Biocomputational Engineering (BIOC)

Courses

BIOC 211 (BIOE 211, ENGR 211, MAT 211, ME 211) Capstone Design Project I 3 Credits
Students work on teams, integrating knowledge and skills acquired in their prior course work, to design practical solutions to real-world problems, typically in collaboration with industry, entrepreneurs, faculty, or campus departments. Teams perform in-depth engineering design while considering engineering standards and the project business case. Constraints, including technical, financial, environmental, societal, supply chain, regulatory, and others are considered throughout. Teams produce written reports, oral presentations, and prototypes appropriate for the project.
Prerequisites: CSE 007 and BIOC 237
Can be taken Concurrently: BIOC 237

BIOC 212 (BIOE 212, ENGR 212, MAT 212, ME 212) Capstone Design Project II 0,2 Credits
Students continue developing their solutions from BIOC 211 through prototype fabrication and testing, iteration, and failure mode analysis. New information about the project, as well as new knowledge, standards, and constraints, may be identified, considered and integrated into the solution. Teams are expected to produce a final project-specific prototype, an implementation plan appropriate to the project, as well as related business case financial models. Additional deliverables include written reports and presentations.
Prerequisites: BIOC 211 and BIOC 309
Can be taken Concurrently: BIOC 309

BIOC 213 Fundamentals of Biomedical Signals 3 Credits
Fundamentals of analysis of data obtained from common quantitative techniques, including imaging, EEG, cardiograms, and bioinformatics. Introduction to sampling, Fourier transforms, filters, clustering, and classification. Common tools for data processing and application of programming.
Prerequisites: MATH 205 and PHY 021 and BIOE 210
Can be taken Concurrently: BIOE 210

BIOC 214 Fundamentals of Biological Modeling 3 Credits
Introduction to quantitative biology approaches through modeling. Practical methods of applying basic mathematical modeling and programming. Topics include linear and non-linear models, DNA and protein structures, ligand-receptor binding, reaction kinetics, electrical and mechanical cell dynamics, gene regulatory models, and fundamentals of epidemiology.
Prerequisites: MATH 205 and CSE 017 and PHY 021

BIOC 237 (BIOS 237) Introductory Molecular Modeling and Simulation 3 Credits
Key concepts, methods, and tools used in molecular modeling and simulation. A hybrid lecture/hands-on practice course using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Topics include (but not limited to) UNIX operating system, text editors, Python programming, scientific programming using Python, PDB (Protein Data Bank), molecular mechanics, minimization, molecular dynamics, Monte Carlo simulation. The understanding of these concepts and algorithms as well as their applications to well-defined practical examples involving currently important biological problems will be emphasized.Key concepts, methods, and tools used in molecular modeling and simulation. A hybrid lecture/hands-on practice course using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Topics include (but not limited to) UNIX operating system, text editors, Python programming, scientific programming using Python, PDB (Protein Data Bank), molecular mechanics, minimization, molecular dynamics, Monte Carlo simulation. The understanding of these concepts and algorithms as well as their applications to well-defined practical examples involving currently important biological problems will be emphasized.
Prerequisites: CHM 030 or CHM 040
Attribute/Distribution: NS

BIOC 240 Biocomputational Engineering - Capstone 1 3 Credits
Students work in teams on design projects in which they will integrate and apply concepts from numerous courses in the Biocomputational Engineering curriculum. Projects have constraints, including technical feasibility, engineering standards, and economic analysis, as well as global and/or social impact.
Prerequisites: BIOC 214 and BIOC 236

BIOC 241 Biocomputational Engineering - Capstone 2 3 Credits
Students continue their work on Biocomputational Engineering design projects from BIOC 240. Designs from the previous semester will be further developed, such that they have more technical depth and adhere to established constraints and standards.
Prerequisites: BIOC 240

BIOC 309 Bioengineering Applications in Machine Learning 3 Credits
Introduction to machine learning and AI techniques as well as their applications in biomedical data quantification, prediction, and visualization. Topics include principles of bioengineering data modalities and systems, fundamentals of machine learning approaches for biomedical data analysis, such as denoising, standardization, statistical analysis, dimensionality reduction, predictive modeling, as well as computational tools for implementing AI methods.
Prerequisites: MATH 205 and PHY 021