ELE 210U: ENGINEERING CIRCUIT LAB PROJECT (required)

Credit: 1 hour.

Catalog Description: Laboratory to design and build electrical circuit projects. Team project must be designed and implemented by the end of the semester. Meets two hours a week.

Prerequisites: ELE 250. **Co-requisite:** ELE 210.

Textbooks(s) and/or Other Required Materials: None.

Topics Covered:

1. Pspice Analysis including DC, AC and transient analysis.
2. Using the DMM to measure resistance, voltage and current.
3. Use of the power supply as a DC source and the function generator as an AC source.
4. Introduction of the Digital Oscilloscope by describing the three basic sections; vertical, horizontal and triggering. The digital oscilloscope will be compared to an Analog oscilloscope.
5. Using the oscilloscope to measure charge and discharge times for simple RC circuits.
6. Using the oscilloscope to make phase measurements using cursors and triggering off the source.
7. Using a DMM and an oscilloscope to observe operational amplifiers in DC and AC operation.

Class/Laboratory Schedule:

Lecture: included during lab
Lab: 2 hours/week

Course Objectives and Relationship to Program Outcomes:

1. Use a triple output power supply to provide DC power to a circuit, making sure the correct polarity and level is observed at all times (Outcome: A, B, E, F, G, I, K).
2. Use a Digital Multi-meter (DMM) to measure DC voltages in a circuit (Outcome: A, B, D, E, F, G, I, K).
3. Use a DMM to measure the resistance of a component and the resistance of a circuit in a circuit making sure to follow safe measuring techniques (Outcome: A, B, E, F, G, I, K).
4. Use a DMM to measure AC RMS voltages at the secondary of a transformer (Outcome: A, B, E, F, G, I, K).
5. Use a Function Generator (FG) to provide a sine wave at a given frequency and amplitude to a linear circuit (Outcome: A, B, E, F, G, I, K).
6. Adjust a FG to provide different waveforms to a given amplitude, frequency and offset (Outcome: A, B, E, F, G, I, K).
7. Enable and disable different types of modulation (AM, FM, FSK) and sweep functions that the FG is capable of (Outcome: A, B, E, F, G, I, K).

8. Use a Digital Oscilloscope to properly measure AC and DC voltages using grids and cursors.
9. Set up an Oscilloscope to measure the voltage between two nodes (Outcome: A, B, E, F, G, I, K).
10. Properly trigger an oscilloscope to make phase measurements using cursors (Outcome: A, B, E, F, G, I, K).
11. Set up an oscilloscope to use the delayed sweep to zoom in on a portion of a waveform. The delayed sweep will then be used to make critical time and phase measurements (Outcome: A, B, E, F, G, I, K).
12. Use an oscilloscope to make rise and fall time measurements, propagation delay and period measurements (Outcome: A, B, E, F, G, I, K).

The laboratory integrates theories covered in lecture, PSPICE Circuit Analysis software and laboratory experiments to allow the student to understand the basic theories and laws pertaining to circuit analysis. Circuit analysis software is introduced to the student so that a solution can be obtained and used to check measurements made in the laboratory. The software is also used to illustrate Kirchhoff's laws by allowing changes to be made in a schematic and obtaining the results and relating them to the laws discussed in lecture. The student then is given the opportunity to use measurements on the same circuits reinforcing Kirchhoff's laws.

The student is trained in the safe and proper use of laboratory equipment and shown how to properly construct simple circuits from a schematic. Equipment that is covered in the laboratory includes power supplies, DMMs, function generators and digital oscilloscopes. The student will build circuits that contain resistors, capacitors, inductors and operational amplifiers.

Safe operation of equipment will be observed throughout the semester. Some topics described above will overlap. The student is given a final exam at the end of the semester to demonstrate the ability to properly read component values and properly set up a function generator and an oscilloscope to make a measurement involving phase shift.

Coverage (and level) of ABET Outcomes: A (3), B (3), E (3), F (2), G (2), I (1) and K (2).

Contribution of Course to meeting the Professional Component:

Engineering Topics: 100%

Date: June 2004.