I B.Tech I Sem

15AEC02-NETWORK ANALYSIS

L T P C
3 1 0 3

Course Objectives:

To help students develop an understanding on analyzing electrical circuits using various techniques. To make the student familiarize with the fundamental concepts of coupled circuits, resonance, filters and to analyze the transient response in electric circuits.

Course Outcomes:

Upon completion of the course, students will be able to:

a. To solve the electrical network using mesh and nodal analysis by applying network theorems.
b. Understand the basic concepts of coupled circuits, resonance and filters and solve problems.
c. Analyze transient response in AC and DC electric circuits.

UNIT-I

Introduction: The capacitance parameter, The inductance parameter , The resistance parameter, reference direction for current and voltage, active element convention , the dot convention for coupled circuits, Kirchhoff's laws, the number of network equation, source transformation, example of the formulation of network equation loop variables analysis, node variables analysis, duality, network. Dependent sources.

Network graph theory: concept of network graph , terminology used in network graph, relation between Twigs and Links, properties of tree in a graph, formation of incidence Matrix[Ai], number of trees in a graph, cut-set matrix, tie set matrix, fundamental tie-set matrix, fundamental of cut-set.

UNIT-II

Initial Conditions in Networks: Why Study Initial Conditions, Initial Conditions in Element, Geometrical Interpretation of Derivatives, A Procedure for Evaluating Initial Conditions, initial State of a Network.

Resonance: Introduction, Definition of 'quality factor Q' of inductor and capacitor, Series resonance, Bandwidth of the series resonant circuits, Parallel resonance (or anti-resonance), Conditions for maximum impedance, Currents in parallel resonance,

UNIT-III

Network theorems: Superposition and Reciprocating, Maximum power transfer theorem, Thevenin's Theorem, Norton's Theorem and Tellegen's theorem.

Network function: poles and zeros, terminal pairs or ports, network function for one port and two port, the calculation of network function: ladder network, general network, poles and zeros of network function

UNIT- IV

Two port parameters: relation of two port variables, short circuit admittance parameters, the open circuit impedance parameters, Transmission parameters, the hybrid parameters, relation between parameter sets, parallel connection of two port network.

Input power, power transfer and insertion loss: energy and power, effective or root mean square values, average power and complex power, problem in optimizing power transfer, insertion loss.

UNIT- V

Filters: Introduction, the neper & decibel, Characteristic Impedance of symmetrical networks, Currents & voltage ratios as exponentials; the propagation constant, Hyperbolic trigonometry, Properties of symmetrical networks, Filter fundamentals; pass and stop bands, Behavior of characteristic impedance, The constant – k low pass filter, the constant – k high pass filter, The m-derived T section, The m-derived π section.

Text Books:

1. Engineering Circuit Analysis, William H Hayt Jr. Jack E Kemmerly, Steven Durbin, 8th edition, Tata McGraw-Hill, 2013.
2. Networks, Lines, and Fields, John D. Ryder, 2nd Edition, PHI publications, 2013.

References:

1. Network Analysis, Van Valkenburg, 3rd Edition, Pearson, 2006.
2. Network and Systems, D Roy Choudary, 1st Edition, New Age International, 2015.
3. Circuits & Network Analysis & Synthesis, A. Sudhakaar & Shyanmugam S.Palli, 2nd Edition, Tata McGraw Hill, 2006.
4. Network Analysis and synthesis, Franklin F. Kuo, 2nd Edition, Wiley India Pvt Ltd., 1962.