

## BME120 QUANTITATIVE PHYSIOLOGY: SENSORY MOTOR SYSTEMS

- Catalog Data:** **BME120 Quantitative Physiology: Sensory Motor Systems (Credit Units: 4) F.** A quantitative and systems approach to understanding physiological systems. Systems covered include the nervous and musculoskeletal systems. Prerequisite: Mathematics 3D or equivalent, or consent of instructor. Concurrent with BME220. Formerly Engineering E110B. (Design units: 2)
- Textbook:** Seeley, Stephens, and Tate., *Anatomy & Physiology*, 6<sup>th</sup> edition, McGraw-Hill, 2002.
- References:** Supplemental readings will be placed at the engineering copy center ET 203 and on the course website at: <http://eee.uci.edu/>.
- Coordinator:** William Tang.
- Course Outcomes:** Students will be able to:  
Understand relevant anatomies of the nervous and musculoskeletal systems.  
Apply engineering models and mathematics to understand human physiology.  
Design devices for enhancing human function.
- Prerequisites By Topic:** Freshman-level differential equations.
- Lecture Topics:** Muscle.  
Neurons (as cables and computers).  
Motor systems (emphasis on arm movement control).  
Sensory systems (emphasis on auditory system).  
Basic dynamics/mechanical circuits (spring, mass dashpot).  
First and second order linear differential equations.  
Electrical circuits.  
Nonlinear equations and simulation.  
Ion transport.  
Signal processing – frequency analysis and filters.  
Control theory – feedforward, feedback, impedance control, Black's formula.  
Biomechanical modeling of movement control and surgery.  
Functional electrical stimulation systems.  
Rehabilitation robotics.  
Biomimetic devices (e.g. robotic insects).  
Neuroprostheses (e.g. cochlear implants).  
Brain computer interfaces.
- Class Schedule:** Each class meets 3 hours per week for 10 weeks and students are assigned to a 1 hour discussion session per week.
- Computer Usage:** Students will use Microsoft Word and Excel to prepare Problem-Based Learning (PBL) reports and CAD tools to simulate neural circuits.

**Laboratory Projects:** One Computer laboratory on the modeling of neural circuits.

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

**Relationship to Program Outcomes:** This course relates to program outcomes 1, 2, and 4 as stated at: [http://www.eng.uci.edu/dept/objective\\_biomedical](http://www.eng.uci.edu/dept/objective_biomedical).

**Design Content Description**

**Approach:** Student will use PBL skills to analyze and design systems to simulate neural and musculoskeletal systems. (50%) Specific discussions on neural and musculoskeletal system analyses and designs. (40%) Students will use computer to model and analyze neural circuits. (10%)

**Lectures:** 90%

**Laboratory Portion:** 10%

**Grading Criteria:**

Homework:	20%
PBL reports:	20%
Midterm exam:	20%
Final exam:	<u>35%</u>
	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:** William Tang **Date:** July 2005

**CEP Approved:** Fall 2002