RAGHU ENGINEERING COLLEGE

Autonomous

(Approved by AICTE, New Delhi, Accredited by NBA (CE,ECE, MECH, CSE), NAAC with 'A+' Grade & Permanently Affiliated to JNTU GV-Vizianagaram)

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Department of Electronics and Communications Engineering

I Year II Semester	**L**	**T**	**P**	**C**
Code: 2304101	**3**	**0**	**0**	**3**

NETWORK ANALYSIS

Preamble: This course is designed with the objective of expanding the student's knowledge in Network Analysis beyond the basic topics. It includes Network theorems, Transients, Steady State Analysis, Magnetically Coupled Circuits, Resonance and Two Port Parameters. This course would help students to explore the analysis of complex networks.

Prerequisite: Engineering Mathematics, Basic Electrical and Electronics Engineering.

Course Objectives

1. To introduce basic electrical circuits with nodal and mesh analysis and network theorems.
2. To introduce Transient response for DC and AC excitation by applying Laplace Transforms.
3. To explain Steady State Analysis of AC Circuits.
4. To teach concepts of resonance and Coupled Circuits.
5. To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

Course Outcomes

At the end of this course, students will demonstrate the ability to

CO1	Understand basic electrical circuits with nodal and mesh analysis and network theorems.	L3
CO2	Analyze Transient response for DC and AC excitation by applying Laplace Transforms.	L3
CO3	Analyze Steady state response of AC circuits.	L3
CO4	Understand the concept of resonance and Coupled Circuits	L2
CO5	Compute the parameters of two-port networks.	L3

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	P012	PSO1	PSO2
CO1	3	3	2			1		1		1		1	1	1
CO2	3	3	2			1		1		1		1	1	1
CO3	3	3	2			1		1		1		1	1	1
CO4	3	3	2			1		1		1		1	1	1
CO5	3	3	2			1		1		1		1	1	1

1 – Weak, 2 – Moderate and 3 – Strong

UNIT-I: 12 Hours

Types of circuit components, Types of Sources, Network reduction techniques-series, parallel circuits, Star-Delta conversion and Source Transformations, Mesh analysis and Nodal analysis,

problem solving with resistances only including dependent sources also. Principal of Duality with examples.
Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens - problem solving using dependent sources also.

UNIT-II: **12 Hours**

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots.
Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

UNIT-III: **12 Hours**

Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, numerical problems.

UNIT-IV: **12 Hours**

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.
Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT-V: **12 Hours**

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.
Image and iterative impedances. Image and iterative transfer constants. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks.

Text Books:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

Reference Books:

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017 Fundamentals of
3. Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill