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

Prerequisites: Phys 2212/2232
Corequisites: None

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

Section Instructor: Dr. Harris

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 in the gatech.coursera.org course syllabus

Textbook(s) and Required Materials: NI myDAQ and Circuits Textbook Bundle (Includes NI myDAQ student data acquisition board and The Textbook Circuits by Fawwaz Ulaby & Michel Maharbiz. Available at Barnes and Noble and at http://www.studica.com/GeorgiaTech.html

Also required will be a parts kit available at the Georgia Tech Shopping Mall, under the category of ECE Classroom Kits: https://epay.gatech.edu/C20793_ustores/web/

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

Purchase the Turning Point clicker for in-class quizzes. For more information, see the FAQs page for students at http://www.cetl.gatech.edu/it/clicker/student.

Online Resources: lectures and homework: gatech.coursera.org

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 Structure:

This course is being taught in conjunction with two online Coursera courses: Linear Circuits and Introduction to Electronics. Sign up for the class through the link gatech.coursera.org (DO NOT USE coursera.org). All of the lectures for the term will be online. The homework will be completed online. There will also be daily quizzes in class on the online lecture material and associated worksheets. The assigned lectures for each class period are listed on the syllabus in the Coursera site. You can sign into the Coursera course at gatech.coursera.org. We suggest using the Internet browser Chrome (Internet Explorer does not work well for this application).

There will be multiple 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.

There will be homework and a lab the last week of the semester. (Note: This lab is allowable under the Georgia Tech Dead Week Policy since the scope and workload of this activity does not reach the level of a standard lab and would be classified as a hands-on in-class activity rather than an open-ended lab for the purposes of the Dead Week Policy.)

Grading:

1. Homework (15%) (done on the gatech.coursera.org platform)
2. Quizzes (5%, lowest 3 will be dropped) (T Square for the online students)
3. In-Class Worksheets (5%, lowest one dropped) (T Square for the online students)
4. Tests (40% total):
   - Tests are done at a common time, 7pm, across all sections; Conflict time is 11 am on the date of the test. Instructors must be notified on conflicts 3 days in advance
     - Test 1, June 2 (20%)
     - Test 2, June 30 (20%)
5. Final Exam, (20%), date and time is listed in the Registrar’s site for exam schedule; conflicts will be done in the Alternate Exam Period on Friday evening of exams week.
6. Labs (15%)
7. Extra Credit:
   - Applications (2%) (build and demo an interesting circuit)
Lab Software:

We will use the ELVISmx Instrument Launcher software for the myDAQ device. This software is Windows-based, so please install it on a Windows machine or the Windows partition of a MAC. Use Bootstrap or Parallels with this software. The software comes with the myDAQ and is also available at the National Instruments site for free. WARNING: it takes more than 1 hour to download and install.

Support on the device can be found from the following link:


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

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