ENGR 37: INTRODUCTION TO CIRCUIT ANALYSIS

Foothill College Course Outline of Record

Heading	Value
Units:	5
Hours:	5 lecture per week (60 total per quarter)
Prerequisite:	PHYS 4B.
Corequisite:	MATH 2A.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- Students will correctly identify the production, characteristics, applications, and voltage change methods of Direct Current and Alternating Current.
- Students will correctly calculate quantities in DC and AC circuits containing resistive devices,capacitors, and inductors using Ohm's and Watt's Laws, Kirchoff's Laws, and appropriate circuit analysis methods.

Description

Analysis of lumped, linear circuits in steady state DC and AC. Principals and Laws are used, such as Ohm's Law and Kirchhoff's Law, Thevenin's and Norton's Theorem. Methods of analyzing circuits also include Linearity, Superposition, Source Transformation, and Maximum Power Transfer. First and second order circuits' complete response, AC power and steady-state analysis, frequency and transient response and circuits using op-amps.

Course Objectives

The student will be able to:
A. Apply basic laws - Ohm's Law and Kirchhoff's Law - to resistive circuits.
B. Perform mesh and nodal analysis.
C. Apply circuit theorems, including Thevenin's and Norton's Theorem.
D. Analyze linear circuits containing operational amplifiers.
E. Analyze first- and second-order circuits.
F. Understand and able to use phasors for steady-state sinusoidal circuit analysis.

Course Content

A. Fundamental concepts, including the definitions of:
1. Charge
2. Current
3. Voltage
4. Energy
5. Power
B. Fundamental laws governing circuit behavior, including those of:
1. Ohm's Law
2. Kirchhoff's Law
3. Series and parallel resistive circuit
4. Voltage Division Theory
5. Current Division Theory
6. Delta-Wye transformations
C. A treatment of source-resistor networks and methods of analysis
1. Nodal Analysis and Super Nodes
2. Mesh Analysis and Super Mesh
D. Systematic simultaneous equations, and their application to the solution of simple source-resistor networks with many nodes and meshes

E. Network theorems
1. Thevenin's Theorem
2. Norton's Theorem
3. Maximum power transfer
4. Superposition
5. Source transformations
6. Linearity
F. Operational Amplifiers
1. Practical Op Amps
2. Ideal Op Amps
3. Voltage follower
4. Non-inverting Amplifier
5. Inverting Amplifier
6. Differential Amplifier
G. Fundamentals of energy storage elements, including current voltage and power relations
1. Capacitors
2. Inductors
3. Series and parallel equivalents
4. Integrator and differentiator
H. Linear, constant coefficient, differential equations, and solution by substitution, includes consideration of boundary conditions, natural and forced solutions
I. Transient response
1. RC circuits - natural and forced response
2. RL circuits - natural and forced response
3. RC/RL circuits - step response
4. RLC circuits - natural and forced response
J. Sinusoidal steady state network response
1. Sinusoid
2. Phasor analysis includes frequency response of simple first and second order networks
3. Impedance and admittance
4. Circuit Theories
a. Kirchhoff's Laws
b. Nodal analysis
c. Mesh analysis
d. Superposition Theorem
e. Source transformation
f. Thevenin and Norton's Theorems
K. Power in sinusoidal driven networks
1. Average and RMS values
2. Real and imaginary power components
3. Power factors

Lab Content

Not applicable.

Special Facilities and/or Equipment

A. Rooms with computers for animation, simulation, projectors for lecturing.
B. Computer programs for simulation, such as Pspice, Multisim, Workbench, etc.
C. When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address.

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

A. Midterm exams
B. Weekly quizzes and/or problem sets
C. Final examination

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

A. Lecture
B. Discussion
C. Cooperative learning exercises

Representative Text(s) and Other Materials

Irwin, J. David. Basic Engineering Circuit Analysis. 11th ed. Riverside: Wiely, 2015.

Hambley, Allan R. Electrical Engineering Principles and Application. 7th ed. Pearson, 2018.

Alexander and Sadiku. Fundamentals of Electric Circuits. 6th ed. McGraw-Hill Higher Education, 2017.

Nilsson and Riedel. Electric Circuits. 11th ed. Pearson, 2019.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

A. Homework problems: Homework problems covering subject matter from text and related material, ranging from 20-30 problems per week. Students will need to employ critical thinking in order to complete assignments.

B. Lecture: Five hours per week covering subject matter from text and related material. Reading and study of the textbook, related materials and notes.

C. Weekly reading assignments from text and outside sources. Roughly one chapter per week.

Discipline(s)

Engineering