

ELE 1051: Basic Electrical Technology [2 1 0 3]

Syllabus

Hours / week: 3

Number of credits: 3

Topic 01: DC Circuit [10 hours]

Chapter 01 Electric Circuit Elements

Electric circuit, classification of Circuit elements

Active elements: Ideal voltage source, practical voltage source, ideal current source, practical current source, source transformation.

Passive elements: Resistor, Inductor, and capacitor

Resistor: Resistance, resistors in series, resistors in parallel, current division, power consumed by a resistor, star- delta and delta – star transformations.

Inductor: Inductance, energy stored by an inductor, inductors in series, inductors in parallel.

Capacitor: Capacitance, equivalent capacitance of capacitors in series, voltage division, capacitors in parallel, energy stored by a capacitor.

Chapter 02 DC Circuit Analysis

Mesh current method, Node voltage method, Thevenin's Theorem, Superposition Theorem, Maximum Power Transfer Theorem

Chapter 03 DC Transient Analysis

Transient Behaviour of R-L Circuit: Growth of current in an inductive circuit, time constant, decay of current in an inductor.

Transient Behaviour of R-C Circuit: Growth of voltage in a capacitor, time constant, discharge of voltage in a capacitor.

Topic 02: Magnetic Circuit [6 hours]

Chapter 04 Magnetic Circuits

Magnetic flux, flux density, flux produced by a current carrying conductor, magnetic field produced by a solenoid, MMF, magnetic field strength, permeability, reluctance, permeance, analogy with electric circuits, series and parallel circuits, Iron losses: hysteresis and eddy current losses.

Chapter 05 Electromagnetism

Fundamental equation for force acting on a conductor, Fleming's left-hand rule, Faraday's laws of electromagnetic induction, equation for induced emf in a conductor, Fleming's right-hand rule, Lenz's law, Induced emf in a coil, self and mutual induced emf, coupling coefficient, coils in series- series aiding, series opposition, dot rule.

Topic 03: Single-Phase AC Circuit [10 hours]

Chapter 06 Single-phase AC Circuit

Alternating voltages and currents, generation of single-phase alternating voltage, average value and RMS value of periodic sinusoidal and non-sinusoidal wave forms, form factor.

Representation of time-varying quantities as Phasor; j Operator; Representation of Phasor in polar, rectangular, and exponential form.

Basic AC circuits: sinusoidal alternating current in a pure resistor, pure inductor and a pure capacitor, waveforms of voltage, current, and power, Phasor diagram, inductive and capacitive reactances.

Steady-state analysis of RL, RC, and RLC series circuits: concept of impedance and Phasor diagram, expression for average power, power factor. Parallel AC circuits: admittance, conductance, susceptance. Analysis of series parallel circuits, Phasor diagrams, active power, reactive power and apparent power, complex power, power triangle, improvement of power factor.

Chapter 07 Resonance

Series and parallel resonance, variation of reactance/susceptance and impedance/admittance with frequency, Q factor, half-power frequencies, bandwidth, relation between Q factor and bandwidth

Topic 04: Three-Phase AC Circuit [6 hours]

Chapter 08 Three phase AC Circuit

Generation of 3-phase balanced sinusoidal voltages, waveform of 3-phase voltages, phase sequence, star and delta connections, line voltage and phase voltage, line current and phase current, analysis of 3-phase circuit with star/delta connected balanced and unbalanced loads, Phasor diagram of voltages and currents, power measurement by two-wattmeter method with unbalanced and balanced loads.

Topic 05: Electrical Power System Components [4 hours]

Chapter 09 Electrical Power System

Power system components: Electrical Power System – An overview, Generation, Transmission, Distribution, Utilization of Electric Power – Major Loads

Overview of Electrical Machines: Transformers & DC motors - Principle of Operation, Construction, & Applications. AC Motors: Induction & Synchronous Motors - Principle of Operation, Construction, & Applications.

Energy measurements: Measurement of Electric Energy – Block Schematic of a Digital Energy Meter.

REFERENCES

Books:

1. Kothari D. P. & Nagarith I. J, Basic Electrical Engineering, TMH
2. Nagasarkar T. K. & Sukhija M. S., Basic Electrical Engineering, OUP
3. Theraja B.L. & Theraja A.K., A Textbook of Electrical Technology (5e), S. CHAND
4. Hughes E., Electrical and Electronic Technology (9e), Pearson Education

Web link:

1. <https://nptel.ac.in/courses/108/105/108105053/>