BME311

Course Syllabus

1. *Department*: Biomedical Engineering *Number*: BME311 *Credit Hours*: 3
Title: Linear Systems in Biomedical Engineering *Required*

2. *Course Description*:
Fundamentals of linear systems analysis as applied to problems in biomedical modeling and instrumentation. Properties of biomedical systems and signals. Representation of continuous- and discrete-time signals and system response. Convolution. Fourier analysis in continuous and discrete domains. Laplace transform. Frequency response and its application in biomedical systems. Filter design. Circuit analogs to mechanical and thermodynamics systems and their applications in modeling biomedical systems. Applications in biomedical instrumentation. Students use MATLAB to simulate and analyze biomedical linear systems.

3. *Prerequisite(s)*: BME 201, ECE331

4. *Textbook(s) and/or other required material*:
Signals and Systems, Second Edition, Simon Haykin and Barry Van Veen, 2003, Wiley

5. *Course objectives. By the end of this course, the student should be able to: (use demonstrative verbs)*
1. Classify signals and systems according to their properties;
2. Describe linear shift-invariant systems in terms of impulse response and frequency response and discuss the relationships between these two representations;
3. Apply Laplace, Z, continuous Fourier, and discrete Fourier transforms to solve appropriate problems in the analysis of biomedical systems and signals;
4. Discuss and apply mathematical models of biomedical systems that are based on linear system analogs;
5. Simulate and analyze biomedical linear systems using MATLAB.

6. *Topics covered (give the number of lectures per topic, as well as the total number of lectures per semester)*:
Total of 25 lectures(in parentheses):

1.Time domain properties of signals and systems (4)
BME Application: Mechanical, fluid and electrical modeling of BME systems, Example: Cardiovascular system.
2.Impulse response representation of discrete and continuous LTI systems (4)
BME Application: Modeling Skeletal Muscle, Example: Convolution of action potential and muscle response.
3. Frequency domain representations of signals (FS, DTFS,FT,DTFT) (6)

BME Application: Performing an FFT on the EEG data from the BME 301 lab. using MATLAB.
4. Frequency response of continuous and discrete LTI systems(4)
BME Application: Filtering the EEG signal using MATLAB.
5. Continuous system analysis using the Laplace Transform (3)
BME Application: Muscle reflex control and stability analyisis.
6. Discrete system analysis using the Z transform (2)
7. Feedback Systems (2)
BME Application: Pupil control system.
Exams(2 plus final exam)

7. *Class/laboratory schedule (sessions per week and duration of each session)*:
Two 75 minutes lectures per week.