
Bioengineering Graduate Courses and Technical Electives

Fall 2022

BIOE 220A, Molecular Bioengineering This course Introduces students to molecular components of biology with application of engineering principles for analysis. Topics include: molecular components of cells, DNA/RNA structure and function, protein structure/function/folding, gene and protein regulation, DNA replication, and experimental and computational research methods. *Instructors: Stowers R S and Dey S S, 3 units. T R 11:00 am - 12:15 pm*

BIOE 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. *Instructors: Visell Y, 1 unit. T 9:00 am - 9:50 am*

BIOE 230, Bioengineering Student Seminar Seminar series where students present their original thesis research and also review journal articles that critically analyze contemporary bioengineering research. Three quarters of ENGR 230 are required for the optional BioE graduate emphasis. Presentations will be evaluated and feedback provided. *Instructors: Visell Y, 1 unit. R 2:00 pm - 3:15 pm*

Technical Electives The optional Bioengineering Emphasis course requirement includes 1 (or more) technical elective(s). *Technical Electives for emphasis must equal up to 4 units.*

BIOE 210, Biomolecular and Biochemical Methods The goal of the course is to generate in our students an understanding of the logic behind the key tools used to characterize biomolecules and biosystems. Both the mechanisms by which these techniques work, and the

rationale for why each would be employed (strengths, weaknesses, potential pitfalls). *Instructors: Plaxco K W and Mukherjee Arn, 4 units. M W 2:00 pm - 3:15 pm*

BIOE 211, Quantitative Experiments This course is built around experimental design, data analysis, and quantitative modeling of biological processes and phenomena. Topics including experimental design considerations and a priori assumptions, probability, dimensional reduction, hypothesis testing, statistical analysis, and quantitative modeling through ordinary and partial differential equations. Case studies of recent and classic research papers in Bioengineering are used to illustrate key course topics through class discussions. *Instructors: Stowers R S and Dey S S, 3 units. T R 11:00 am - 12:15 pm*

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. *Instructors: Waite J H, 2 units. M W F 1:00 pm - 1:50 pm*

BMSE 265, BMSE Seminar Discussion Group A weekly seminar discussion group to review, in advance, relevant literature of participating BMSE seminar guests. *Instructors: Jaeger L A, 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. *Instructors: Morse D E, 2 units. TBA*

BMSE 290B, Group Studies: Biomineralization Presentation and discussion of current research, to be selected from the following list: B. Biomineralization. *Instructors: Stucky G D, 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. *Instructors: Mahan M J, 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. *Instructors: Rothman J H, 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. *Instructors: Clegg D O, 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. *Instructors: Waite J H, 2 units. TBA*

BMSE 294B, MCDB 294B, Bioengineering: Career and Development Opp. 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. *Instructors: Clegg D O, 2 units. R 12:00 pm 1:50 pm*

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

CH E 210A, Fundamentals & Applications of Classical Thermo. & Stat. Mech. 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. *Instructors: Doherty M F, 4 units. M W 12:30 pm - 1:45 pm, F 12:30 pm - 1:45 pm*

CH E 220A, Advanced 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. *Instructors: Takatori S, 4 units. M W F 2:00 pm - 3:15 pm*

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. *Instructors: Clegg D O, 2 units. 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. *Instructors: Lipshutz B H, 2 units. F 12:00 pm - 1:50 pm*

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. *Instructors: Hai Y, 3 units. M W F 10:00 am - 10:50 am*

CHEM 262A, Drug Design Sources for new drugs. Biochemistry of diseases. Target validation techniques. Mechanism of action of enzymes and receptors. Enzyme inhibition and receptor binding studies. Structure based drug design: conformational analysis, docking and binding affinity calculations. Course also teaches proposal writing skills. *Instructors: Reich N O, 3 units. M W F 11:00 am - 11:50am*

CHEM 290, Seminar in Chemistry and Biochemistry

Presentation of seminar required of all departmental graduate students. *Instructors: Han Songi, 2 units. F 11:00 am - 12:50 pm*

DYNS 592, DYNS Seminar Research seminar for special interest groups in dynamical neuroscience. *Instructors: Smith S L, 1 unit. TBA*

