

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Circuits and Networks
Course Code:	1ET1090304
Pre-requisite Course:	Basics of Elements of Electrical Engineering, Knowledge of integration and differentiation

Course Objectives:

1. To understand the application of fundamental laws and network theorems for circuit analysis.
2. To study and analyze the transient response of first and second order circuits.
3. To learn network parameters and its relation for two port networks.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	-	2	5	28	70	12	30	12	30	08	20	150

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Introduction to Basic Circuits Elements: Charge, Work, Potential, Potential difference, Current, Power, Energy, Resistance, Inductance, Capacitance, Active elements, Passive elements, Ideal and Practical Voltage and Current Sources, Dependent & Independent Sources, VI relationship of circuit elements, Classification of Electrical Networks, Basic definitions like. node, junction, circuit, network, loop, mesh, branch etc., Kirchhoff's Voltage Law, Voltage Division, Kirchhoff's Current Law, Current Division, Introduction to Coupled Circuits, Dot Convention.	05	08
2	Nodal Analysis and Mesh Analysis of resistive Circuits: Introduction, Nodal Analysis of circuits with independent and dependent sources, Mesh Analysis of circuits with independent and dependent sources, Source Transformation Theorem for circuits with independent sources and dependent sources.	07	14
3	Network Theorems for D.C. and A.C. Circuits: Introduction, Superposition Theorem, Thevenin's Theorem and Norton's Theorem for circuits with independent and dependent sources, Maximum Power Transfer Theorem, Reciprocity Theorem, Substitution Theorem, Millman's Theorem, Compensation Theorem, Duality Theorem, Duality between Electricity and Magnetism.	12	22

4	Initial Conditions: Introduction, Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.	04	08
5	Time domain Response of First Order and Second Order Circuits: Introduction, Differential Equations, General and Particular Solutions, Source free and forced response of R-L, R-C and R-L-C circuits with D.C. and Sinusoidal Excitation.	05	08
6	Laplace Transform Analysis: Introduction, Laplace Transform of Standard Functions, Initial value theorem and final value theorem, Laplace transform of basic elements including initial conditions, Solving Differential Equations, Network Analysis using Laplace Transform, Resistor-inductor-capacitor in Laplace Domain, S-Domain Network, Network Analysis in S-Domain.	05	08
7	Two –Port Networks Parameters: Introduction, Two Port Impedance Parameters (z-parameters), Admittance Parameters (Y-parameters), Hybrid Parameters (H-parameters), Inverse Hybrid Parameters, Transmission Parameters (ABCD-parameters), Relationship between different parameters.	10	18
8	Introduction to Network Topology: Graph, Tree, planner and non-planner networks, Incidence Matrix, Kirchhoff's Laws in Incidence Matrix Formulation, Basic Cutset matrix, Kirchhoff's Laws in Basic Cutset Formulation, Tie-set matrix, Kirchhoff's Laws in Tie-set Formulation, Loop and Nodal analysis of Networks with dependent & independent voltage and current sources, Relationship between Basic Cutset, Tie-set and incidence matrices.	08	14

Text Books:

1. Network Analysis By M.E Van Valkenburg PHI Publication.
2. Circuits Theory by U. B. Bakshi, A.V.Bakshi, Technical Publication Pune.
3. Circuits Theory, Analysis and Synthesis by A.Chakrabarati, Dhanpat Rai & Co.
4. Network Analysis By G. K. Mithal, Khanna Publications.

Reference Books:

1. Electric Circuits and Networks By K. S. Suresh Kumar – Pearson Education.
2. Circuits and Networks By U. A. Patel, Mahajan Publishing House U. A. Bakshi and A. P.
3. Graphs: Theory and Algorithms By K. Thulasiraman, M.N.Swamy, Wiley Publication.
4. Electric Circuit Analysis By S N Sivanandam, Vikas Publishing House.

List of Experiments:

1. To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL.
2. To verify Superposition theorem experimentally for a given resistive circuit consisting two independent sources.
3. To verify Thevenin's theorem experimentally for a given circuit.
4. To verify Nortons's theorem experimentally for a given circuit.
5. To verify Milman's theorem experimentally for a given circuit.
6. To verify Substitution's theorem experimentally for a given circuit.
7. To verify Maximum power transfer theorem experimentally for a given circuit.
8. To verify Reciprocity theorem experimentally for a given circuit.
9. To measure and calculate RC time constant for a given RC circuit.
10. To measure and calculate RC time constant for a given RL circuit.

11. To measure and calculate Z-parameters for a given two-port system.
12. To measure and calculate Y-parameters for a given two-port system.
13. To measure and calculate H-parameters for a given two-port system.
14. To measure and calculate ABCD-parameters for a given two-port system.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Apply Kirchhoff's laws and networks theorems in the design and analysis of circuits.	3 Applying
CLO2	Apply dot convention technique for analysis of transformer based circuits.	3 Applying
CLO3	Determine the transient response of first and second order circuits using initial condition and Laplace transform techniques.	5 Evaluate
CLO4	Understand basics of network topologies and the tie set and cutset schedules.	1 Remembering
CLO5	Apply two port network technique for analysis.	3 Applying
CLO6	Acquire knowledge regarding various ABCD Parameter.	2 Understanding

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1		M		M			L					M		L		H
CLO2		M		M			L					M	L		H	
CLO3	M	L				M			M	M				M		L
CLO4	L	H		M	M							M	L			
CLO5		M		M			L					M		M	L	
CLO6	H		H	L				M		M	M		L		H	L

H: High, M: Medium, L: Low