PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
ABET COURSE SYLLABI

IEE2123 ELECTRICAL CIRCUITS

Credits and contact hours: 10 UC credits/10 hours (4,5 Lecture hours per week and 5.5 hours of Independent learning experience per week)

Instructor's name: Miguel Ríos

Course coordinator's name Miguel Ríos

Textbook: R. C. Dorf & J.A. Svoboda, Introduction to Electric Circuits. 9ª Ed., John Wiley, 2013

Course Learning Outcomes:

1. Apply the concepts of voltage, current, power and energy, Ohm's and Kirchhoff laws, to the analysis of simple resistive circuits, with independent and dependent DC sources. Use node and mesh methods. Apply superposition, source transformation, Thevenin-Norton and maximum power transfer theorems to the analysis of resistive circuits with independent and dependent DC sources. Analyze electrical circuits including ideal and real operational amplifiers.
2. Apply methods based on ordinary differential equations to the transient and permanent circuit analysis of first and second-order circuits with independent sources. Characterize the response of these circuits.
3. Apply complex and phasor algebra to the analysis of steady state AC circuits. Use the concepts of impedance, admittance, susceptance and conductance to represent and solve circuits.
4. Apply the concepts of AC power, mean, rms values of voltage and current, apparent power, power factor and complex power analysis of single phase and three phase circuits. Apply the theorems and methods of circuits in three-phase balanced and unbalanced systems.
5. Write and solve the equations of a system containing mutual inductances. Apply these concepts to ideal and real transformers.
6. Analyze two port circuits and the frequency response.
7. Understand and analyze basic electrical installations.

Course Catalog Description: The course addresses several themes to enable the student to analyze the static and dynamic behavior of electrical circuits; analyze and solve the equations for mathematical models of electrical circuits and analyze, at an introductory level, the functioning of the real transformer.

Prerequisite Courses: FIS1533 Electricity - Magnetism

Co-requisite Courses: MAT1640 Differential Equations

Status in the Curriculum: Required

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
d. Multidisciplinary teams
e. Identify, formulate, and solve engineering problems
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. Introduction, review of basic DC concepts and units (voltage, current, resistance, capacitor, inductance, Ohm's Law, voltage sources, current sources, dependent sources, power, energy).
2. Review of the fundamental laws of circuits. Use of Kirchhoff's Laws. Writing and solving equations using Nodal analysis. Writing and and solving equations using Mesh analysis.
3. Circuit theorems. Linearity, Superposition, Source Transformation, Thévenin and Norton theorems, Maximum Power Transfer.
4. Operational Amplifiers. Real and Ideal OP-AMPs. Solving electric circuits with OP-AMPs.
5. Step response and steady state analysis of DC and AC electric circuits. First and second order circuits.
6. Sinusoidal steady state AC circuits. Sinusoids and phasors. Phasor analysis. Impedance and admittance. Nodal and mesh analysis. Power analysis, instantaneous and average power, and effective value. Power factor and its correction.
7. Three phase circuits, Delta and Wye balanced sources and connections. Solving three and four wire circuits. Power and power factor correction. Introduction to unbalanced systems.
8. Magnetically coupled circuits. Mutual inductance and energy in coupled circuits. Linear transformers. Ideal transformers. Real Transformers.
9. Frequency response and Bode plots. Two port networks and parameters. Basic electrical installations.