ECE4782 Course Syllabus

ECE4782

Biosystems Analysis (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

Inan,Omer T

Prerequisites

ECE 2026 [min C] or BMED 3510 [min C] or CHBE 4411 [min C] or ME 3015 [min C]

Corequisites

None

Catalog Description

Signal processing and modeling tools are presented for analyzing biomedical signals, with a particular focus on physiologic monitoring for human health and performance. Crosslisted with CHE and ME 4782.

Textbook(s)

Khoo, Michael C. K., *Physiological Control Systems : Analysis, Simulation, and Estimation*, Wiley-IEEE Computer Society Press, 2001. ISBN 9780780334083 (required)

Course Outcomes

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

1. Design and implement pre-processing algorithms for reducing noise and artifacts from biosignal recordings
2. Describe challenges in real-world biomedical signal processing problems such as motion artifacts and low signal-to-noise ratio
3. Develop strategies for mitigating these real-world challenges including through the design of multi-modal signal processing and machine learning techniques
4. Communicate the design of biosignal processing algorithms to a diverse audience of engineers and / or clinicians via written and oral presentation

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. (P) 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. (P) 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. (M) 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. (LN) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

A. Fundamentals of digital signals and systems
1. Convolution
2. Fourier transform
3. Digital filters
B. Fundamentals of probability and statistics, and basic machine le
1. Probability distribution and density functions
2. Basics of machine learning
3. Regression and classification
4. Signal modeling techniques
C. Physiologic monitoring
1. Cardiovascular and pulmonary physiological and signals
2. Nervous system and neurological disorders
3. Biomechanics: posture, balance, and movement
4. Acoustic signals: speech, heart sounds, snoring
5. Trauma, hemorrhage and other acute monitoring
D. Special topics in biosignal processing and modeling
1. Cuffless blood pressure estimation
2. Extreme environment human performance augmentation