ECE 2240: Introduction to Electric Circuits

Credits and Contact Hours: 4.0 Credit Hours
15 weeks: Three 50-minute lecturers + one 3-hour lab per week

Instructor's Name: Hanseup Kim

Text Book(s) and/or Required Material:

- F.T. Ulaby and M.M. Maharbiz, *Circuits*, Second Edition, NTS Press, 2012

Catalog Description: This course will study the basics of analog circuits: voltage, current, power, resistance, capacitance, and inductance. Topics will include circuit analysis techniques such as Kirchhoff's Laws, node voltages, superposition, and Thevenin and Norton equivalent circuits. Simple op-amp and RC, RL and RLC circuits. Laplace-transform techniques. Alternating current and impedance, phasor transforms, sinusoidal steady- state systems, frequency response, and filters. This course includes a lab.

Prerequisites:

- C- or better in PHYS 2210: Physics for Scientists and Engineers I; **and**
  - MATH 1220: Calculus II; or
  - MATH 1320: Engineering Calculus II; or
  - MATH 1321: Accelerated Engineering Calculus II; **and**
- Full major status in Electrical Engineering or Computer Engineering

Designation: Required

Contribution of Course to Meeting the Requirements of ABET Criterion 5: information

Specific Outcomes of Instruction:
In this course, students will be prepared to:

1. Use Kirchhoff's and Ohm's Laws
2. Perform Node-voltage analysis of circuits
3. 3. Perform Mesh-current analysis of circuits
4. Solve ideal op-amp circuits
5. Find Thevenin and Norton equivalents
6. Use superposition
7. Solve RL, RC and RLC circuits
8. Solve circuits using Laplace transforms
9. Analyze impedance circuits and filters
10. Analyze the frequency responses of circuits

Relationship of the Course to the Program Outcomes:

(a) An ability to apply knowledge of mathematics, science, and engineering. Students apply tools to solve circuit problems such as steady-state equations, transient circuit equations,

Laplace transforms, phasors for complex power calculations and frequency responses. Students apply this knowledge to solve homework, exam, and lab problems.

(b) An ability to design and conduct experiments, as well as to analyze and interpret data. All labs require that circuit measurements be collected, interpreted, and presented in a report.

(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. Each lab requires that students derive component values for a given circuit.

(e) An ability to identify, formulate, and solve engineering problems. In lab write-ups, students write conclusions about why results and theory may have differed. In homework and exams, students select appropriate formula to analyze a given circuit.

(f) An understanding of professional and ethical responsibility. In lab write-ups, students compose and submit reports on their own responsibility for measurement results.

(g) An ability to communicate effectively. Students write formal reports for each of their three labs. Thirty percent of the lab score is for communication, including grammar.

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Students make extensive use of software and hardware: MATLAB (to analyze measurements), Benchlkink (to transfer data from oscilloscopes to PCs), MyDAQ (to collect and display measurements on individual PCs), digital power supplies, digital multimeters, and oscilloscopes. Students use these tools to test and analyze the circuits they build in each lab.

Topics Covered in the Course:

- RLC circuits
- Laplace transform
- Frequency response analysis
- Complex analysis
- Filters