ECE 235, Stochastic Processes in Engineering A first-year graduate course in Stochastic processes, including: review of basic probability; gaussian, poisson, and Wiener processes; wide-sense stationary

processes; covariance function and power spectral density; linear systems driven by random inputs; basic Wiener and Kalman filter theory. *Instructors: Pedarsani R, 4 units. M W 4:00 pm - 5:50 pm*

ECE 594Q, Nanotechnology 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. *Instructors: Smith S L, 1-5 units. T R 4:00 pm - 5:50 pm*

ECE 595E, Group Studies in Electrical and Computer Engineering 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. *Instructors: Lee H and Manjunath B S, 1 unit. TBA*

EEMB 595T, Parasitology A critical review of research in selected fields of biology. *Instructors: Kuris A M, 2 units. M 2:30 pm - 3:30 pm*

EEMB 595TE, Theoretical Ecology and Evolution Focus on Bayesian Methods, featuring special guest instructor Grace DiRenzo. *Instructors: Briggs C J and Proulx S R, 2 units. TBA*

MATRL 222A, Structure Evolution Study of phenomena underlying the evolution of structure across the relevant length and time scales in Materials. Structural defects. Driving forces, mechanisms and kinetics of structural change. Diffusional transport. Fundamentals of phase transformations. Crystallization. Evolution of microstructural features and patterns. *Instructors: Pitenis A A, 3 units. M W 2:00 pm - 3:15 pm*

MATRL 226, Symmetry and Tensor Properties of Materials Description of the principles of crystal symmetry, functional materials, and their properties, including dielectrics, piezoelectrics, and magnetic and transport phenomena. Fundamental concepts, tensorial and mathematical description of functional behavior. *Instructors: Stemmer S, 3 units. T R 2:00 pm - 3:15 pm*

MCDB 226, Basic Pharmacology Will cover a wide range of drugs with a focus on drugs used to treat disorders of the nervous and cardiovascular systems, antibacterial agents, antivirals, and anticancer drugs. Will also look at the pharmacology of inflammation and coagulation. The goal is to understand the underlying physiology behind disorders of these systems and the mechanisms of the drugs used to treat them. Additional out-of-class hours are necessary. *Instructors: Azarenko O, 5 units. M W F 8:00 am - 8:50 am*

MCDB 226AL, Basic Pharmacology Lab Analysis of drug sites and mechanisms of action using isolated tissues, organs, and intact animal preparations. *Instructors: Stoyan T, 4 units. T 9:30 am - 5:00 pm, R 9:30 am - 5:00 pm, W 10:00 am - 5:30 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. *Instructors: Waite J H, 2 units. M W F 1:00 pm - 1:50 pm*

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. *Instructors: Hayes C S, 4 units. M W F 10:00 am - 10:50 am*

MCDB 263, Progress in Biochemistry and Molecular Biology Research seminars presented by invited speakers on current research topics. *Instructors: Louis M R and Gardner B M, 1 unit. W 3:00 pm - 3:50 pm*

MCDB 290DN, Developmental Neurobiology Presentation and discussion of current research. *Instructors: Clegg D O, 2 units. TBA*

MCDB 294B, BMSE 294B, Bioengineering: Career and Development Opp. 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. *Instructors: Clegg D O, 2 units. R 12:00 pm 1:50 pm*

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. *Instructors: Begley M R, 3 units. M W 2:00 pm - 3:15 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. *Instructors: Luzzatto-Fegi, 3 units. M W 9:30 am - 10:45 am*

PSTAT 215A, Bayesian Inference Fundamentals of the Bayesian inference, including the likelihood principle, the discrete version of Bayes theorem, prior and posterior distributions, Bayesian point and interval estimations, and predictions. Bayesian computational methods such as Laplacian approximations and Markov Chain Monte Carlo (MCMC) simulation. *Instructors: Franks A, 4 units. T R 2:00 pm - 3:15 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. *Instructors: Yu G and Coburn K M, 4 units. T R 12:30 pm - 1:45 pm, T R 3:30 pm - 4:45 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. *Instructors: Feldman R, 4 units. M W 11:00 am - 12:15 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. *Instructors: Kippin T E, 4 units. T R 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. *Instructors: Conroy-Beam D, 4 units. T R 9:30 am - 11:00 am*