

16EC203 NETWORK THEORY

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

This course enables the students to learn advanced concepts in circuit analysis which are applicable in solving electronic circuits. The aim of this course to introduce the student to the derivation of transient responses of RC, RL and RLC circuits, steady state response of circuits to sinusoidal excitation in time domain, application of phasors to circuit analysis and introduction to graph theory to analyze circuits.

Course Outcomes:

Upon successful completion of this course, students should be able to:

- CO1: Apply KVL, KCL, source transformation, star-delta transformation, voltage and current division rules on Electrical networks.
- CO2: Investigate series and parallel circuits with AC excitation and resonant circuits.
- CO3: Analyze the transient response of RL, RC and RLC circuits for DC and AC excitations.
- CO4: Understand the concepts of various network theorems and applying to the linear circuits.
- CO5: Analyze the two port network parameters, Interconnect, Represent and analyze two port networks.
- CO6: Determine branch currents and voltages using Thevenin and Norton.

SKILLS:

- ✓ Determine currents and voltages of all elements of any electrical system network.
- ✓ Analysis of simple house wiring diagram.
- ✓ Analysis of simple circuits by using theorems.
- ✓ Calculate power, current and voltage in any AC and DC circuits.
- ✓ Design of suitable Battery for small applications.
- ✓ Application of two-port network parameters to analyze transmission lines and filters.

UNIT - 1**L-9, T-3**

INTRODUCTION OF CIRCUIT ELEMENTS: Ideal, Practical and dependent sources and their V-I characteristics, Source transformation, Voltage and current division, V-I characteristics of passive elements and their series / parallel combination, Energy stored in Inductors and capacitors, Kirchhoff's voltage law and Kirchhoff's current law, Mesh and nodal analysis, Star and delta conversions.

UNIT - 2**L-9, T-3**

SINUSOIDAL STEADY STATE ANALYSIS AND RESONANCE: Instantaneous, Peak, Average ,RMS values, Crest factor and form factor of periodic waveforms, Notation and concept of phasors, Response of R, L, C series and parallel combination circuits to sinusoidal excitation, Calculation of active and reactive powers, Resonance - Series and parallel resonance circuits, concept of bandwidth and Q factor.

UNIT - 3**L-9, T-3**

NETWORK TRANSIENT ANALYSIS: Transient response of R-L, R-C, R-L-C circuits (Series and parallel combinations) for D.C and sinusoidal excitations, Initial conditions, Time domain and laplace transform methods of solutions.

UNIT - 4**L-9, T-3**

NETWORK THEOREMS: Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Compensation, Maximum power transfer theorems, Millman theorem, Application of theorems to DC and AC circuits.

UNIT - 5**L-9, T-3**

TWO PORT NETWORK PARAMETERS: Introduction to Two port networks, Open circuit impedance and short circuit admittance (Y), Transmission and inverse transmission, Hybrid and inverse hybrid parameters, Relation between parameter sets, Interconnection of two port networks, Graph theory - Definitions, Graph, Tree, Basic tie-set and basic cut set matrices for planar networks, Loop and nodal methods of analysis of networks with independent and dependent voltage and current sources, Duality and dual networks.

TEXT BOOKS:

1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", 7th edition, Tata McGraw-Hill, 2007.
2. A Sudhakar and Shyammoan S Palli, "Circuits & Networks: Analysis and Synthesis", 5th edition Tata McGraw-Hill, 2007.

REFERENCE BOOKS:

1. Syed A. Nasar, "Electric Circuits", Tata McGraw-Hill, Schaum's Series, 1988.
2. Franklin F.Kuo, "Network Analysis and Synthesis", 2nd Edition, John Wiley and Sons, 2003.
3. Mahmood Nahvi and Joseph Edminister, "Electric Circuits", 4th edition, Schaum's Outline series, Tata McGraw-Hill, 2004.

ACTIVITIES:

- Measure the Resistance of any resistive Electrical Appliance like water heater, incandescent bulb.
- Design of small size house wiring system.
- Design circuits with suitable load to get maximum power from source.
- Determination of RLC values for given resonant frequency connected series/parallel combination.
- Design resonant circuit for oscillator and filter applications.
- Design of Power bank for mobile charger circuit.
- Determination of Voltage and current characteristics of given Black box.
- Verify duality for a given Network.