Course Title: COEN 3421: Electronics I (with Lab)
Also listed as EEEN 3421: Electronics I (with Lab)

Semester Credit Hours: 4 (3,3)

I. Course Overview

This course is the first of two courses in the use of electronic devices in analog and digital circuits. The lecture component covers device physics and modeling of op-amps, diodes, FETs, and BJTs; single and multi-stage amplifiers; differential amplifiers; feedback; frequency response; Bode plots. Laboratory component covers generation and acquisition of signals; current, voltage, and impedance measurements; transfer function measurement; and spectrum measurements and analysis.

II. PMU Competencies and Learning Outcomes

Skills in analyzing and designing analog and digital 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 the class discussions, assignments, and lab activities. Professional communication skills (written and oral) are encouraged through discussions 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 is the first of two courses in the use of electronic devices in analog and digital circuits. The lecture component covers device physics and modeling of op-amps, diodes, FETs, and BJTs; single and multi-stage amplifiers; differential amplifiers; feedback; frequency response; Bode plots. Laboratory component covers generation and acquisition of signals; current, voltage, and impedance measurements; transfer function measurement; and spectrum measurements and analysis.

IV. Requirements Fulfilled

This is a required course for all computer engineering majors.

V. Required Prerequisites

Successful completion of:

- COEN 2311: Circuits I
- COEN 2111: Circuits I Lab

Completion of concurrent registration for:

- COEN 3312: Circuits II

VI. Learning Outcomes

At the end of this course, students will:

- Be able to accurately define current, voltage, and power gain in amplifiers
- Be able to accurate calculate the current-voltage characteristics of diode, FETs, and BJTs
- Be able to define the small-signal characteristics of FETs and BJTs
- Be able to use small-signal circuit models of FETs and BJTs in the analysis of circuits
- Be able to calculate the frequency response of circuits
- Be able to analyze circuits using diodes, FETs, and BJTs using modern electronics instrumentation

VII. Assessment Strategy

The assessment strategy measures the student's understanding of electronics and apply the knowledge acquired in the analysis and design of circuits. This is achieved in the following ways:

- Class participation is used to help indicate to the instructor and the student his or her level of involvement and understanding.
- Homework assignments are used to provide feedback to students and to indicate individual progress in meeting course goals
- Design problems – conducted both experimentally in the lab and theoretically using PSPICE® – are used to provide students with advanced design and analysis problems, done either individually or in groups, that focus on advanced critical thinking and problem solving skills
- Mid-term examinations are used to indicate students' developing level of mastery of the topics of the course
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge integral to 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 cooperation with the instructor, each student selects a design problem to become a part of the student's portfolio. In addition, each student keeps an engineering notebook which accurately reflects all activities done in the lab portion of this course.

VIII. Course Format

The course consists of lectures, class discussions, homework assignments to be completed outside of class, laboratory exercises and projects, and examinations. Students prepare for class by reading the text and additional materials and by completion of assignments so that they may be discussed in class are expected as indicators of the student's commitment to professional growth.

Classroom Hours: **Class: 3 hours per week**
Lab: 3 hours per week

IX. Topics to be Covered

A. Introduction to electronics: signals and amplifiers
B. Operational amplifiers
C. Diodes
D. MOS field-effect transistors (MOSFETs)
E. Bipolar junction transistors (BJTs)
F. Single-stage amplifiers
G. Differential and multistage amplifiers

X. Laboratory Exercises

All laboratory exercises are designed to provide students with expertise needed to make measurements from analog and digital circuits using diodes, FETs, and BJTs. In addition a problem is assigned to focus on the design, implementation, and analysis of circuits to electronic applications.

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, and use of student owned laptop. Students utilize the application software packages (MATLAB and PSPICE) in homework problems and in labs.

XII. Special Projects/Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Adel Sedra and Kenneth Smith, *Microelectronic Circuits*, Fifth Edition, Oxford University Press, 2004

B. Alternative Textbooks

None

C. Supplemental Print Materials

1. Scientific calculator
2. Laptop Computer
3. MATLAB and PSPICE access either on laptop or in a general purpose computer lab
4. Engineering notebook