EE-210
CIRCUITS I

DEPARTMENT Electrical and Computer Engineering

COORDINATOR Laura M. Rust, Associate Professor of Electrical Engineering

CATALOG DESCRIPTION This is an introductory course presenting fundamental DC and AC circuit analysis techniques. Topics include circuit variables and elements; resistors, inductors, and capacitors; and sinusoidal steady-state analysis with power calculations. Laboratory experience is designed to reenforce the fundamental analysis techniques discussed in class.

PREREQUISITES PHYS-224,PHYS-225, Electricity & Magnetism and Lab

CLASS/LAB SCHEDULE Three 60-minute class periods and one 120-minute lab period per week (3-2-4)

TEXTBOOK James W. Nilsson, *Electric Circuits*, 6th ed. Addison Wesley Publishers, 2000, (or instructor's choice)

REFERENCE J. David Irwin, *Basic Engineering Circuits Analysis*, 5th ed. Prentice-Hall, 1996
Dorf and Svoboda, *Introduction to Electric Circuit Analysis*, 3rd ed. John Wiley and Sons, 1998

CREDITS Engineering science: 3.5 credits; Engineering design: 0.5 credits

RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES

EE-210 contributes to students' achievement of the Electrical Engineering Program Educational Objectives as outlined below:

PEO1: Students receive a thorough introduction to basic circuit analysis. Students study the effect of resistors, capacitors and inductors on circuit variables and learn to select the values of these circuit elements to satisfy given design specifications.

PEO2: Laboratory exercises provide the students with hands-on experience in a teamwork environment.

PEO3: The hands-on experience students gain in the laboratory, and the ability to interpret experimental results using theory learned in class, enhance their self-confidence.

PEO4: Students receive a solid foundation in the mathematics required to analyze electrical circuits, which lays a foundation for lifelong practice of electrical engineering.

COURSE LEARNING OBJECTIVES

Students who receive credit for EE-210 will have demonstrated the ability to do the following tasks.

1. Describe independent and dependent sources; resistance and conductance; apply Ohm's law and Kirchoff's laws; and use color code and resistor size to determine resistance values, tolerance, and power rating.
2. Use modern measuring equipment safely, such as the oscilloscope, digital and analog meters and function generators.
3. Analyze series and parallel resistor networks and use voltage and current division concepts.
4. Apply circuit analysis techniques, including nodal and mesh analysis, source transformations, Thevenin and Norton equivalent circuits, and the principle of superposition, to solve for circuit variables
5. Determine voltage-current relationships in capacitors and inductors and calculate the energy stored in each.
6. Define and determine sinewave parameters such as peak value, rms value, frequency, period and phase angle (leading and lagging) and dc offset.
7. Analyze impedance and model circuits with resistors, inductors and capacitors excited by sinewaves using phasors and standard circuit analysis techniques in the frequency domain.
8. Convert frequecy domain phasor quantites to appropriate time domain quantities and visa versa.
9. Calculate power factor, real power and reactive power for circuits driven with sinusoidal sources.

TOPICS

1. *Circuit Variables:* units, charge, current, energy, voltage, power, passive sign convention (1 class);
2. *Circuit Elements:* independent and dependent voltage and current sources, resistance, conductance, Ohm's law, Kirchoff's laws (3 classes);
3. *Resistive Circuits:* series and parallel resistors, circuits with constant and time-varying independent sources, voltage and current division (no-load and loaded), non-ideal measurement devices (4 classes);
4. *Techniques of Circuit Analysis:* solution of simultaneous equations, nodal/mesh analysis of circuits containing resistors, independent and dependent sources, sources tranformations, Thevenin and Norton equivalent circuits (with independent and dependent sources), superposition (7 classes) ;
5. *Inductance and Capacitance:* series and parallel inductors and capacitors, energy and power in inductors and capacitors (2 classes) ;
6. *Sinusoidal Steady-State Analysis:* sinusoidal signal and terminology, development of phasor techniques, Euler's identity, conversion between phasor and time domains, complex algebra, rectangular and polar conversions, impedance, reactance, susceptance, admittance, phasor equivalent circuit, phasor domain circuit analysis, Thevenin and Norton equivalent circuits in the fequency domain using phasors, real power calculations (7 classes) ;
7. *Sinusoidal Steady-State Power:* real and reactive power, rms value for arbitrary periodic signals, complex power, power factor, power triangle, power factor correction, maximum average power transfer (3 classes) ;
8. *Exams:* (3 classes) .

LABORATORY EXERCISES

1. *Safety Procedures and Resistance Measurements*
2. *Power Supplies, Voltage and Current Measurements*
3. *Series and Parallel Resistances, Voltage and Current Division*
4. *The Oscilloscope and Function Generator*
5. *Mesh Current and Node Voltages*
6. *Thevenin and Norton Equivalent Circuits*
7. *Impedance Characteristics of Electrical Circuit Elements*
8. *Voltage and Current Phasor Relationships*
9. *Sinusoidal Steady-State Power*
10. *Practical exam or lab exercise of instructor's choice.*