

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 Theory and Analysis

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

Unit 2: AC Circuit Theory and Analysis

Generation of AC voltage, definition of basic terms of ac waveform, average, and RMS value of ac waveform, phasor algebra, characteristics of inductors and capacitors, inductors and capacitors in series and parallel, voltage current relationship in inductor and capacitor, steady state analysis of RLC circuits, impedance, admittance, reactance, real, reactive and apparent power, power factor and significance of power factor, 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 and Transformers Fundamentals

Electromagnetism fundamentals, magnetic field and flux, magnetic field strength, MMF, permeability, B-H curve and its significance in the construction of electromechanical energy conversion devices, introduction to a simple magnetic circuit with air gap, reluctance and permeance, Faraday's law of electromagnetic induction, self inductance and mutual inductance, single phase transformers: construction, principle of operation, ideal transformer, voltage and current relationship, losses, efficiency, and regulation

Unit 4: Basics of Electrical Machines and Instruments

Basic principle of DC and AC machine (generator and motor), construction features, basic operation principle, types, Principle of the DC voltmeter, ammeter, and ohmmeter

References:

1. R. L. Boylestad, *Introductory Circuit Analysis*, Prentice Hall Inc
2. V. Del Toro, *Principles of Electrical Engineering*, PHI, New Delhi
3. W.H. Hayt, J.E. Kemmerley and S.M. Durbin, *Engineering Circuit Analysis*, Tata McGraw Hill
4. E. Hughes, *Electrical and Electronic Technology*, Pearson Education