BME 333- Biomedical Signals and Systems

3 Credits, 4 Contact hours
LEC: 3 hrs/wk, Recital:1 hr/wk
Instructor: Antje Ihlefeld, PhD

Textbook(s)/Materials:

Recommended Textbook:

OWN: "Signals & Systems," Second Edition, Oppenheim, Willsky, Nawab

(Prentice Hall)

Course overview:

This course will focus on computational techniques to assess the functionality of systems and to analyze and synthesize signals. The course will cover fundamentals in signal processing as it applies to biomedical engineering. We will look at several application areas, including neural signals, basics of speech and audio processing, and common approaches for analyzing real-world signals.

Course Description:

This lecture series introduces fundamental techniques for analyzing and interpreting signals and systems. The primary objective is to develop an in-depth understanding of what computational attributes are important when trying extract meaning from a biomedical signal, how signal attributes can be classified and altered through signal processing. Moreover, there are multiple, redundant ways to assess signals and systems, and the course introduces the most common, fundamental engineering techniques and shows how they relate to each other. Homework assignments strongly encourage students to build up practical engineering skills in signal processing.

Prerequisites:

The course requires familiarity with linear algebra. BME 310 is a suitable pre-requisite.

This is a required course for undergraduate students to be offered inSpring 2018.

Goals:

To provide students with:

1. Complete understanding of the nature of continuous and discrete signals and their applications in engineering systems.

2. Knowledge of the terminology of and concepts of both analog and digital signals and systems.

3. Experience in the characterization of signals

4. Understanding of and experience in the use of transforms for signal classification and analysis.

5. Experience in signal processing and system analysis using Matlab.

Course Outcomes:

As an outcome of completing this course, students should be able to:

1) Appropriately apply terminology of signals and systems.

2) Read and interpret signal characteristics from common signal representation techniques

3) Demonstrate ability to design basic computational systems for signal analysis

4) Convert analog into discrete signals and vice versa and have a clear grasp of sampling, under sampling and aliasing.

5) Have a high-level understanding of the connections between Laplace, z-,and Fourier-transforms.

6) Design and perform Matlab experiments to verify concepts.

Topics Covered:

-Signals and Systems

-Linear Time Invariant systems

-Laplace transform

-Z-transform

-Fourier analysis and filtering

-Communication signals (amplitude-modulation, frequency-modulation)

-State Space Analysis

-Random Signals