

BIME 4040 Physiological Systems and Modeling for Engineering

This course is required for the Biomedical Engineering concentration.

Course Coordinator:

Purvis Bedenbaugh

Catalog Description:

Introduction to physiology, emphasizing concepts and systems for engineering, including cell signaling, body signaling and control systems. Quantitative introduction to cardiovascular and renal systems. Example of brain-machine interfaces. Survey of other physiological systems.

Course Structure:

three 50-minute lectures (four credits)

Prerequisites:

BIME 3000

Textbook:

Human Physiology: An Integrated Approach. by Dee Unglaub Silverthorn, C. Ober (Illustrator), Claire W. Garrison (Illustrator). Pearson Education, 2006, ISBN: 0805368515

Course Objectives:

Upon completion of this course, students shall be able to:

- Describe principals of cell signaling systems, including receptors, amplification, second messengers and genetics
- Model operation of endocrine signaling systems
- Analyze cardiac and cardiovascular system, solid and fluid, from an engineering perspective
- Model electrical events in the heart and ECG waveform
- Model the flow of blood through a compliant circulatory system using engineering software.
- Solve for the stress in a blood vessel wall subjected to blood pressure
- Analyze the link between fluid flow in the heart and cardiac sounds
- Model the kidneys as an active-transport counter-current exchanger
- Model the quantitative relations for respiratory system
- Analyze signal processing for cochlear implants (3)
- Model body systems: digestive system, blood and lymph, immune system
- Mathematically model the integumentary system, and transport across skin boundary
- Model the autonomic nervous system, the brain and the spinal cord
- Apply Matlab in the modeling of physiological systems

Course Topics:

- Cell signaling systems: receptors, amplification, second messengers, genetics
- Cell signaling, Neuronal Signaling
- Neuronal Signaling, Endocrine Signaling
- Heart and Cardiovascular System
- Heart and Cardiovascular system
- Cardiovascular, Renal system
- Renal System
- Renal System, Respiratory System
- Respiratory system, Cochlear implants
- Cochlear implants, digestive system
- Blood and lymph, immune system
- Immune system, skin and epithelia
- Brain and spinal cord
- Autonomic nervous system

- biological control systems introduction

Relevant Program Outcomes:

Graduates of the BS in Engineering Program will demonstrate:

- L1) Measurements on and interpretation of data from living systems
- L2) Understanding of biology and physiology

Professional Component Content:

Math/Science: 0; Engineering: 4 cr; General Education: 0

Assessment Requirements:

Student work samples

- Targeted Exam Questions (Outcome L2)

Student Course Survey (outcome L1)

Last Review:

October 15, 2008 by Paul Kauffmann