Bioengineering Related Undergraduate Technical Courses Winter 2021

ENGR 120A, Molecular Bioengineering, and ENGR 120B, Cellular Bioengineering, are newly added courses that are now being offered in the fall and winter quarters. In addition to the courses below, there are many other more general courses not specifically biology-related but that are useful for BIOE training. Please contact Angelina Toporov, Grad Advisor and Emphasis Coordinator for more details via email at atoporov@engineering.ucsb.edu. Please see individual departments for more information about these courses.

CH E 107, Introduction to Biological Processing Familiarizes engineering students with biological processing and production at multiple scales. Chemical engineering principles will be infused with key biological concepts, including an introduction to biochemistry, cell biology, and molecular biology. *Instructors: O'Malley, 3 units.*

CHEM 112B, Biophysical Chemistry Forces influencing macromolecular conformation, microscopy and diffraction methods, quantum mechanics, statistical mechanics.*Instructors: Sepunaru, Chary, 4 units.*

CHEM 125L, Laboratory Techniques in Biochemistry Application of molecular biology techniques to perform mutagenesis and cloning; restriction endonucleases, PCR, plasmid purification and DNA analysis. Protein purification and analysis methods: expression of proteins in bacterial systems.*Instructors: Kahn, Schopp, Tian, 4 units.*

CMPSC 111, Introduction to Computational Science Introduction to computational science, emphasizing basic numerical algorithms and the informed use of mathematical software. Matrix computation, systems of linear and nonlinear equations, interpolation and zero finding, differential equations, numerical integration. Students learn and use the Matlab language. *Instructors: Gilbert, Jaffe, Shlomi, 4 units.*

CMPSC 130A, Data Structures and Algorithms I The study of data structures and their applications. Correctness proofs and techniques for the design of correct programs. Internal and external searching. Hashing and height balanced trees. Analysis of sorting algorithms. Memory

management. Graph traversal techniques and their applications. *Instructors: Koc, Shang Shening, Gartland, Gudipati, 4 units.*

CMPSC 138, Automata and Formal Languages Formal languages; finite automata and regular expressions; properties of regular languages; pushdown automata and context-free grammars; properties of context-free languages; introduction to Turing machines and computability. *Instructors: Egecioglu, 4 units.*

CMPSC 165A, Artifical Intelligence Introduction to the field of artificial intelligence, which seeks to understand and build intelligent computational systems. Topics include intelligent agents, problem solving and heuristic search, knowledge representation and reasoning, uncertainty, probabilistic reasoning, and applications of AI. *Instructors: Wang Yuxiang, Zhu Yuqing, Xu, Feng, 4 units.*

CMPSC 174A, Fundamentals of Database Systems Database system architectures, relational data model, relational algebra, relational calculus, SQL, QBE, query processing, integrity constraints (key constraints, referential integrity), database design, ER and object- oriented data model, functional dependence, lossless join and dependency preserving decompositions, Boyce-Codd and Third Normal Forms. *Instructors: Su, 4 units.*

CMPSC 181, Introduction to Computer Vision Overview of computer vision problems and techniques for analyzing the content of images and video. Topics include image formation, edge detection, image segmentation, pattern recognition, texture analysis, optical flow, stereo vision, shape representation and recovery techniques, issues in object recognition, and case studies of practical vision systems. *Instructors: Manjunath, Ruschel Dos, 4 units.*

CMPSC 185, Human-Computer Interaction The study of human-computer interaction enables system architects to design useful, efficient, and enjoyable computer interfaces. This course teaches the theory, design guidelines, programming practices, and evaluation procedures behind effective human interaction with computers. *Instructors: Hollerer, 4 units.*

ECE 141A, Introduction To Nanoelectromechanical and Microelectromechanical Introduction to nano- and microtechnology. Scaling laws and nanoscale physics are stressed. Individual subjects at the nanoscale including materials, mechanics, photonics, electronics, and fluidics will be described, with an emphasis on differences of behavior at the nanoscale and real-world examples. *Instructors: Pennathur, 3 units.*

