

## ECE 3201: Electronic Circuit Design and Analysis

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

**Instructor:** John Ayers

**Textbooks:** Robert L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11<sup>th</sup> Edition (Upper Saddle River, NJ: Pearson, 2013). Robert L. Boylestad, Louis Nashelsky, and Franz J. Monssen, *Laboratory Manual to accompany Electronic Devices and Circuit Theory* (Upper Saddle River, NJ: Pearson, 2013).

**Other supplemental materials:** An electronic component kit including diodes, transistors, resistors, and capacitors is available from the university bookstore.

### ***Specific course information:***

- a. *Catalog Description:* Physical electronics underlying the operation of electronic devices. Diodes, diode models, and diode circuits. Transistors, transistor models, and transistor circuits. DC, small signal, and frequency analysis of transistor amplifiers. Compound transistor configurations. Computer analysis tools. Design projects are implemented and tested in the laboratory. Laboratory reports with revisions are required for each project.
- b. *Prerequisite:* [ECE 2001](#); open only to students in the School of Engineering.
- c. *Required, elective, or selected elective:* Required

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

- a. *Specific outcomes of instruction:* Students will be able to
  - Describe the conduction mechanisms in semiconductors and the basic operation of diodes and transistors.
  - Analyze or design diode circuits including clippers, clammers, voltage multipliers, half-wave rectifiers, and full-wave rectifiers.
  - Analyze the DC behavior of digital logic circuits made using transistors.
  - Analyze the DC voltages and currents, the ac small-signal performance, and the frequency response of transistor amplifier circuits.
  - Design single transistor or compound amplifier circuits to meet requirements of gain, input impedance, output impedance, frequency response with possible constraints in power dissipation and component count.
  - Analyze electronic circuits using computer tools such as PSpice.
  - Construct diode and transistor circuits on a prototyping board, and measure the characteristics of diodes, transistors, and their circuits using function generators, oscilloscopes, and digital multimeters.
  - 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, ac small-signal, and frequency response behavior of diode and transistor circuits.

- (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 diode and transistor circuits to meet given specifications with constraints on the power, and the number, size, or total cost of components and must specify component voltage or power ratings with appropriate safety margins.

- (3) an ability to communicate effectively with a range of audiences**

*n/a*

- (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 characteristics of diode and transistor circuits. Measured data are plotted and analyzed to determine the DC characteristics, ac small-signal parameters, frequency response, and cutoff frequencies of transistor amplifiers.

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

Students use the internet to find diode and transistor data sheets and device models for PSpice and hand analysis.

***Topics covered:***

- Semiconductor materials
- Diodes and Diode Circuits
- Transistors and Transistor Circuits
- Computer Analysis Tools