

Required Course:	ECE 202 - Linear Circuit Analysis II
2002 Catalog Data:	ECE 202: Linear Circuit Analysis II. Credit 3. Continuation of EE201. Uses of Laplace transform techniques to analyze circuits with and without initial conditions. Characterization of circuits based upon impedance, admittance and transfer function parameters. Determination of frequency response via analysis of poles and zeros in the complex plane. Relationship between the transfer function and the impulse response of a circuit. Use of continuous time convolution to determine time domain responses. Properties and practical uses of resonant circuits and transformers. Input-output characterization of a circuit as a two-port. Low and high-pass filter design.
Prerequisites:	ECE 201, MATH 261, PHYS 251. Pre-requisite or co-requisite: MATH 262.
Prerequisites by topic:	DC, transient, and sinusoidal steady-state AC analysis of linear electrical circuits (ECE 201).
Textbook:	Charles L. Alexander and Matthew N. O. Sadiku, <i>Fundamentals of Electric Circuits</i> , McGraw-Hill, 2004. ISBN 0-07-246331-7.
Coordinator:	Maher E. Rizkalla, Professor of Electrical and Computer Engineering
Goals:	This course is designed to teach the student to apply previously acquired knowledge of linear circuit analysis (ECE 201) to new concepts of circuit characterization. Students must acquire a working knowledge of Laplace transforms and their use in circuit analysis. They must also acquire competency in the use of PSpice and Matlab for circuit analysis, design and simulation.
Outcomes:	Upon successful completion of the course, students should be able to <ol style="list-style-type: none"> 1. Write circuit equations for magnetically coupled circuits which can be modeled with mutual inductances, linear transformers, and ideal transformers. [a] 2. Solve problems involving magnetically coupled circuits using reflected impedances and Thevenin equivalent circuits. [a, e] 3. Determine the Laplace transforms of standard functions such as step functions, cosines, and exponential functions. [a] 4. Use functional transforms and operational transforms to obtain the Laplace transform of complex signals that are derived from standard functions. [a] 5. Use Laplace transforms to obtain the response of linear circuits to inputs that can be Laplace transformed (inversion of Laplace transforms). [a, e] 6. Convert time-domain circuit representations to the s-domain [a, e] 7. Determine the time domain response to inputs that have an s-domain representation. [a, f] 8. Solve circuits in the s-domain using the node-voltage method and mesh

- analysis. [a, f]
9. Determine the output of a linear system using convolution. [e]
 10. Determine the transfer function for linear circuits and use it to determine the sinusoidal steady-state output. e
 11. Determine the resonant frequency and bandwidth of series and parallel resonant circuits as used in band-pass filters. [a, e]
 12. Analyze and design simple RC and RL low-pass and high-pass filters. [a, e]
 13. Analyze and design simple RLC band-pass filters. [a, e]
 14. Determine the two-port y , z , h , and transmission parameters for a linear circuit. [a, e]
 15. Use two-port mathematical models and circuit models to compute properties of terminated two-port circuits such as voltage gains, Thevenin equivalent circuits, etc. [a, e]
 16. Use MatLab to obtain the output of linear circuits for prescribed inputs. [k]

Topics: (Based on 2 classes per week, 15 weeks, plus a final exam)

1. Magnetic Coupling, mutual inductance (3 classes)
2. Ideal transformers, linear transformers (3 classes)
3. Two-port parameters (3 classes)
4. Passive frequency selective circuits: Band pass, low pass, high pass filters (3 classes)
5. Step function, delta function, and Laplace transforms (4 classes)
6. Complex frequency, natural frequency, poles and zeros (2 classes)
7. Use of PSpice with schematic capture for steady-state and transient analysis (2 classes)
8. Use of Matlab for circuit analysis (2 classes)
9. Circuit analysis with s-domain (2 classes)
10. Transfer functions (1 class)
11. Natural response, convolution (3 classes)
12. Exams (3 classes)

Computer usage: Circuit simulation using PSpice. MATLAB time domain circuit analysis.

Laboratory projects: None

ABET category: Engineering science 3.0 credits or 100%

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