BME 373 – Biomedical Electronics II

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

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

Description:
Continuation of BME 372, emphasizing biomedical applications of oscillators, active filters, and wave-shaping circuits.

Prerequisites:
BME 372

Objectives:
1. **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.
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 covered:
1. MOSFET and its equivalent circuit
2. Junction FETs and its equivalent circuit
3. Boolean Algebra, Basic Logic Gates and Logic Gate Design Specifications
4. Frequency Response
5. Miller Effect
6. Small Signal Equivalent Circuits for the BJT
7. Negative Feedback: Gain Stability, Impedances, Transient and Frequency Response,
8. Positive Feedback: Oscillators, Comparators and Schmitt Triggers, Astable Multi-vibrators , Timers
9. Rectifiers, Peak Detectors, Sample and Hold Circuits, Clamp Circuits
10. D/A and A/D Converters
11. Laboratory experiments: Design of a BJT amplifier, Op Amps and Medical Instrumentation Amplifier, and Timers and wave shaping circuits

Professional Component:
Biomedical Engineering Track Topics in Bioinstrumentation

Performance Criteria	**Specific Activity During the Course**	**Assessment Methods/Metrics**
Course Objective 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.		
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	**Calculation the Signal Spectrum**.	Laboratory reports
N-1 Collect Data from human, tissues or cells	ECG Simulator Analysis	Lab Report 3
N-2 Analyze Data from human, tissues or cells	ECG Simulator Analysis	Lab Report 3
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