

Course Title: Elements of Engineering II

Course Code: ENGG 112

Credit Hours: 3

Course Description:

This course provides a foundation in electrical technology and covers topics in basic dc and ac circuit analysis, transformers and electrical machines applicable to all branches of engineering.

Course Contents:

Unit 1: DC Circuit Analysis

Resistors: characteristics (value, power rating, codes, tolerances), current, voltage, power relationships, temperature coefficient, equivalent resistance in parallel and series connection, delta-star connection, Ideal and non-ideal sources, dependent and independent sources, closed, open and short circuits, Kirchhoff's current and voltage laws, voltage divider and current divider rule, series and parallel connection of sources, node and mesh analysis, Superposition theorem, Thevenin's and Norton's theorems, Maximum power transfer theorem

Unit 2: AC Circuit Analysis

Generation of AC voltage, definition of basic terms of ac waveform, average, and RMS value of ac waveform, characteristics of inductors and capacitors, inductors and capacitors in series and parallel, voltage current relationship in inductor and capacitor, impedance, admittance, reactance, phasor algebra, steady state analysis of RL, RC and RLC circuits, real power, reactive power and apparent power, power factor and significance of power factor, Series and parallel ac circuits, Mesh and Nodal analysis and star delta in ac circuits, Superposition, Thevenin's, and Nortons theorem in ac circuits, resonance in series and parallel RLC circuits, bandwidth, and effect of Q-factor in resonance, 3-phase circuits: generation of 3-phase, merits of 3-phase over 1-phase generation, phase sequence (ABC or CBA), voltage and current phasors in different sequence (ABC or CBA), line and phase quantities in Y-connected and delta connected balanced load, power in 3-phase circuits

Unit 3: Magnetic Circuits

Electromagnetism fundamentals, magnetic field and flux, magnetic field strength, MMF, Permeability of free space, Relative permeability, Reluctance and permeance, introduction to a simple magnetic circuit with air gap, Comparison of magnetic circuit with electric circuit, Series and parallel magnetic circuits, B-H curve and its significance in the construction of electromechanical energy conversion devices, Faraday's law of electromagnetic induction, self-inductance and mutual inductance, Dot convention in electric circuit

Unit 4: Introduction to Transformer and Electrical Machines

Single phase transformers: construction and operation of ideal transformer, voltage and current relationship, Types of practical transformers, DC generators and motors: working principles and applications, AC generators and motors: working principles and applications

References:

1. R. L. Boylestad, *Introductory Circuit Analysis*, Prentice Hall Inc

2. E. Hughes, *Electrical and Electronic Technology*, Pearson Education
3. V. Del Toro, *Principles of Electrical Engineering*, Prentice Hall India

Evaluation:

In-Semester Evaluation: 50%

End-Semester Evaluation: 50%