ECE 3710 Circuits and Electronics (2-0-2)

Prerequisites: Phys 2212/2232
Co-requisites: None

Catalog Description: An introduction to electric circuit elements and electronic devices and a study of circuits containing such devices.

Section Instructor: Dr. Joy Harris (Joyelle.Harris@ece.gatech.edu)

Section GTA:

Lead Instructor for ECE 3710: Dr. Harris, Joyelle.Harris@ece.gatech.edu, (Dr. Harris coordinates the course across the sections but does not manage the individual sections. Please see your section instructor for questions on grades, conflict scheduling, etc.)

Office Hours: You may go to the office hours of any of the ECE3710 instructors. These hours are posted on canvas.gatech.edu.

Required Materials:

- National Instruments myDAQ available online (http://www.studica.com/GeorgiaTech.html) or at Barnes and Noble bookstore. The myDAQ can be new or used.
- NEW lab parts kit available here: https://www.sparkfun.com/products/13946?custom_code=GTECE3710

The first lab will be the second week of class, so please make your purchases immediately.

Textbook: Circuits by Fawwaz Ulaby & Michel Maharbiz. Available at Barnes and Noble

Online Resources: Online lectures and homework available at Canvas.gatech.edu

Course Structure:

This course is divided into three mini-courses:

- Linear Circuits 1: DC Analysis
- Linear Circuits 2: AC Analysis
- Introduction to Electronics

All of the lectures for the term are online. The homework will be completed on line. There will also be daily quizzes and worksheets in class based on the online lecture material. The assigned lectures for each class period are listed in the syllabus.

There will be seven labs where students will perform hands-on activities using data acquisition boards. Some of these activities include exploration of RC and RLC circuits, op amp circuits, filters, and physically-motivated applications of electronic circuits. These hands-on activities are designed for students to complete during class and turn in a worksheet.

Grading

1. Homework completed on the canvas.gatech.edu platform (15%). No credit will be given for late homework.
    a. Linear Circuits 1: DC Analysis (5%)
    b. Linear Circuits 2: AC Analysis (5%)
    c. Intro to Electronics (5%)
2. Quizzes (5%, lowest 2 will be dropped)
3. In-Class Worksheets (5%, lowest 2 dropped)
4. Labs (15%)
5. Tests (40% total):

    Tests are completed at a common time across all sections.

    - Test 1, Thursday, June 4, 7:40 – 8:30 pm (20%)
    - Test 2, Thursday, June 25, 7:40 – 8:30 pm (20%)
6. We have a common final exam from 6:00 pm – 8:45 pm. The final exam is cumulative. Conflict exams can be arranged with your instructor.
    - Final exam, Thursday, July 23 (20%)
7. Extra Credit:
    - Applications: Build and demo an interesting circuit (2 points on your final grade)

Topical Outline

Resistive Circuits
- Components
- Ohm's Law
- Resistors in parallel, series
- Kirchhoff's Current and Voltage Laws
- Voltage divider and current divider laws
- Thévenin Equivalent Circuits
- Superposition

Reactive Circuits
- Inductors and Capacitors
- Parallel and series connections of inductors and capacitors
- Transient Analysis of First-Order circuits

Frequency Analysis of Circuits
- Steady-state sinusoidal analysis and impedance
- Transfer function
- Bode plots
- Filtering

Power in AC Circuits
- Real, reactive, and apparent power
- Power factor

Fundamental Devices in Electronics
- Ideal diodes

- Simple piecewise linear model of diode
- MOS Field-Effect Transistors
- Operational Amplifiers

Electronic Applications

- Rectifiers
- Amplifiers
- Active Filters
- Logic Gates (and introduction to Boolean algebra logic)

Course Objectives:

The objectives of this course are to teach students

- to analyze circuits that contain resistors, capacitors, and inductors with direct current and alternating current sources.
- to analyze circuits in the time domain showing transient response and in the frequency domain showing filtering and resonance properties.
- to be familiar with nonlinear circuit components and practical circuits can be built from these components.

Learning Outcomes: At the completion of the course, the students should be able to

- determine voltages and currents in a resistive network.
- sketch the transient response of RC and RL circuits and be familiar with the standard transient responses of RLC circuits.
- use complex phasors to determine the steady-state responses of sinusoidal sources voltages or currents.
- understand and analyze the frequency response characteristics of filters
- analyze power characteristics in reactive circuits.
- build and test real circuits containing RLC components, op amps, diodes, and transistors.
- design and build simple filters, rectifiers, and amplifiers

Academic Integrity:

Academic honesty is essential to achieve high-quality education and to maintain the value of a Georgia Tech diploma. While I encourage you to work together and to form study groups, it is important that you take responsibility for the content of all assignments. Collaboration is allowed on online homework. Cheating on quizzes, tests, and final exams will not be tolerated. When uncovered, violations will be reported to the Dean of Students immediately. A valuable resource for the Georgia Tech Student Code of Conduct and the Academic Honor Code is:

http://www.catalog.gatech.edu/rules/18b.php