BME 372 – Biomedical Electronics I

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

Textbook(s)/Materials Required:
Electronics, 2nd Edition, Hambley

Description:
The first of a two-semester sequence. It covers the design of electronic circuits for Biomedical applications. This course covers basic operational amplifier circuits as well as the operation of semiconductor diodes and transistors. An introduction to digital logic circuits is also provided. Hands-on breadboarding of electronic circuits are used throughout the course to supplement the lectures.

Prerequisites by topic:
BME 301

Objectives:
1. **Fundamental Electronics:** Understand the fundamental principles electronics**.** In particular, gain knowledge in circuit analysis, amplifiers, operational amplifiers, diodes and transistors. Apply knowledge of engineering and science to identify, formulate, and solve problems in these areas.
2. **Data Interpretation:** Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronics test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report.
3. **Electronic circuits for Biomedical Applications:** Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals.
4. **Work in Multi-disciplinary teams:** Learn to work and communicate effectively with peers on multi-disciplinary teams to attain a common goal.

Topics:
1. Basic Circuit Analysis: Passive and active components, Independent and dependent voltage and current sources, Kirchkoff's voltage and current laws, Voltage and current division, Mesh and Nodal Analysis, Superposition, and Thevenin's and Norton's equivalent circuits
2. Electronic Systems and Amplifiers
3. Ideal Amplifiers
4. Operational Amplifiers
5. Medical Instrumentation Amplifiers
6. Feedback
7. Diodes and Ideal Diodes
8. Bipolar Junction Transistors and BJT amplifiers

9. Laboratory experiments: Operation of an oscilloscope, Operation of a multi-meter, Measurement of circuit parameters, and Design of a BJT amplifier

Professional Component:

Biomedical Engineering Track Topics in Bioinstrumentation

Performance Criteria	**Specific Activity During the Course**	**Assessment Methods/Metrics**
Course Objective 1: Fundamental Electronics: Electronics: Using an understanding the fundamental principles electronics to gain knowledge in more complicated circuit designs, field effect transistors, amplifiers, frequency response, signal generation, timers, and wave-shaping circuits. Apply knowledge of 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: Data Interpretation: Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronics test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report.		
B-1 Design and conduct experiments	Designing a Transistor Amplifier.	Laboratory reports
B-2 Properly collect, analyze, & present data	Oscilloscope Measurements.	Laboratory reports
B-3 Interpret meanings from analyzed data	Oscilloscope Measurements.	Laboratory reports
e Course Objective 3: Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals.		
E-1 Formulate a potential engineering approach	Calculation of Circuit Operation	Exams
E-2 Develop suitable solution to engineering problem	Calculation of Circuit Operation	Exams
K-2 Use Modern technology/instrumentation	Using Laboratory Test Equipment: Oscilloscopes, meters and signal generators	Laboratory reports
Course Objective 4: Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi-disciplinary teams to attain a common goal.		
D-1 Work with others & share responsibilities	All laboratory experiments	Laboratory reports
D-2 Build consensus and effective team interactions	All laboratory experiments	Laboratory reports