

ECE 2100: Circuit Analysis

Required Course

2006-2007 Catalog Data:	Analysis of linear electric circuits using methods based on Kirchhoff's laws and network theorems. RL, RC, and RLC transients. Sinusoidal steady state analysis. Credit: 4 hours Prerequisites: PHYS 2070 or taken concurrently and MATH 1230
Textbook(s) and/or Required Materials:	<ol style="list-style-type: none">1. C. K. Alexander and M. N. O. Sadiku, 2007. <i>Fundamentals of Electric Circuits</i>, (3rd edition). McGraw-Hill.2. Kelemen et al., 2006. <i>ECE 2100 Laboratory Manual</i>, published by the WMU IEEE Student Branch.3. digital multimeter4. laboratory safety glasses
Recommended Materials:	<ol style="list-style-type: none">1. MATLAB® and Simulink® mathematics software suite (available in Computer Aided Engineering Center)2. OrCAD® PSpice® circuit simulation package (available in Computer Aided Engineering Center or free download)
Reference Materials:	N/A
Course Coordinator:	Dr. Damon A. Miller, Associate Professor, ECE
Instructor (Fall 2006):	Dr. Giuseppe Grassi, Visiting Professor of Electrical Engineering, University of Lecce, Italy

Prerequisites by Topic:

1. Complex numbers
2. Elementary differential and integral calculus
3. Energy and power
4. Electric charge, electric current, and electric potential

Course Objectives: (ABET Learning Outcomes)

ABET learning outcome assigned to this course according to ECE Assessment Plan: c and d.

1. an understanding of electric charge, current, voltage, energy, and power (a);
2. an ability to analyze linear DC circuits using Ohm's Law, Kirchhoff's voltage law (mesh analysis), and Kirchhoff's current law (nodal analysis) (a, e);
3. an ability to utilize network analysis techniques including superposition, source transformations, and Thevenin and Norton's theorems (a, e);
4. an ability to design simple DC voltmeters and ammeters using d'Arsonval movement meters (c, e);
5. an ability to analyze and design electronic circuits that utilize operational amplifiers (a, c, e);
6. an understanding of the terminal characteristics of capacitors and inductors (a);
7. an ability to analyze steady state linear AC circuits containing dependent and independent sources, resistors, capacitors, and inductors (a, e);
8. an ability to perform DC and AC power calculations including power factor correction (a, c, e);
9. an ability to represent the total system response as a sum of a transient and steady state response and a natural and forced response (a, e);
10. an ability to determine the step response of first and second order linear circuits (a, e);
11. an ability to analyze and experimentally validate DC and AC circuits (b, e, k);

12. an ability to use electronic test instrumentation such as voltmeters, ammeters, ohmmeters, signal generators, oscilloscopes, and wattmeters (b, k);
13. an ability to prepare effective written technical communications for engineering analysis work (g);
14. an ability to thoroughly and accurately document laboratory work using a laboratory notebook (g);
15. an ability to function as an effective engineering team member (d); and
16. a recognition of the need for life-long learning (i).

Topics:

1. Electrical units, quantities, elements
2. Circuit topology
3. Basic circuit laws: Ohm's Law, Kirchhoff's Laws, voltage and current division
4. Nodal and mesh analysis
5. Circuit theorems: linearity, superposition, source transformation, Thevenin's and Norton' Theorems, maximum power transfer
6. Operational amplifiers
7. Capacitance and inductance
8. Sinusoids and phasors
9. Sinusoidal steady state analysis
10. AC circuit power
11. RC, RL, and RLC circuit: transient and steady state response and forced and natural response to step input

Course/Laboratory Schedule: Three 50 minute lectures and one 3 hour lab (each week)

Evaluation:

1. Examinations (70%)
2. Laboratory (10%)
3. Homework (20%)

Laboratory Projects:

1. Basic Circuit Measurements and Ohm's Law
2. Series and Parallel Circuits
3. Basic DC Meter Design
4. Node Voltage and Mesh Current Analysis
5. Superposition and Thevenin's Theorem
6. Operational Amplifiers as Circuit Elements
7. Operational Amplifiers in RC Circuits
8. AC Circuits
9. AC Circuit Power
10. RC Step Response
11. RLC Step Response

Computer Usage:

Limited to extra credit for using SPICE on certain laboratory projects. Students are encouraged (but not required) to use SPICE to check work.

Contribution to Professional Component:

ABET professional component content as estimated by faculty member who prepared this course description:
Engineering Design: 0 credits Engineering Science: 4 credits or 100%

Relation of Course to Program Outcomes:

This course provides significant support for:

EE and CE program objectives: Depth

ECE expected learning outcomes: c and d.

Person who prepared this description and date of preparation:

Prepared by: Damon A. Miller

Date: 14 February 2007