

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

Syllabus

Hours / week: 3

Number of credits: 3

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

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

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.

Chapter 06

Single-phase AC Circuits:

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

Chapter 08

Three phase AC Circuits:

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.

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:

1. Kothari D. P. & Nagrath I. J, Basic Electrical Engineering, TMH
2. Nagasarkar T. K. & Sukhija M. S., *Basic Electrical Engineering*, OUP
3. Hughes E., *Electrical and Electronic Technology (9e)*, Pearson Education
4. http://www.nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Basic%20Electrical%20Technology/New_index1.html