

**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:** Paul Benkeser (pbenkeser@gatech.edu)**Lead Instructor for 3710:** Dr. Harris, [Joyelle.Harris@ece.gatech.edu](mailto: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:** TBA**Required Materials:**

- National Instruments myDAQ will be provided. If you wish to purchase your own, they are available online (<http://www.studica.com/GeorgiaTech.html>) or at Barnes and Noble bookstore. The myDAQ can be new or used.
- The lab parts kit will be provided.

**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

Classes will be held MTuWTh. Exams are given on the dates indicated in the Grading section of this syllabus. All of the lectures for the term are online. The homework will be completed online. There will also be daily 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%)
  - a. Linear Circuits 1: DC Analysis (5%)
  - b. Linear Circuits 2: AC Analysis (5%)
  - c. Intro to Electronics (5%)

2. In-Class Worksheets (10%)
3. Midterm exam, Wednesday June 5 (30%)
4. Final exam, Friday June 22 (30%)
5. Labs (15%)

## 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)

## 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. This must be completed prior to the first day of class.

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

<http://www.ni.com/white-paper/11420/en>

### **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

## **Summer 2019 Schedule**

### Linear Circuits 1 (DC Analysis)

#### Week 1 (May 20<sup>\*\*\*</sup>)

- M: Lessons 1.0 – 1.5; Lessons 2.1 – 2.2
- Tu: Lessons 2.3 – 2.8; Lab 1
- W: Lessons 2.9 – 2.10
- Th: Lessons 2.11 – 2.15; Lab 2

#### Week 2 (May 27)

- M: Lessons 3.1 – 3.10
- Tu: Lessons 3.13 – 3.16, Lab 3
- W: Lessons 3.11 – 3.12, 3.17; Lab 4

### Linear Circuits 2 (AC Analysis)

- Th: Lessons 1.1 – 1.8,

#### Week 3 (June 3)

- M: Lessons 2.1 – 2.7
- Tu: Lessons 2.8 – 2.11; Lab 5
- W: Midterm Exam
- Th: Lessons 3.1 – 3.10

### Intro to Electronics

#### Week 4 (June 10)

- M: Lessons 1.1, 2.1 – 2.5
- Tu: Lessons 3.1 – 3.5
- W: Lessons 3.6 – 3.8; Lab 6
- Th: Lessons 4.1 – 4.3

#### Week 5 (June 17)

- M: Lessons 4.4 – 4.5
- Tu: Lessons 5.1 – 5.3
- W: Lessons 5.4 – 5.7
- Th: Lab 7
- F: Final Exam

<sup>\*\*\*</sup>Video lectures and homework will be available by May 13 on Canvas for students who desire to get a head start. The instructor encourages you to do