecular Materials Synthesis. 2 units. TBA

BMSE 290B, Group Studies: Biomineralization
Presentation and discussion of current research, to be selected from the following list: B. Biomineralization. 2 units. TBA

BMSE 290BP, Group Studies: Bacterial Pathogenesis
Presentation and discussion of current research, to be selected from the following list: BP. Bacterial Pathogenesis. 2 units. TBA

BMSE 290CE, Group Studies: C. elegans Development
Presentation and discussion of current research, to be selected from the following list: CE. C. elegans Development. 2 units. TBA

BMSE 290DN, Group Studies: Development Neurobiology
Presentation and discussion of current research, to be selected from the following list: DN. Developmental Neurobiology. 2 units. TBA

BMSE 290HW, Group Studies: Marine Structural Proteins
Presentation and discussion of current research, to be selected from the following list: HW. Marine Structural Proteins. 2 units. TBA

BMSE 294B, MCDB 294B, Bioengineering: Career and Development Opportunities
Based on presentations by experts from the bioengineering industry. Presenters describe their companies’ technologies and developments, including biosensors, therapeutics, tissue engineering, quantum dots and advanced instrumentation. Training and educational requirements for different career tracks are discussed. 2 units. M 10:00 am 12:00 pm

BMSE 595, Biochemistry/Molecular Biology Literature Seminar
A critical review of research in selected areas of biochemistry-molecular biology. 2 units. TBA

CH E 210A, Fundamentals and Applications of Classical Thermodynamics and Statistical Mechanics
Fundamental concepts in classical thermodynamics and statistical mechanics for engineering students. Establishes the framework within which problems can be solved using methodologies that start with
molecular level understanding. 4 units. M W 12:30 pm - 1:45 pm, F 12:30 pm - 1:20 pm

**CH E 220A, Advanced Transport Processes-Laminar Flow and Convective Transport Processes**
Basic principles of fluid mechanics and convective transport processes. Governing equations and boundary conditions. Non-dimensionalization and scaling. Self-similar solutions and similarity transformations. Unidirectional flows. The thin gap approximation, lubrication theory and thin film dynamics. Low Reynolds number flows. 3 units. T R 11:00 am - 12:15 pm, F 11:00 am - 12:15 pm

**CH E 241, Advanced Science and Engineering of Energy Conversion**
The course provides a framework for understanding the energy supply issues facing society with a focus on the science, engineering, and economic principles of the major alternatives. Emphasis will be on the physical and chemical fundamentals of energy conversion technologies. 3 units. M W 8:00 am - 9:15 am

**CH E 294B, Bioengineering** Based on presentations by experts from the bioengineering industry. Presenters describe their companies’ technologies and developments, including biosensors, therapeutics, tissue engineering, quantum dots and advanced instrumentation. Training and educational requirements for different career tracks are discussed. 2 units. T R 12:00 pm - 1:50 pm

**CHEM 223, BMSE 223, MCDB 223, Current Events Organic Chemistry**
Faculty and students present and critically discuss current chemical literature.

**CHEM 242A, Chemical Aspects of Biological Systems** Macromolecular biosynthesis and specialized cellular processes. A survey of nucleic acid and protein biosynthesis, characterization of lipids and membranes; function of membranes in transport, energy transduction, and cellular control; mechanisms of muscle contraction and cell motility; neurochemistry. 3 units. M W F 10:00 am - 10:50 am

**CHEM 243, The RNA World** Introduction to RNA structure and thermodynamics. Biological roles of RNA in contemporary organisms. Implications for the origins of life. 3 units. T R 9:30 am - 10:45 am
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Description</th>
<th>Units</th>
<th>Time</th>
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<tbody>
<tr>
<td>CHEM 290</td>
<td>Seminar in Chemistry and Biochemistry</td>
<td>Presentation of seminar required of all departmental graduate students. 2 units. F 10:00 am - 11:50 am</td>
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<tr>
<td>DYNS 592</td>
<td>DYNS Seminar</td>
<td>Research seminar for special interest groups in dynamical neuroscience. 1 unit. TBA</td>
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<tr>
<td>ECE 235</td>
<td>Stochastic Processes in Engineering</td>
<td>A first-year graduate course in Stochastic Processes, including: review of basic probability; gaussian, poisson, and Weier processes; wide-sense stationary processes; covariance function and power spectral density; linear systems driven by random inputs; basic Wiener and Kalman filter theory. 4 units. M W 4:00 pm - 5:50 pm</td>
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<tr>
<td>ECE 594Q</td>
<td>Nanotechnology</td>
<td>Instruction in these variable unit courses may be carried out by lecture, by laboratory, or by a combination of these. These courses provide a study of topics of current interest in various areas of electrical and computer engineering. 1-5 units. M W 12:00 pm - 1:50 pm</td>
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<tr>
<td>ECE 595E</td>
<td>Group Studies in Electrical and Computer Engineering</td>
<td>Instruction in research group meetings carried out by lecture, by laboratory, or by a combination of the two. Courses provide a critical review of research in various areas of electrical and computer engineering. E. signal processing. 1 unit. TBA</td>
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<tr>
<td>EEMB 595EV</td>
<td>Evolutionary Biology</td>
<td>A critical review of research in selected fields of biology. 2 units. R 3:00 pm - 4:50 pm</td>
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<td>EEMB 595T</td>
<td>Parasitology</td>
<td>A critical review of research in selected fields of biology. 2 units. M 2:30 pm - 3:30 pm</td>
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<tr>
<td>EEMB 595TE</td>
<td>Theoretical Ecology and Evolution</td>
<td>Focus on Bayesian Methods, featuring special guest instructor Grace DiRenzo. 2 units.</td>
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<td>TBA</td>
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MCDB 226AL, Basic Pharmacology Lab  Analysis of drug sites and mechanisms of action using isolated tissues, organs, and intact animal preparations.  4 units.  T 9:30 - 5:00 pm

