

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.

Textbook(s): Fawwaz Ulaby and Michel Maharbiz, *Circuits*, (2nd edition), National Technology & Science Press, 2010, ISBN-13: 978-1-934891-10-0; and National Instruments myDAQ board.

Topical Outline

Resistive Circuits (3.5 weeks)

- 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 (1.5 weeks)

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

Frequency Analysis of Circuits (2.5 week)

- Steady-state sinusoidal analysis and impedance
- Transfer function
- Bode plots
- Filtering

Power in AC Circuits (1 week)

- Real, reactive, and apparent power
- Power factor

Fundamental Devices in Electronics (2.5 weeks)

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

Electronic Applications (3.5 weeks)

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

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.

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