

# EC 201 NETWORK ANALYSIS (3-1-2: 5)

## **Introduction to Electrical Circuits**

Electrical Network Concept, Network Terminology, Classification of electrical networks, R-L-C Parameters, Voltage and current sources, Independent and Dependent sources, Source Transformation, Voltage-current relationship for passive Elements, Kirchhoff's laws, Network Reduction Techniques-Series, Parallel, Series-parallel, Star to Delta Transformation, Basic Circuit Analysis- Nodal and Mesh Analysis.

## **Network Theorems**

Superposition Theorem, Thevenin's Theorem, Maximum power transfer Theorem, Millman's Theorem, Reciprocity Theorem, Tellegen's Theorem- Statement and proofs, Problem solving using dependent and independent sources for d.c and a.c excitation.

## **Series and Parallel Resonance in AC circuits**

Characteristics, Properties of Resonance Circuits, Selectivity, Bandwidth and Quality Factor.

## **Network Topology**

Concept of Tree, Branch, Tree Link, Incidence Matrix, Tie-set Matrix and Loop currents, Cut set matrix and node pair potentials, Duality and Dual Networks.

## **Coupled Circuits**

Concept of Self and Mutual inductance, Co-efficient of coupling, Dot convention for representing coupled circuits, Loop Analysis of coupled circuits.

## **Transient Analysis**

Transient response of R-L, R-C, R-L-C networks by Laplace transform method with DC and AC excitation. Response to step, Impulse and ramp inputs

## **Two Port Networks**

Z, Y, ABCD, h-parameters, Conversion of one Parameter to another parameter, Condition for reciprocity and symmetry, 2 Port network connections in Series, Parallel and cascaded, Problem Solving.

## **Network Functions & Responses**

Concept of complex frequency, Driving point and Transfer functions for one port and two networks, Poles & Zero of network Functions, Restriction on Pole and Zero locations of network function, Time domain behaviour from pole-zero plot.

## **Fourier Series & Fourier Transforms**

Fourier Series representation of non-sinusoidal waves, Discrete Spectra, rms values of Non-sinusoidal waves, Steady state response of linear circuits to non-sinusoidal waves, Power in such circuits, Applications to RL and RC circuits, Fourier transform of signum and step functions.

## **Filter Circuits**

Passive filters and Attenuators – classification and general relations in filters.

## **Network Synthesis**

Hurwitz Polynomials, positive Real Functions, Properties of real immittance functions, Synthesis of LC driving point immittances, Synthesis of RC driving point Impedances, Synthesis of RC impedances or RL admittances, Properties of RL impedances and RC admittances.

## **Suggested Practicals:**

1. Verification of Principle of Super-position Theorem with dc and ac source.

2. Verification of Thevenin, Norton and Maximum Power Transfer Theorems in ac circuits.
3. Verification of Reciprocity and Tellegen's Theorem.
4. Study of Resonance in R-L-C series circuit.
5. Study of Resonance in R-L-C parallel circuit.
6. Determination of self-inductance, mutual-inductance and coupling co-efficient of a single phase two winding transformer representing a coupled circuit.
7. Determination of transient response of current in RL and RC circuits with step voltage input.
8. Determination of transient response of current in RLC circuits with step voltage input for under-damp, critically damp and Over-damp cases.
9. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.
10. Frequency response of low pass and High Pass Filters.
11. Frequency response of Band pass and Band Elimination Filters.
12. To determine equivalent parameter of parallel connections of two port network and study loading effect.
13. To calculate and verify "ABCD" parameters of a two port network.
14. Determination of frequency response of a Twin-T notch filter.
15. To determine attenuation characteristics of a low pass/high pass active filter.
16. Spectral Analysis of Non-sinusoidal wavefor

**Text Books:**

1. Hayt & Kemmerley, Engineering Circuit Analysis, Tata McGraw Hill.
2. J. D. Ryder, Networks, Lines and Fields, PHI.

**References:**

1. M. E. Van Valkenburg, Network Analysis, Prentice Hall of India.
2. Donald E. Scott : "An Introduction to circuit analysis: A System Approach" McGraw Hill.
3. N. C. Jagan and C. Lakshminarayana, Network Analysis, B.S. Publications.
4. J. Edminister and M.Nahvi, Electric circuits, Schaum's Outlines, TMH.
5. C.L Wadhwa, Network Analysis and Synthesis, New Age International Publishers.
6. G. Panda & A.K. Mohapatra, Network Theory, Kalyani Publishers