COURSE CONTENT

NETWORK ANALYSIS AND SYNTHESIS

I Semester: ECE

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
2520204	Foundation	3	0	0	3	40	60	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:45		

Prerequisites: **Introduction to Electrical Engineering.**

Course Overview:

This course introduces network analysis and synthesis, covering topology, coupled circuits, transient and steady-state behavior, two-port networks, filters, and attenuators. It develops skills in analyzing RLC circuits, poles and zeros, resonance, and designing filters and networks using synthesis techniques.

Course Objectives:

1. To understand the fundamentals of network topology and magnetic circuits.
2. To analyze transient and steady-state responses of RC, RL, and RLC circuits.
3. To learn various two-port network parameters and network function analysis for impedance matching.
4. To understand the classification, design of filters and attenuator networks.
5. To master network synthesis techniques to design driving-point and transfer functions using positive real functions.

Course Outcomes: After Completion of the Course, Students should be able to

1. Analyze network topology and magnetically coupled circuits using dot convention.
2. Determine transient responses, resonance, and damping behavior of RLC circuits by applying root locus methods.
3. Understand two-port network parameters, calculate key impedances and network functions.
4. Design and study constant-k, m-derived filters and attenuators networks.
5. Synthesize LC, RC, and RL networks based on driving-point impedance and transfer functions.

UNIT - I: Network Topology: Basic cut set and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT - II: Transient and Steady state analysis: RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT - III: Two port network parameters: Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T,Π, L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network.

UNIT - IV: Filters: Classification of Filters, Filter Networks, Constant-K Filters-Low pass, high pass, Band pass, band-stop filters, M-derived Filters- T and π filters- Low pass, high pass Attenuators: Types – T, π , L, Bridge T and lattice ,Asymmetrical Attenuators T, π , L Equalizers- Types- Series, Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers.

UNIT - V: Network Synthesis: Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non ladder networks, Poles, Zeros analysis of network functions, Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and causer methods.

TEXT BOOKS:

1. Van Valkenburg, "Network Analysis", 3rd Ed., Pearson, 216.
2. JD Ryder, "Networks, Lines and Fields", 2nd Ed., PHI, 1999.

REFERENCE BOOKS:

1. J. Edminister and M. Nahvi – "Electric Circuits", Schaum's Outlines, Mc Graw Hills Education, 1999.
2. A. Sudhakar and Shyammohan S Palli, "Networks & Circuits" , 4th Ed., Tata Mc Graw- Hill Publications.
3. William Hayt and Jack E. Kimmerley, "Engineering Circuit Analysis" , 6th Ed., William Hayt and Jack E. Kimmerley, McGraw Hill Company.

ELECTRONIC RESOURCES:

1. https://www.electrical4u.com/network-topology/
2. https://www.allaboutcircuits.com/textbook/alternating-current/
3. https://www.electrical4u.com/two-port-network/
4. https://www.electrical4u.com/electronic-filters/
5. https://nptel.ac.in/courses/108/106/108106073

MATERIALS ON LINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper–I
8. Model question paper–II
9. Lecture notes
10. Drshya Siksha Sangrah Videos (DSSV)