2/4 B.Tech - THIRD SEMESTER

EC3T4 **Network Analysis and Synthesis** **Credits: 3**

Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1period/week **Semester end examination: 70 marks**

Prerequisites: Engineering Mathematics –II (EC2T1), Introduction to Electrical Circuits (EC1T6)

Course Objectives:

- To learn the concepts of mesh, node analysis, and network theorems.
- To learn the graphical representation of a network , transient analysis and application of
  Laplace transforms to RLC circuits.
- To learn the concepts of two port network parameters and different types of networks
- To learn the concepts of network functions.
- To learn the synthesis for a given network.

Course Outcomes:

Student will be able to

- Apply mesh, nodal analysis to complex circuits and express them using Thevenin's and Norton's equivalent forms
- Evaluate the performance of RL, RC, and RLC circuits by the application of Laplace transform.
- Analyze the given network using different two port network parameters.
- Determine the response of a network using network functions.
- Synthesize Network functions.

UNIT I

Network Theorems (Application to d.c & a.c analysis): Mesh analysis, Node analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer Theorem, Reciprocity Theorem, Millman's Theorem, Tellegen's Theorem, Substitution Theorem and Compensation Theorem.

UNIT II

Network Topology : Graph of a network, Definitions associated with a graph, Incidence matrix, Loop matrix, Cutset matrix, Relationship among submatrices of A, B and Q. Relation between branch voltage matrix V_b, Twig voltage matrix V_t, and Node voltage matrix V_n, Relation between Branch current matrix I_b, and loop current matrix I_l, Network Equilibrium Equation, Duality.

Transient Analysis: Initial conditions, Resistor-Inductor Circuit, Resistor-Capacitor Circuit, Resistor-Inductor-Capacitor Circuit. Applications of Laplace Transforms to transient analysis: The transformed circuit, Resistor-Inductor circuit, Resistor-Capacitor circuit,

Resistor-Inductor-Capacitor circuit, Response of RL circuit to various functions, Response of RC circuit to various functions.

UNIT III

Two-Port Networks: Open-circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Inverse transmission parameters, Hybrid parameters, Inverse hybrid parameters, Inter relationship between the parameters, Inter connection of two port networks, T-Network, π network, lattice networks, terminated two port networks.

UNIT IV

Network Functions: Driving point Functions, Transfer functions, analysis of ladder networks, Analysis of Non-ladder networks, poles and zeros of network functions, Restrictions on pole & zero location for driving point functions, Restrictions on pole & zero locations for transfer functions, time-domain behavior from the pole-zero plot, graphical method for determination of residue.

UNIT V

Network Synthesis: Introduction, Hurwitz polynomials, Positive Real Functions, Elementary synthesis concepts, Realization of LC Functions, Realization of RC Functions, Realization of RL Functions.

Learning Resources

Text Books:

1. Engineering Circuit Analysis - William Hayt and Jack E.Kimmerley, McGraw Hill Company,6th edition
2. Network Analysis - M.E.Van Valkenburg, Prentice-Hall of India Private Ltd.

References:

1. Introduction to Modern Network Synthesis - M.E. Van Valkenburg, Wiley India Limited, 2nd Edition, 1986.
2. Theory & Problems of Electric Circuits - Joseph A Edminister, Schuam Series.
3. Network Analysis & Synthesis - Ravish R Singh, Tata McGraw- Hill Publications, 1st Edition, 2013
4. Networks & Circuits - A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill Publications, 4th Edition

Web Resources:

1. http://nptel.iitm.ac.in/video.php?subjectId=108102042
2. http://freevideolectures.com/Course/2350/Networks-Signals-and-Systems/33