I B.Tech II Sem

COURSE NO. - NETWORK THEORY

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
- To impart knowledge on applying appropriate theorem for electrical circuit analysis
- To explain transient behavior of circuits in time and frequency domains
- To teach concepts of resonance
- To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

UNIT 1: INTRODUCTION TO ELECTRICAL CIRCUITS

Passive components and their V-I relations, Energy sources - Ideal, Non-ideal, Independent and dependent sources, Source transformation Kirchoff's laws, Star–to-Delta or Delta-to-Star Transformations, Mesh analysis and Nodal analysis problem solving, Super node and Super mesh for DC Excitations.

Unit Outcomes

- Gain knowledge on basic network elements, voltage and current laws
- Apply Kirchhoff's laws, network reduction techniques on simple electrical circuits with dependent & independent sources
- Solve complex circuits using mesh and nodal analysis techniques

UNIT 2: NETWORK THEOREMS

Superposition theorem, Thevenin & Norton theorems, Maximum power transfer theorem, Reciprocity theorem, Millman theorem, Miller Theorem, Compensation theorem - problem solving using dependent sources also, Duality and dual networks.

Unit Outcomes:

- Understand significance of duality and dual networks
- Select appropriate theorem for network simplification
- Determine maximum power transfer to the load

UNIT 3: AC CIRCUITS AND TRANSIENTS

A.C Circuits: Characteristics of Sine wave, phase relation in pure Resistor, Inductor and Capacitor, Impedance, Admittance, Series and Parallel circuits, Power, problem solving using R-L-C elements with DC excitation and AC excitation.

Transients: Steady state and Transient response, DC Response of R-L, R-C and R-L-C, circuits, Sinusoidal Response of R-L, R-C and R-L-C circuit, Circuit elements in S-domain.

Unit Outcomes:

- Understand behavior of circuit elements under switching conditions
- Analyze response of RL, RC & RLC circuits in time & frequency domains
- Evaluate initial conditions in RL, RC & RLC circuits

UNIT 4: RESONANCE AND COUPLED CIRCUITS

Resonance: Series Resonance, Voltages and Currents in a Series Resonant Circuit, Quality factor and its effect on Bandwidth, Parallel resonance, Magnification.
Coupled Circuits: Introduction to Coupled circuits, Self Inductance Mutual inductance, dot convention, Coefficient of Coupling, Series and Parallel connection of Coupled Coils.

Unit Outcomes:

- Understand magnetically coupled circuits
- Determine resonant frequency and bandwidth of a simple series or parallel RLC circuit
- Determine voltages and currents in a resonant circuit

UNIT 5: TWO PORT NETWORKS & NETWORK FUNCTIONS

Two-Port Networks: Two port networks, Open circuit Impedance (Z) parameters, Short circuit Admittance (Y) parameters, Transmission (ABCD) parameters, Inverse Transmission (A'B'C'D') parameters, Hybrid (h) parameters, Inverse hybrid (g) parameters, Inter- relationships of different parameters, Inter-connection of two-port networks, T and π Representation.
Concept of complex frequency, driving point and transfer functions for one port and two port network, poles & zeros of network functions, Restriction on Pole and Zero locations of network function

Unit Outcomes:

- Determine network parameters for given two port network
- Relate different two port network parameters
- Represent transfer function for the given network

Text Books:

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw HillEducation, 2013.
2. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.

References:

1. D. Roy Choudhury, "Networks and Systems", New Age International Publications,1998.

2. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
3. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2003.
4. Network Analysis by A. Sudhakar and Shyammohan S palli. McGraw-Hill, 5th Edition.

Course Outcomes:

- Solve network problems using mesh and nodal analysis techniques
- Analyze networks using Thevenin, Norton, Maximum power transfer, Superposition, Miller and Millman theorems
- Compute responses of first order and second order networks using time & frequency domain analysis
- Design resonant circuits for given bandwidth
- Utilize Z, Y, ABCD and h parameters for analyzing two port circuit behavior