BME50B CELL AND MOLECULAR ENGINEERING
(Required for BME and BMEP)

Catalog Data: **BME50B Cell and Molecular Engineering (Credit Units: 4)**
Physiological function from a cellular, molecular, and biophysical perspective. Applications to bioengineering design. (Design units: 2)

Textbook: Alberts, B., et al., *Essential Cell Biology: An Introduction to the Molecular Biology of the Cell,* Second Edition, Garland Press, 2004.
Wilson, J. and Hunt, T., *Molecular Biology of the Cell,* Garland Science, Fourth edition 2007.

References: Class notes posted on course website: http://eee.uci.edu.

Coordinator: James P. Brody

Relationship to Program Outcomes: This course relates to Program Outcomes
BME: a, c, d, e, f, g, h, i, j, and k as stated at:
http://undergraduate.eng.uci.edu/degreeprograms/biomedical/mission

Course Outcome/Performance Criteria: Students will:
Calculate the diffusion of molecules within a membrane. (BME a)
Calculate how much energy it takes to pump substances across a membrane. (BME a)
Describe the structure and function of mitochondria. (BME a)
Predict where a protein will localize, based up a signal sequence. (BME a)
Interpret data to determine the length of the cell cycle. (BME a)
Interpret a genetic pedigree and calculate the probability of inheriting a trait. (BME a)
Calculate the steady state of a protein concentration, based upon a synthesis rate and degradation rate. (BME a)
Define and describe apoptosis, the process of cell death. (BME a, h)
Calculate the expected onset age of a disease caused by the accumulation of somatic mutations. (BME a)
Work in groups to develop a written design in response to a specific problem. (BME c, d, e, f, g, h, i, j, k)

Prerequisites By Topic: Calculus, differential equations, general chemistry, and mechanics.

Lecture Topics: Exponential growth, size of molecules
Probability density functions and temperature
Gaussian distribution and Diffusion equation
Random walks, free energy, and thermodynamics
Kinetics, free energy
Protein structure, peptide bonds, classes of amino acids
Predicting protein structure, alpha helix, beta sheet
Protein analysis, gels, antibodies
Antibody on/off rates, mobility, BLAST
DNA structure, mutations, repair
Ethics and contemporary issues in biomedical engineering
Central Dogma, Control theory
DNA packaging, Gene regulation
DNA technology, enzyme function
DNA melting Temperature, applications

PCR

Class Schedule: Meets for 3 hours of lecture and 1 hour of discussion each week for 10 weeks.

Computer Usage: Numerical methods using Microsoft Excel or equivalent
Document preparation, Microsoft Word or equivalent
Web/e-mail access

Laboratory Projects:

Professional Component: Contributes toward the Biomedical Engineering Topics and Major Design experience.

Design Content Description

Approach: Students are assigned to teams of five to seven students. Each team must complete three sequential projects. The projects are based upon a one page problem description. From this description, students must define the problem, design a solution, and justify their choices. (90%) Occasional lectures address the design process, including enumeration constraints, identifying the best alternatives, and the iteration of design. (10%)

Lectures: 100%

Laboratory Portion:

Grading Criteria:

Weekly Homework Assignments:	16%
Midterm exam:	20%
Final exam:	30%
Team-oriented design problems:	33%
Class participation and attendance:	1%
	100%

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%
Engineering Science: 2 credit units or 50%
Engineering Design: 2 credit units or 50%

Prepared by: James P. Brody **Date:** July 2008

CEP Approved: Winter 2006