

Subject Code: 1ET1040302	Subject Title: Network Theory and Analysis
Pre-requisite Subject	Fundamental knowledge of electric circuit sources and basic passive elements, basic knowledge of mathematics (integration, differentiation, etc.)

Course Objective: The EC students need the depth knowledge of network analysis as they need to apply the network analysis laws in designing an electronics project. The objective of the course is to make student aware about how to apply basic network laws to electronics network for analysis and synthesis of electronic network.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
04	00	02	05	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Development of Circuit Concepts: Introduction – Charge and Energy – The Relationship of Field and Circuit Concepts – The Resistance Parameter – The Inductance Parameter – The Capacitance Parameter – Dot Convention – Units and Scaling – Approximation of a Physical System as a Circuit	03	05
2	Network Equations: Kirchhoff's Laws – The Number of Network Equations – Source Transformations – Examples of the Formulation of Network Equations – Loop Variable Analysis – Node Variable Analysis – Determinants: Minors and Gauss Methods – Duality – State Variable Analysis	05	10
3	Initial Conditions In Networks: Why Study Initial Conditions? - Initial Conditions in Elements – Geometrical Interpretation of Derivatives – A Procedure for Evaluating Initial Conditions – Initial State of a Network	04	07
4	First Order Differential Equations: General and Particular Solutions – Time Constants – The Integrating Factor – More Complicated Networks	04	07
5	Higher Order Differential Equations: Second order Equations – Higher Order Equations – Networks Excited By External Energy Sources – Response as Related to the S-Plane Location of Roots – General Solution in terms of S, Q and ω_{nm} .	06	13
6	The Laplace Transformation: Introduction – The Laplace Transformation – Some Basic Theorems for the Laplace Transformation – Examples of the Solution of Problems with the Laplace Transformation – Partial Fraction Expansion – Heaviside's Expansion Theorem – Examples of Solution by the Laplace Transformation	06	13

7	Laplace Transform of Other Signal Waveforms: The Shifted Unit Step Function – The Ramp and Impulse Functions – Waveform Synthesis – The Initial and Final Value of $f(t)$ from $F(s)$.	04	07
8	Impedance Functions and Network Theorems: The Concept of Complex Frequency – Transform Impedance and Transform Circuits – Series and Parallel Combinations of Elements – Superposition and Reciprocity – Thevenin's Theorem and Norton's Theorem – Maximum Power Transfer Theorem – Millman's Theorem	07	14
9	Network Functions: Poles and Zeros: Ports – Network Function for the One port and Two Port – The Calculation of Network Functions – Poles and Zeros of Network Functions – Restrictions on Pole and Zero locations for Transfer Functions – Time Domain Behavior from the Pole and Zero Plot – Stability of Active Networks	03	05
10	Two – Port Parameters: Relationship of Two-port Variables – The Open Circuit Impedance Parameters - Short Circuit Admittance Parameters – Transmission Parameters – The Hybrid Parameters – Relationship Between Parameter Sets – Parallel Connection of Two-Port Networks	08	16
11	Network Topology: The Graph of a Network – Tree of a Network – Network Variables – Link Current: Tie-set Schedule – Tree Branch Voltages: Cut-set Schedule.	02	03
	Total	52	100

Course Outcome:

After successful completion of the course, the students will be able to:

- Analyze the basic AC and DC circuits.
- Analyze the transient and steady state behavior of passive circuits such as RL, RC and RLC.
- Analyze the basic networks with help of network theorems.
- Analyze network using Laplace Transforms.
- Analyze the two port network circuits which are helpful in the study of attenuators, filters and equalizers.

List of Text Book:

1. Network Analysis, by M.E Van Valkenburg, PHI Publication

List of Reference Books:

1. Circuits and Networks by U. A. Patel, Mahajan Publishing House
2. Network Analysis by G. K. Mithal, Khanna Publications
3. Engineering Circuit Analysis by William H. Hayt, Jr. Jack E. Kammerly, Steven M. Durbin, Tata Mc-Graw Hill Edition

List of Suggested titles of Experiments:

1. To study and verify KVL experimentally for a given circuit.
2. To study and verify KCL experimentally for a given circuit.
3. To verify Thevenin's theorem experimentally for a given circuit.
4. To verify Norton's theorem experimentally for a given circuit.
5. To verify maximum power transfer theorem experimentally for a given circuit.
6. To verify reciprocity theorem experimentally for a given circuit.
7. To measure and calculate RC time constant for a given RC circuit.
8. To measure and calculate RL time constant for a given RL circuit.

9. To measure and analyze step response of for a given series RLC circuit for following cases: (1) $\zeta = 1$ (critically damped system), (2) $\zeta > 1$ (over damped system), (3) $\zeta < 1$ (under damped system). Choose appropriate values of R, L, and C to obtain each of above cases one at a time.
10. To measure and calculate Z-parameters for a given two-port system.
11. To measure and calculate Y-parameters for a given two-port system.
12. To measure and calculate h-parameters for a given two-port system.
13. To measure and calculate ABCD-parameters for a given two-port system.