Course Title: COEN 2111: Circuits I Lab

Semester Credit Hours: 1 (0,3)

I. Course Overview

This course covers experimental aspects of the topics covered in COEN 2311: Circuits I. Topics include basic bread-boarding techniques and circuit construction; use of multimeters, oscilloscopes, power supplies, and function generators; DC and AC voltage and current measurement techniques; troubleshooting techniques; and comparison of experimental and simulated circuits.

II. PMU Competencies and Learning Outcomes

Skills in design, construction, measurement, and analysis of DC and AC circuits are major components of professional competence for electrical and computer engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in laboratory exercises and projects. Professional communication skills (written and oral) are encouraged through lab participation and assignments. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this class.

III. Detailed Course Description

This course covers experimental aspects of the topics covered in COEN 2311: Circuits I. Topics to be covered include basic bread-boarding techniques and circuit construction; use of multimeters, oscilloscopes, power supplies, and function generators; DC and AC voltage and current measurement techniques; troubleshooting techniques; and comparison of experimental and simulated circuits.

IV. Requirements Fulfilled

This is a required course for majors in computer engineering

V. Required Prerequisites

Successful completion of:

- MATH 1324: Calculus III
- PHYS 1422: Physics for Engineers II

Completion of or concurrent registration for:

- MATH 2332: Differential Equations
- COEN 2331: Circuits I

VI. Learning Outcomes

At the end of this course, students will:

- Be able to accurately measure current, voltage, energy, and power in DC and AC circuits
- Be able to experimentally determine time constants from RC and RL circuits
- Measure an unknown circuit and create an accurate model of its performance from these measurements
- Be able to analyze DC and AC circuits using MATLAB and PSPICE and compare these results to those experimentally measured.

In addition to these outcomes, students develop an understanding of the relationship between the experimental reality and simulation of DC and AC circuits.

VII. Assessment Strategy

The assessment strategy measures students' understanding of circuit theory and apply the knowledge acquired in the analysis and design. This is achieved in the following ways:

- Lab exercises are used to help indicate to the instructor and the student his or her level of involvement and understanding.
- Lab projects are used to provide feedback to students and to indicate individual progress in meeting course goals
- Lab exams are used to indicate students' developing level of mastery of the topics of the course
- An end-of-semester lab practical exam is used to measure the student's mastery in understanding and application of the knowledge integral to the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. In addition, students keep an engineering notebook which accurately reflects all activities done in the course.

VIII. Course Format

The course is taught in a studio format where students alternate between lecture, simulation, and experiment. Preparation for lab by reading the laboratory assignment and doing the pre-lab assignments is required so that students come to class ready to do the required work. This also indicates a student's commitment to professional growth.

Classroom Hours: **Class lecture: 0 hour per week**
Lab Session: 3 hours per week

IX. Topics to be Covered

A. Basic bread boarding techniques and circuit construction.
B. Importance and use of engineering notebooks.
C. Introduction to multimeters, power supplies, oscilloscopes, and function generators.
D. Voltage and current measurements
E. Simulation of DC and AC circuits using PSPICE®.
F. Analysis of DC and AC Circuits using MATLAB® and PSPICE®.
G. Troubleshooting techniques for DC and AC circuits
H. Design of circuits using op-amps
I. Creation of equivalent circuit models via voltage and current measurements

X. Laboratory Exercises

The main focus of this course is laboratory exercises and projects. Labs are followed the topics to be covered and consists of each of the following: background information, pre-lab exercises, in-lab exercises, and post-lab questions and exercises. All of this information is kept in an engineering notebook.

XI. Technology Component

Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for analysis of data and completion of problems is required, for example, use of a scientific calculator, use of student owned laptop. Students utilize the application software packages (MATLAB and PSPICE) in lab.

XII. Special Projects/Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Robert A. Witte, *Electronic Test Instruments: Analog and Digital Measurements,* Second Edition, Prentice Hall PTR, 2002

B. Alternative Textbooks

None

C. Supplemental Materials

1. Scientific calculator
2. Laptop Computer
3. MATLAB® and PSPICE® access
4. Engineering notebook