ENGR 0260 - ELECTRIC CIRCUITS

Catalog Description

Formerly known as ENGR 17
Prerequisite: Completion of PHYS 210 and PHYS 210L with grades of "C" or better; and completion with grade of "C" or better or concurrent enrollment in MATH 33
Hours: 54 lecture
Description: An introduction to the analysis of electrical circuits. Use of analytical techniques based on the application of circuit laws and network theorems. Analysis of DC and AC circuits containing resistors, capacitors, inductors, dependent sources, operational amplifiers, and/or switches. Natural and forced responses of first and second order RLC circuits; the use of phasors; AC power calculations; power transfer; and energy concepts. (C-ID ENGR 260) (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Explain and design circuit networks involving common electrical elements (including buses, connectors, resistors, inductors, capacitors, diodes, and transistors).
- CSLO #2: Write, analyze, and solve complex resistive networks by applying various engineering techniques.
- CSLO #3: Draw, analyze, derive, and solve complex time variant circuit networks.
- CSLO #4: Analyze and solve electrical engineering circuits (both steady state and time variant) for real and complex power.

Effective Term

Fall 2023

Course Type

Credit - Degree-applicable

Contact Hours

54

Outside of Class Hours

108

Total Student Learning Hours

162

Course Objectives

1. Describe the properties of all the basic circuit elements and how properties affect the circuit variables (voltage and current)
2. Analyze and solve basic resistive circuit networks using Ohm's Law, Kirchhoff's Voltage Law, and Kirchhoff's Current Law
3. Explain, analyze and solve complex resistive networks using the techniques of:
3A-series and parallel reduction
3B-voltage and current dividers
3C-voltage and current measurement vs. calculation
3D-delta to Wye reductions
3E-node voltage analysis
3F-mesh current analysis
3G-super-node and super-mesh simplifications
3H-source transforms
3I-Thevenin and Norton equivalents
3J-maximum power transfer calculations
4. Analyze and solve time variant circuits in regards to:
4A-capacitor analysis (solve voltage and current)
4B-inductor analysis (solve voltage and current)
4C-capacitors and inductors in series and parallel (equivalent circuits)
4D-mutual inductance with circuit networks
4E-natural response of RL and RC circuits
4F-response of RL and RC circuits
4G-combined response of RL and RC circuits
4H-sequential switching problems of first order
4I-unbound response in first order circuits
4J-natural response in parallel RLC circuits
4K-natural response in series RLC circuits
4L-step response in parallel RLC circuits
4M-step response in series RLC circuits
5. Examine, analyze and solve circuit networks involving steady state analysis(source and response) for the following:
5A-sinusoidal sources
5B-response of all elementary circuit elements
5C-phasor analysis and use it to solve problems
5D-create phasor diagrams and use them to solve problems
5E-steady state problems, method: frequency domain analysis
5F-apply Kirchhoff's law in the frequency domain
5G-series/parallel reductions in the frequency domain
5H-delta-to-wye reductions in the frequency domain
5I-the method of source transforms in the frequency domain
5J-create Thevenin and Norton equivalent circuits in the frequency domain
5K-frequency domain circuits by the node voltage method
5L-frequency domain circuits by the mesh current method
5M-frequency domain problems including real and ideal transformers
6. Compose calculations concerning electrical power for the following:
6A-steady state power absorbed/delivered by all elementary circuit devices
6B-instantaneous power absorbed/delivered by all elementary circuit devices
6C-the average power delivered/absorbed by all elementary circuit devices
6D-Calculate the reactive power delivered/absorbed by all elementary circuit devices
6E-RMS power delivered/absorbed by all elementary circuit devices
6F-complex power delivered/absorbed by all elementary circuit devices
6G-maximum power delivered to all elementary circuit devices
6H-power absorbed by single phase and three phase electrical devices
7. Identify and solve problems including operational amplifiers for the following:
7A-Correctly identify operational amplifier terminals
7B-Calculate the terminal voltage and current for operational amplifiers
7C-create an accurate model of real, working operational amplifier
7D-compare and contrast real and ideal operational amplifiers
7E-inverting amplifiers
7F-summing amplifiers
7G-non-inverting amplifiers
7H-difference amplifiers
7I-integrating amplifiers
7J-multiple operational amplifiers

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Problem Solving Examinations
  - Example: Exams including problem sets are given to evaluate the engineering concepts and ability to solve engineering problem sets in the Student Performance Outcomes. These are graded according to accuracy and procedure in an attempt to determine the proficiency gained regarding the presented material. Example 1: Given a diagram of a complex DC resistive circuit network, determine all voltages and currents associated with each device in that network. Example 2: Given the switching, series Resistor-Capacitor-Inductor (R-L-C) circuit connected to a DC source; calculate the response (voltage and current) of the resistor at time, t=20ms after the switch has closed. Example 3: Given the transformer circuit below, calculate the maximum power transferred to the load.
- Other
  - Example: Other: Homework sets and quizzes are assigned, collected, and graded to determine the students' ability to perform a solution and communicate the correct result to a reader. Example 1: Complete the problem set from the textbook that is assigned according to the schedule (Instructor to select problems from the text as homework). Example 2: Solve the problem on the board working within groups as assigned by the instructor (engineering problem from the textbook displayed). Graded as group work and/or quiz.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. Example problems on time variant circuits are demonstrated by the instructor at appropriate times throughout the presentation. Students are then asked to participate and given time to work through additional, similar problems. Students are encouraged to take detailed notes and ask questions to clarify any misunderstanding during the lecture.

Distance Learning

1. A lecture is delivered using live/recorded video to present the concepts used to analyze resistive DC circuits. A detailed online discussion will follow outlining the concept, how this concept works and is applied, and a procedure for solving problem sets utilizing this concept.

Typical Out of Class Assignments

Reading Assignments

1. Read the textbook chapter on reduction of resistive networks by method of "source transforms." Be prepared to interact during a classroom discussion on the procedures of this method. 2. Read the handout on analyzing resistors by color code. Be prepared to answer questions on an exam.

Writing, Problem Solving or Performance

1. Given the resistive network shown, use the node-voltage method to solve for all circuit variables (voltage and current). 2. Given the resistor/capacitor/inductor circuit below, solve for the steady state response of the voltage across the resistor.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- ELECTRIC CIRCUITS
  - Author: J. Nilsson, S. Riedel
  - Publisher: Prentice hall
  - Publication Date: 2018
  - Text Edition: 11th
  - Classic Textbook?:
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.

Engineering calculator