ECE2040 Course Syllabus

ECE2040

Circuit Analysis (3-0-0-3)

CMPE Degree
This course is Required for the CMPE degree.

EE Degree
This course is Elective for the EE degree.

Lab Hours
0 supervised lab hours and 0 unsupervised lab hours

Course Coordinator
Zhang,Ying

Prerequisites
PHYS 2212/2232 [min C] and MATH 2403*/2413*/24X3 [min C] * Prerequisites indicated with an asterisk may be taken concurrently with ECE2040

Corequisites
None

Catalog Description
Basic concepts of DC and AC circuit theory and analysis.

Textbook(s)
Dorf & Svoboda, *Introduction to Electric Circuits* (9th edition), John Wiley, 2013. ISBN 1118477502, ISBN 9781118477502 (required) (comment: This book is also available for purchase electronically.)

myDAQ unit, National Instruments. (required) (comment: This item is also required for ECE 2020 and ECE 3084.)

Course Outcomes
Upon successful completion of this course, students should be able to:

1. Analyze small RLC circuits by hand.
2. Use network techniques, like node analysis and loop analysis, to write equations for large linear circuits.
3. Apply Thevenin and Norton theorems to analyze and design for maximum power transfer.
4. Apply the concept of linearity and the associated technique of superposition to circuits and networks.
5. Analyze circuits containing ideal operational amplifiers.
6. Explain the concept of steady state.
7. Apply phasor analysis to AC circuits in sinusoidal steady state.
8. Analyze the frequency response of circuits containing inductors and capacitors.
9. Construct simple Bode plots for first- and second-order circuits.
10. Apply the Laplace transform to linear circuits and systems.

11. Analyze simple two-port circuits.

Student Outcomes

In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.
“LN” for “little to none” indicates that the course does not contribute significantly to this outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (LN) An ability to communicate effectively with a range of audiences
4. (LN) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (LN) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (M) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (M) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

1. Basic Concepts
   a. Voltage, Current, Power and Energy
   b. Circuit elements (R, L, C, ideal operational amplifiers, id
   c. Independent and Dependent Sources
   d. Kirchhoff's Laws
   e. Series and Parallel Combinations of Elements
   f. Voltage Division and Current Division

2. DC circuit analysis
   a. Node Analysis
   b. Mesh Analysis

3. Network Theorems
   a. Linearity
   b. Superposition
   c. Source Transformations
   d. Thevenin's Theorem
   e. Norton's Theorem

4. Circuits Containing Operational Amplifiers
   a. Ideal Op Amp model, with negative feedback condition
   b. Inverting and Non-Inverting Configurations
   c. Voltage Followers, Adders, Difference Amplifiers

5. First and Second-Order Circuits
   a. Singularity Functions

b. RC and RL Source-Free Circuits
c. Constant and Non-Constant Forcing Functions
d. Initial and Final Values
e. Op-amp circuits for integration and differentiation
f. Measurement of signals in physical circuits
g. RLC circuits
h. Time-Domain Analysis

6. Sinusoidal Steady-State (SSS) Analysis
a. Sinusoids
b. Complex Numbers
c. Complex Exponential Representations of Sinusoids (Phasors)
d. Impedance and Admittance
e. Superposition, Thevenin???s and Norton???s Theorems
f. Analysis and Network Theorems for SSS
g. Frequency response
h. Bode plots
i. Resonance
j. Measurement of frequency response of physical circuits

7. Power Analysis
a. Instantaneous and Average Power
b. Power Factor and Power Factor correction
c. Complex Power
d. Maximum Power Transfer