BME 333 – Biomedical Signals and Systems

3 Credits, 3 Contact hours
Instructor: Joel Schesser, Ph.D.

Textbook(s) and other Required Materials:
Signals and Systems Analysis in Biomedical Engineering, Northrop

Description:
BME Tools such as the Laplace and Fourier Transforms, time-frequency analysis are introduced. Applications include signals and noise, processing of the ECG, mathematics of imaging and derivation of useful physiological parameters from input signals.

Prerequisites by topic:
BME 310 and Math 222.

Course Objectives:
1. **Signal Processing:** Understand the mathematical principles of continuous and digital signal processing**.** Apply knowledge of math, engineering and science to identify, formulate, and solve problems in these areas.
2. **Biomedical Signal Processing:** Apply knowledge of math, engineering and science to understand the principle of biomedical signal processing. Understand how to apply specific mathematical techniques to solve problems in the areas of biomedical signals (e.g., calculation of an ECG spectrum using Fourier Series and calculation of Heart Rate Variability using Fourier Transforms).

Topics covered:
1. Unit Impulse Function
2. Linear Systems Analysis with Biomedical Engineering Applications Engineering Systems Analysis using Linear Ordinary Differential Equations
4. Convolution and Stability of SystemsApproximation of Signals – Fourier Series
6. Calculation the Spectrum of BioMedical Signals Using Fourier Series
7. Fourier Transforms
8. Discrete Fourier Transforms
9. Filtering
10. Calculation the Spectrum of BioMedical Signals Using Fourier Transforms
11. Heart Rate Variability Analysis
12. Basic Imaging Technologies and Processing
13. Modulation: Amplitude, Angle and Pulse Code
14. Sampling Theorem
15. Laplace Transforms
16. Solving Systems using Laplace Transforms
17. Z-Transforms

Professional Component:

Biomedical Engineering Track Topics in Bioinstrumentation

Performance Criteria	**Specific Activity During the Course**	**Assessment Methods/Metrics**
Course Objective 1: Signal Processing: Understand the mathematical principles of continuous and digital signal processing**.** Apply knowledge of math, engineering and science to identify, formulate, and solve problems in these areas.		
A-1 Apply foundations of math, science, engineering to develop solution to	Apply student knowledge of the course materials	Final Exams
Course Objective 2: Biomedical Signal Processing: Apply knowledge of math, engineering and science to understand the principle of biomedical signal processing. Understand how to apply specific mathematical techniques to solve problems in the areas of biomedical signals (e.g., calculation of an ECG spectrum using Fourier Series and calculation of Heart Rate Variability using Fourier Transforms)		
E-1 Formulate a potential engineering approach	Calculations of Signal Transforms	Exams
E-2 Develop suitable solution to engineering problem	Calculation of system outputs using learned math tools	Exams