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FORT WAYNE

Course	ECE 20100 - Linear Circuit Analysis I
Type of Course	Required for the CmpE, EE, and ME programs
Catalog Description	Volt-ampere characteristics for circuit elements; independent and dependent sources; Kirchhoff's laws and circuit equations. Source transformation; Thevenin's and Norton's theorems; superposition. Step response of 1st order (RC, RL) and 2nd order (RLC) circuits. Phasor analysis, impedance calculations, and computation of sinusoidal steady state responses. Instantaneous and average power, complex power, power factor correction, and maximum power transfer. Instantaneous and average power.
Credits	3
Contact Hours	3
Prerequisite Courses	None
Corequisite Courses	MA 26100
Prerequisites by Topics	Prerequisites: Two semesters of calculus; complex numbers; computer literacy and experience with MatLab or equivalent; some familiarity with vectors and matrices. Concurrent Prerequisites: Third semester of calculus.
Textbook	*Electric Circuits*, J. W. Nilsson and S. A. Riedel, Prentice Hall, 9th Ed., 2011.
Course Objectives	Techniques for the efficient formulation of an independent set of Kirchhoff equations, including the nodal method, the mesh method and the modified nodal method are given. The Thevenin equivalent, source transformations and superposition are studied. Simple models for the voltage amplifier and the operational amplifier are developed. The linear, time-invariant capacitor and inductor are introduced along with a complete treatment of energy storage. Transient and steady-state solutions of RC, RL and RLC circuits are emphasized, with zero, constant, or sinusoidal inputs. Sinusoidal analysis with phasors, impedance and admittance properties, instantaneous power,

complex power, and the maximum power theorem are the final topics considered.

Students who successfully complete this course will have demonstrated:
1. An understanding of the basic concepts of linear circuit elements and measurement variables (1).
2. An ability to analyze simple resistive circuits using Ohm's law and Kirchhoff's laws (1).
3. An ability to solve circuit problems using the techniques of mesh current, node voltage, superposition, and Thevenin/Norton equivalent circuits (1).
4. A basic understanding of operational amplifiers (1).
5. An understanding of inductors and capacitors as energy storage elements (1).
6. An understanding of the natural and step responses of RL and RC circuits (1).
7. An understanding of the natural and step responses of RLC circuits (1).
8. An understanding of phasors and an ability to determine the sinusoidal steady-state response of linear circuits (1).
9. An ability to calculate the sinusoidal steady-state power for linear circuits (1).

Lecture Topics
1. Kirchhoff's Current & Voltage Laws
2. Circuit analysis with dependent sources
3. Nodal Analysis; nodal analysis with voltage sources
4. Mesh Analysis; mesh analysis with current sources
5. Modeling the voltage amplifier and the operational amplifier
6. Thevenin and Norton equivalent circuits
7. Energy storage elements; response to simple waveforms
8. 1st-order circuits: transient and DC steady-state response
9. Zero input response, natural frequencies; initial conditions
10. 2nd-order circuits: transient response; steady-state response to sinusoidal inputs
11. Sinusoidal analysis with phasors
12. Impedance and admittance; Thevenin and Norton equivalents
13. Average and complex power in the sinusoidal steady-state

Computer Usage   None

Laboratory Experience   None

Design Experience   Low

Coordinator   Hossein M. Oloomi, Ph.D.

Date 10/01/2018

Changes made
1. Table added
2. Date