BME 5411: New Course – Biomedical Physiology and Engineering II

Instructors: Dr. Michael Brown, Dr. Jorge Riera, and Dr. Brian Hillen

Time: Tu & Th 3:25PM - 4:40PM

Location: Engineering Center 2680

Course Objective

This is an introductory course for new BME graduate students. It emphasizes physiology and associated engineering concepts frequently encountered in the Biomedical Engineering field. It starts by introducing biological processes and interactions at the molecular, cellular and organ levels to help students understand how an organism works. Subsequently, key physical concepts and engineering analyses of selected physiological functions under normal and diseased states will be introduced. The foci of this course will be (1) neural physiology and engineering and (2) musculoskeletal physiology and engineering. This course should prepare BME graduate students for advanced courses in life science and biomedical engineering areas.

Learning Outcomes

(1) Obtain fundamental knowledge about biological processes and interactions of the neural system.
(2) Obtain fundamental knowledge about engineering principles associated with biological processes and interactions of the neural system.
(3) Obtain fundamental knowledge about biological processes and interactions of the musculoskeletal system.
(4) Obtain fundamental knowledge about engineering principles associated with biological processes and interactions of the musculoskeletal system.

Prerequisites

NA

Grading

40% Assignments: 1/27/2015 (MB), 2/19/2015 (JR), 3/24/2015 (MB), and 4/16/2015 (BH).
30% Mid-Term: 2/26/2015 (MB and JR).
30% Final Exam (MB and BH)

Major Topics

1/13/2015 to 1/27/2015: Neural physiology (MB)

1. Neurons: Cellular and Network Properties
2. Organization of the Nervous System: CNS
3. Sensory Physiology
4. Autonomic Nervous System
5. Somatic Motor Nervous System

1/29/2014 to 2/24/2014: Neural engineering (JR)

1. Introduction to modeling neuronal masses and implications to the forward problems in electrophysiology
2. The basic cellular substrates of functional neuroimaging: Illustrated through particular applications
3. The biomedical engineering basis of brain machine interfaces: creating bridges from neuron to sensors using few particular examples
4. Basic concepts for causality and connectionism in the Brain

3/3/2014 to 3/24/2014: Musculoskeletal physiology (MB)

1. Skeletal Muscle Physiology
2. Smooth Muscle Physiology
3. Cardiac Muscle Physiology
4. Integrated Control of Body Movement
5. Control of Movement in Visceral Muscles
6. Muscular Disorders

3/18/2014 to 4/23/2014: Musculoskeletal engineering (BH)
Musculoskeletal engineering (BH)

1. Musculoskeletal mechanics
   How do engineering principles apply to forces and movement of musculoskeletal systems?
2. Measurement and analysis of musculoskeletal systems
   How do we use engineering techniques to describe and analyze the mechanics of musculoskeletal systems?
3. Engineering system design applied to musculoskeletal systems
   How do we engineer systems to modify the mechanics of musculoskeletal systems?

Text Books

Human Physiology: An Integrated Approach (5th Edition) Publication Date: October 17, 2009 | ISBN-10: 0321559800 | ISBN-13: 978-0321559807 | Edition: 5

Brain-Machine Interface Engineering (Synthesis Lectures on Biomedical Engineering) [Paperback]
Jose Principe (Author), Justin C. Sanchez (Author), John Enderle (Editor)

Handbook of Brain connectivity
Viktor K. Jirsa (Author), A R McIntosh (Author)
http://books.google.com/books/about/Handbook_of_brain_connectivity.html?id=euzOcpfJwJQC

Brain Imaging Methods
Arthur W. Toga (Author), John C. Mazziotta MD PhD (Author)
http://www.amazon.com/Brain-Mapping-Methods-Second-Edition/dp/0126930198

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the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.