Catalogue Description:
Circuit variables and elements, Kirchhoff’s laws, basic analysis of resistive circuits, Thevenin’s and Norton’s equivalent circuits, circuit simplification, sinusoidal steady-state analysis, linear and i9de3l transformers, power relations, Fourier series and responses to periodic inputs, circuit simulation using SPICE.

Credit hours: 3 credits

Required or elective: Required for CCE/ECE students

Prerequisites: By course: None, By topic: High-school physics, calculus, and algebra, including complex numbers

Textbook(s) and/or required materials: Sabah, N.H.: Electric Circuits and Signals. CRC Press, Boca Raton, Florida. (Chapters 1-7, and Chapter 9)

Course Objectives
1. The objectives of the course are to:
2. Introduce students to the general field of electric circuits
3. Highlight the relevance of electric circuits to engineering
4. Impart a sound understanding of basic concepts of electric circuits
5. Instruct students in techniques for analyzing electric circuits
6. Foster problem solving skills

Course Topics
1. Circuit variables: current, voltage, and power; assigned positive directions
2. Active circuit elements: ideal, independent and dependent, voltage and current sources
3. Passive circuit elements: ideal resistors, Ohm’s law and power dissipation; capacitors; inductors
4. Nature and limitations of circuit models
5. Basic circuit laws: Kirchhoff’s current law, Kirchhoff’s voltage law and their application to series and parallel connections of elements, Δ-Y transformation, and source transformation
6. Basic analysis of resistive circuits: node-voltage and mesh-current methods; superposition
7. Circuit simplification techniques: Thevenin’s and Norton’s equivalent circuits; substitution theorem; source rearrangement; removal of redundant elements
8. Sinusoidal steady-state: response to complex excitation; phasors and phasor relations of circuit elements; impedance and reactance; circuit representation in the frequency domain; phasor diagrams
9. Mutual inductance, linear and ideal transformers; reflection of circuits; transformer imperfections
10. Power relations: instantaneous and average power, complex power, power factor correction, maximum power transfer
11. Responses to periodic inputs: Fourier series; symmetry properties; circuit responses to periodic inputs; average power and rms values

Course Learning Outcomes
1. Understand the concepts of current, voltage, power, and energy and their interrelations
2. Understand the basic attributes of voltage sources, current sources, resistors, capacitors, inductors and their voltage-current relations
3. Apply KCL and KVL
4. Derive the equivalent series or parallel resistance and conductance
5. Analyze resistive circuits by the node-voltage method, mesh-current method, or superposition
6. Derive TEC and NEC between specified terminals
7. Apply the substitution and source absorption theorems
8. Simplify a circuit by rearranging sources, or by removing redundant elements
9. Represent circuits in the frequency domain in terms of phasors and impedances or admittances
10. Apply circuit relations and theorems in the frequency domain in order derive steady-state sinusoidal responses
11. Analyze circuits that include linear or ideal transformers
12. Apply complex power to the analysis of power circuits
13. Derive the condition for maximum power transfer and determine the maximum power transferred
14. Derive the Fourier series expansion of a periodic function
15. Determine the response of a circuit to a periodic input
16. Simulate basic electric circuits using PSpice

Class/laboratory schedule: Three 50-minute lectures per week

Resources of the course: Textbook, PSpice, and Moodle

Evaluation methods
1- Three quizzes (48%)
2- PSpice Quiz (12%)
3- Final exam (40%)
**Professional Components**
Engineering topics: 90%
General education: 0%
Mathematics and basic sciences: 10%

**Person(s) who prepared this description and date of preparation**
Karim Kabalan, Fadi Karameh and Nassir Sabah, Sept 2008

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