ELEG 2113 ELECTRIC CIRCUITS II

Spring Semester 2000

Catalog Data: Introduction to complex numbers. Sinusoidal steady-state analysis of electric circuits; active, reactive, apparent and complex power; balanced and unbalanced three-phase circuits; mutual inductance; the use of the Laplace transform for electric circuit analysis and two-port networks. Prerequisites: ELEG 2103. Corequisites: ELEG 2111L and MATH 3403.

Textbook: *Electric Circuits*, Sixth edition, James W. Nilsson and Susan A. Riedel, Prentice Hall, 2000.

Reference: TBD

Coordinator: K. J. Olejniczak, Ph.D., P.E., Associate Professor of Electrical Engineering

Goal: To impress how important AC circuit analysis is to their future success as electrical engineers. To have all students master the technical and practical aspects of AC circuit analysis.

Prerequisites by Topic

1. The concept and properties of vectors.
2. DC circuit analysis concepts (i.e., series - parallel simplifications, Δ-Y transformations, source transformations, Thévenin and Norton equivalent circuits, superposition, nodal analysis, and mesh analysis)

Topics:

1. Complex numbers
   - Introduction to complex numbers and complex arithmetic
   - Rectangular, polar and exponential forms
2. Sinusoidal steady-state analysis
   - The sinusoidal source and response
   - The phasor
   - Frequency-domain representation of passive circuit elements
   - KCL and KVL in the frequency domain
   - Series, parallel and Δ-Y simplification of impedances and admittances
   - Source transformations, Thévenin and Norton equivalent circuits, and superposition
   - Nodal and mesh analysis
3. Sinusoidal steady-state power calculations
   - Instantaneous, average, reactive, apparent and complex power
   - Root-mean-square (rms) values and power calculations
   - The power triangle and displacement power-factor-correction
   - Maximum power transfer
4. Balanced and unbalanced three-phase circuits.

- Balanced three-phase sources
- Analysis of the Y-Y, Y-Δ, Δ-Y, and Δ-Δ connections
- Power calculations in balanced and unbalanced three-phase circuits

5. Mutual inductance
   - Development of self- and mutual inductance in stationary magnetic circuits
   - The Dot Convention
   - Energy calculations
   - The linear and ideal transformer models
   - Equivalent circuits for magnetically-coupled coils
6. The Laplace transform
   - Definition of the unilateral and bilateral Laplace transform
   - The step and impulse functions
   - Functional and operational transforms
   - Inverse Laplace transformation via partial fraction expansion
   - Poles and zeros of F(s)
   - Initial- and final-value theorems
7. The Laplace transform in electric circuit analysis
   - s-domain representation of passive circuit elements
   - Electric circuit analysis in the s domain
   - The transfer function and its importance
   - The transfer function and its use for sinusoidal steady-state response of AC circuits
8. Two-port networks
   - The terminal equations of a two-port network
   - Two-port parameters (i.e., z, y, a, b, h and g parameters)
   - Reciprocal and symmetric two-port circuits
   - Analysis of terminated two-port networks

Computer Usage:

Use of PSpice® and MATLAB® for required homework assignments and for checking homework solutions.

Estimated Content:

Engineering Science: 2.5 credits or 83%
Engineering Design: 0.5 credit or 17%

* Each class is 50 minutes and meets three times a week.