

ECE4784 Course Syllabus

ECE4784

Engineering Electrophysiology (3-0-0-3)

CMPE Degree

This course is Elective for the CMPE degree.

EE Degree

This course is Elective for the EE degree.

Lab Hours

0 supervised lab hours and 0 unsupervised lab hours

Course Coordinator

Hunt, William D

Prerequisites

ECE3040 or BMED 3500

Corequisites

None

Catalog Description

Basic concepts of electrophysiology from an engineering perspective. Functionality of relevant organs and systems; instrumentation tools which monitor electrophysiological function. Crosslisted with BMED 4784.

Textbook(s)

Barr & Plonsey, *Bioelectricity: A Quantitative Approach* (3rd edition), Springer, 2000. ISBN 9780387488646 (required)

G.W. Neudeck, *The PN Junction Diode: Volume II (Modular Series on Solid State Dev., Vol 2)* (2nd edition). ISBN 10: 0201122960(optional) (comment: Chapters 2 and 3)

Course Outcomes

Upon successful completion of this course, students should be able to:

1. Explain the basic concepts of electrophysiology and the analogies to active / passive electrical circuits.
2. Explain the function of relevant organs, systems in the body as well as the analysis tools used to monitor and quantify those biological systems.

Student Outcomes

In the parentheses for each Student Outcome:

"P" for primary indicates the outcome is a major focus of the entire course.

"M" for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.

"LN" for "little to none" indicates that the course does not contribute significantly to this

outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (LN) An ability to communicate effectively with a range of audiences
4. (LN) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (P) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (LN) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (P) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

1. Membrane Biophysics: Diffusion across cell membrane, Nernst potential
2. Action Potentials: Membrane behavior, Origin of action potential
3. Electrical Stimulation of Excitable Tissue: Space Constants and
4. Extracellular Fields: Monopole and Dipole models
5. Electrophysiology of the Heart: Anatomy/physiology of heart, Heart
6. Neuromuscular Junction: Transmitters, Poisson statistics, Post-j
7. Skeletal Muscle: Anatomy/physiology of muscle, Myofibrils and fi
8. Functional Neuromuscular Stimulation: Electrodes, Nerve Excitati
9. Quantitative Sensory Physiology: Auditory Physiology, Retinal Phy
10. Interface Circuitry / Systems(Supplemental material may include