ECE 181, Introduction to Computer Vision Overview of computer vision problems and techniques for analyzing the content of images and video. Topics include image formation, edge detection, image segmentation, pattern recognition, texture analysis, optical flow, stereo vision, shape representation and recovery techniques, issues in object recognition, and case studies of practical vision systems.*Instructors: Manjunath, Huynh-Tran, Kozerawski, Sanchez, Luu, Zhong, Ruschel Dos, 4 units.*

EEMB 146, BIOMETRY Linear models and least squares fitting: simple and multiple linear regression; analysis of variance (fixed, random and mixed models; crossed and nested effects; balanced and unbalanced designs); analysis of covariance, factorial designs; incomplete layouts; use of tranformations. *Instructors: Titcomb, Klope, Malakhoff, 5 units.*

ENGR 120B, Cellular Bioengineering introduces students to structural components of cells with application of engineering principles for analysis. Topics include: biomembrane structure and function, membrane proteins, membrane transport, intracellular compartments, intracellular trafficking, chemotaxis, cell cycle, apoptosis, and stem cells. Prerequisites- ENGR 120A or consent of Instructor. *4 units. T R 9:30 am - 10:45 am*

MCDB 123, Physcial Biochem Presentation of selected contemporary concepts and methodologies for determining the structure, size, shape, charge, and interactive behavior of biological macromolecules *Instructors: Waite, 4 units.*

MCDB 126B, Basic Pharmacology Receptor signaling mechanisms: pharmacology of neurotransmitter and hormone receptors: molecular and cellular mechanisms of drug-receptor interactions *Instructors: Smith, Thrower, Fisher, 4 units.*

MCDB 132, Bacterial Pathogenesis The mechanisms by which bacterial pathogens cause disease. Investigation of the bacterial gene products that are produced during infection to understand the metabolic, physiological, and genetic factors that contribute to the virulence of bacterial pathogens. *Instructors: Mahan, 3 units.*

MCDB 133, Molecular and Cellular Immunobiology Introduction to the current concepts of immunology. Emphasis on immunoglobulin structure and function, cell-cell cooperation in the immune response, and the role of major histocompatibility complex and cytokines in regulating immune responsiveness. *Instructors: De Tomaso, Rodriguez, 5 units.*

ME 141A, Introduction to Nanoelectromechanical and Microelectromechanical systems (NEMS/MEMS) Introduction to nano- and microtechnology. Scaling laws and nanoscale physics are stressed. Individual subjects at the nanoscale including materials, mechanics, photonics, electronics, and fluidics will be described, with an emphasis on differences of behavior at the nanoscale and real-world examples. *Instructors: Pennathur, 3 units.*

MTRL 135, PHYS 135, Biophysics and Biomolecular Materials Structure and function of cellular molecules (lipids, nucleic acids, proteins, and carbohydrates). Genetic engineering techniques of molecular biology. Biomolecular materials and biomedical applications (e.g., bio-sensors, drug delivery systems, gene carrier systems). *Instructors: Safinya, 3 units.*

PHYS 135, Biophysics and Biomolecular Materials Structure and function of cellular molecules (lipids, nucleic acids, proteins, and carbohydrates). Genetic engineering techniques of molecular biology. Biomolecular materials and biomedical applications (e.g., bio-sensors, drug delivery systems, gene carrier systems). *Instructors: Safinya, 3 units.*

PHYS 144L, Experimental Research in Biophysics Offers qualified undergraduates the opportunity to work in research laboratories in biophysics. *Instructors: Staff, 3 units.*

PSTAT 10, Principles of Data Science with R Offers qualified undergraduates the opportunity to work in research laboratories in bio-

physics. *Instructors: Holmes, Guan, Padilla, Li, Lu, 5 units.*

PSTAT 134, Statistical Data Science Overview and use of data science tools in R and Python for data retrieval, analysis, visualization, reproducible research and automated report generation. Case studies will illustrate practical use of these tools. *Instructors: HSU, 4 units.*