MCDB 229, Protein Biochemistry  Discussion topics relevant to structure-function relationships in proteins including the chemical reactivity of amino acid side chains, posttranslational modifications, and the covalent and noncovalent interactions of multimeric structures.  Case studies involve recent advances in structure-function relationships of mechanoproteins.  2 units.  M W F 10:00 am - 10:50 am

MCDB 231, General Microbiology  Introduction to biological properties of microorganisms historical foundations of the field of microbiology; a study of major groups of microorganisms, their structure, physiology, cultivation, and pathogenicity.  4 units.  M W F 10:00 am - 10:50 am

MCDB 251, Neurobiology I: Cellular Organization and Biophysics of the Nervous System  Nervous system properties ranging from single cells to whole organisms, using examples from vertebrates/invertebrates studied in terms of morphology, physiology, behavior.  4 units.  M W 3:30 pm - 4:45 pm

MCDB 263, Progress in Biochemistry and Molecular Biology  Research seminars presented by invited speakers on current research topics.  1 unit.  W 3:00 pm - 4:00 pm

MCDB 266, Optogenetics and Functional Imaging  Class is a journal club based on primary literature with rotating presenters and active discussion.  This quarter we will focus on Channelrhodopsin and GCaMP, covering the original papers, new variants, and best use cases.  Optogenetics is ten years old now and has proven to be a powerful technique to identify behaviorally critical brain regions and map neural circuit connections.  Imaging neuronal activity, in the whole brain of behaving animals, is now possible.  Come learn about the development, potential and caveats of these tools.  1 unit.  TBD

ME 219, Mechanics of Materials  Matrices and tensors, stress deformation and flow, compatibility conditions, constitutive equations, field
equations and boundary conditions in fluids and solids, applications in solid and fluid mechanics. 3 units. T R 12:30 pm - 1:45 pm

**ME 220A, Fundamentals of Fluid Mechanics** Introductory course in fluid mechanics. Basic equations of motion (continuity, momentum, energy, vorticity), coordinate transformations, "potential" flow, thin airfoil theory, conformal mapping, vortex dynamics, boundary layers, stability theory, laminar/turbulent transition, turbulence. Inviscid/viscid, irrotational/rotational, incompressible/ compressible flow examples. 3 units. T R 11:00 am - 12:30 pm

**PSTAT 231, Introduction** Introduction to data mining techniques. Model assessment and performance evaluation. Data preparation. Programming techniques for transforming raw data into a form suitable for predictive modeling. Extracting data to a form that predictive models can utilize. Incorporating non-numeric data in predictive models. Techniques for managing exceptional and extreme data. Building predictive models using SAS Enterprise Miner 5 in SAS 9, including Decision Trees, Neural Networks, and Bayesian Networks. 4 units. T R 5:00 pm - 6:15 pm

**PSTAT 274, Time Series** Stationary and non-stationary models, seasonal time series, ARMA models: calculation of ACF, PACF, mean and ACF estimation. Barlett’s formula, model estimation: Yule-Walker estimates, ML method. Identification techniques, diagnostic checking, forecasting, spectral analysis, the periodogram. Current software and applications. 4 units. M W 2:00 pm - 3:15 pm

**PSY 211, Basic Concepts in Behavioral Neuroscience** Intended to provide fundamental understanding of neuroscience and behavior for graduate students at the beginning of their studies. Provides a broad overview of brain function with focus on the molecular, cellular, system, and behavioral level of analysis in order to instill a comprehensive appreciation of the biological mechanisms important to behavior. 4 units. M W 3:30 pm - 4:45 pm

**PSY 221A, Design and Measurement** Experimental design and statistical analysis in psychological research. Includes basic probability, sampling and distribution theory, hypothesis testing, and estimation. 4 units. T R 9:30 am - 11:00 am; F 9:30 am-10:45 am
PSY 268, Brain Development: An examination of the major developmental events producing the organization and connectivity of the nervous system, offered concurrently with Psychology 168, but graduate students will be required to complete additional reading and writing assignments. 4 units. M W 5:00 pm - 6:15 pm.