# ECE 2001: Electrical Circuits

***Credits and contact hours:*** 4 Credits (Three 1-hour lectures and one 2-hour laboratory)

***Instructor:*** John Ayers

***Textbooks:*** James W. Nilsson and Susan A. Riedel, Electric Circuits, 10th Edition (Upper Saddle River, NJ: Pearson, 2015). John E. Ayers, Electrical Circuits Laboratory Manual. (Available to students on the course web site.)

*Other supplemental materials*: The following are available from the university bookstore: a component kit including operational amplifiers, resistors, capacitors, inductors, connectors, and wire; a digital multimeter; and a prototyping board.

***Specific course information*:**

*a.* *Catalog Description*: Analysis of electrical networks incorporating passive and active elements. Basic laws and techniques of analysis. Transient and forced response of linear circuits. AC steady state power and three-phase circuits. Periodic excitation and frequency response. Computer analysis tools. Design projects are implemented and tested in the laboratory. Laboratory reports are required for each project.

b. *Prerequisite*: Prerequisite: MATH 2410Q and either PHYS 1402Q or 1502Q or 1230 or 1530, both of which may be taken concurrently.

c. *Required, elective, or selected elective:* Required

***Specific goals for the course*:**

a. *Specific outcomes of instruction*: Students will be able to

- Analyze the DC behavior of circuits including resistors and sources.
- Determine the transient response of first-order and second-order circuits.
- Analyze or design operational amplifier circuits.
- Analyze the steady-state response of circuits driven by sinusoidal sources.
- Determine the frequency response of passive circuits and active filters.
- Construct electrical circuits and characterize their behavior using laboratory measurements.
- Analyze circuits using computer tools such as PSpice.
- Analyze and interpret laboratory data and present it in laboratory reports.

b. *EAC Criterion 3 Student Outcomes addressed by the course*:

**(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics**
Students analyze the DC, transient, sinusoidal steady-state, and frequency response behavior of circuits constructed using sources, passive components, and operational amplifiers.

**(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors**
Students design operational amplifier circuits to meet specifications of voltage gain, frequency response, or power output, with constraints on power consumption or circuit complexity.

**(3) an ability to communicate effectively with a range of audiences**
Students are required to prepare formal laboratory reports for each laboratory experiment or design project.

**(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts**
*n/a*

**(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives**
*n/a*

**(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions**
Students use power supplies, digital multimeters, function generators, and oscilloscopes to measure the DC, sinusoidal steady-state, transient, or frequency response behavior of passive circuits and circuits containing operational amplifiers. Measured data are analyzed and presented in formal engineering reports.

**(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**
*n/a*

***Topics covered:***

- Ohm's Law, Kirchhoff's Laws, and Resistive Circuits
- Thevenin's Theorem, Norton's Theorem, and Maximum Power Transfer
- Operational Amplifier Circuits
- Capacitors, Inductors, and Transformers
- Transient Response of First- and Second-Order Circuits
- Sinusoidal Steady-State Analysis and Sinusoidal Steady-State Power
- Frequency Response
- Computer Analysis Tools