CSU The California State University

Circuits, with Lab
TCSU ENGR 120

A. Description

An introductory course in the analysis of linear circuits containing resistors, inductors, capacitors, independent and dependent voltage, and current sources. Analysis techniques are developed from Kirchhoff's network theorems and include node and loop methods, superposition and source transformations. Thevenin's and Norton's theorems are applied to DC and AC circuits. Differential equations are used to find transient response. Periodic waveform analysis including evaluation of average and rms values. AC analysis techniques include sinusoids and phasors, the concept of impedance, frequency response, and resonance. Additional topics may include use of simulation software, real and imaginary power in AC circuits, operational amplifiers, approximations at high and low frequencies, impedance matching, correction of power factor, three-phase circuits, digital building blocks, and semiconductor devices.

B. Prerequisites

Single Variable Calculus - 2nd Semester and Physics - Calculus Base II

C. Co-requisite

Circuits Laboratory

E. Minimum Unit Requirement

4 units, including at least 3 units of lecture and 1 unit of laboratory

F. Course Topics

1. Circuit Variables and Elements
2. Kirchhoff's Laws
3. Simple Resistive Circuits
4. Mesh-current and Node-voltage Analysis
5. Thevenin's and Norton's Theorem
6. Maximum Power Transfer Theorem
7. Superposition Principle
8. Capacitor, Inductor, Power and Energy
9. Response of first order RL & RC circuits
10. Natural and step response of RLC circuits
11. Sinusoidal Steady-State Analysis
12. Equivalence circuits, Mesh-Current and Node-voltage methods
13. Sinusoidal Steady-State power calculations
14. Operational Amplifier Circuits (optional)

G. Laboratory Topics

1. Use of electronic test equipment

2. Current and voltage measurement in DC and AC circuits
3. Measurements of RLC circuits
4. Measurements of output voltage of an Op-Amp when used as amplifier, summer, or integrator (optional)

H. Student Learning Outcomes

Lecture Objectives:

1. Teach students how to analyze DC and AC circuits;
2. Introduce a wide variety of electrical and electronic circuits;
3. Build the theoretical foundation for advanced studies of electronic systems; and
4. Prepare students to pass the electrical part of the FE exam.

Laboratory Objectives:

1. Teach students how to use electronic equipment at an introductory level;
2. Build and test basic electronic circuits; compare results with theory; and
3. Write reports summarizing laboratory work.

Lecture Outcomes:

1. Steady state voltages, currents, and power for DC and AC circuits
2. Thevenin and Norton equivalent of circuits with independent sources
3. Rise time and fall time, of R-C circuits
4. Frequency response of high-pass, low-pass and resonant circuits

Laboratory Outcomes:

1. Measure resistances, currents and voltages using a multimeter
2. Measure periodic signals including their amplitudes, periods, and phase shifts using an oscilloscope
3. Measure characteristics in networks of linear and nonlinear resistors
4. Measure characteristics in networks of resistors and capacitors
5. Measure characteristics in networks of resistors and inductors
6. Measure characteristics in RLC networks
7. Write a laboratory report for each experiment that includes a discussion comparing experimental and theoretical results
8. Output voltage of an Op-Amp when used as amplifier, summer, or integrator (optional)

I. CAN Equivalent

CAN ENGR 12 (Equivalency ends Fall 2010)