

Department Of Computer Science and Engineering
Kathmandu University
Dhulikhel, Kavre



Subject: Elements of Engineering II

Course: ENGG112

Level: B.E./B.Sc/B. Tech. 1st Year/2nd Semester Credit Hours: 3

This is a fundamental course in electrical technology and covers the topics that are applicable to professionals from all branches of engineering.

Course Contents:

Basic Circuit Theory

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 formula, node and mesh analysis, solution by determinant and substitution, superposition theorem, Thevenin's and Norton's theorems and network solution using these theorems, maximum power transfer to the load in a 2 -port resistive network.

AC Circuit Fundamentals

Generation of AC voltage (brief theoretical introduction of ac machine), definition of time period, frequency, waveform, phase, and phase difference, peak, peak-to-peak, average, and RMS or effective value of any type of ac voltage or current waveform, phasors: phasor algebra and steady state analysis of RLC circuits, impedance, admittance, and 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 or delta connected balanced load, Y-delta equivalence, power in 3-phase circuits.

Magnetic Circuits and Transformers

Revision of electromagnetism, magnetic field and flux, magnetic field strength, MMF, permeability of free space, relative 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, comparison of magnetic circuit with electric circuits, Faraday's law of electromagnetic induction, self inductance and mutual inductance, coupling coefficient, dot convention in electric circuit, single phase transformers: construction, principle of operation, ideal transformer, voltage and current relationship, turns ratio, impedance transformation, losses, efficiency, and regulation, operation of relay and solenoid.

Electrical Machines and Instruments

Basic principle of DC and AC machine (generator and motor), construction features, basic operation principle, types, characteristics, principle of moving coil and moving iron galvanometer, principle of the DC voltmeter, ammeter, and ohmmeter, voltmeter sensitivity and error correction.

Text Books:

1. R. L. Boylestad, *Introductory Circuit Analysis*, Prentice Hall Inc, Eighth edition, 1999
2. V. Del Toro, *Principles of Electrical Engineering*, PHI, New Delhi, 2nd edition, 1986
3. A. D. Helfrick, W. D. Cooper, *Modern Electronic Instrumentation and Measurement Techniques*, PHI, New Delhi, Sixth Indian reprint, 1998

References:

1. W.H. Hayt, J.E. Kemmerly and S.M. Durbin, *Engineering Circuit Analysis*, Tata McGraw Hill, Sixth edition, 2002
2. E. Hughes, *Electrical and Electronic Technology*, Pearson Education