Course Code	EEE1003B			
Course Category	Professional Core			
Course Title	Electrical Circuit Analysis			
Weekly Teaching Hrs. and Credits	L	T	Laboratory	Credits
	2	-	2	2 + 0 + 1

Pre-requisites: Basics of electrical engineering, Laplace transform and Linear differential equations.

Course Objectives:

1. To learn network simplification techniques and develop strong foundation for electrical networks.
2. To develop analytical qualities in electrical circuits by the application of various theorems.
3. To understand the behavior of circuits by analyzing the transient response using classical methods and Laplace transform approach.
4. To apply knowledge of network theory to simulate linear and nonlinear networks.

Course Outcomes: After completion of this course, students will be able to

1. Understand the basic concepts of network theory (CL-I).
2. Apply the problem-solving techniques to solve complex electrical networks (CL-I).
3. Demonstrate the transient response for understanding the behavior of electrical network (CL-II).
4. Analyze linear as well as nonlinear circuits using software tools (CL-IV).

Course Contents:

Basic Circuit Analysis and Simplification Techniques: Source transformation: voltage and current sources, mesh analysis, nodal analysis, super node and super mesh, coupled circuits and dot conventions. Concept of graph theory and various matrices.

Network Theorems: Superposition, Thevenin, Norton, maximum power transfer, reciprocity, Millman theorems for solving ac and dc circuits. Simulation of all theorems using software.

Analysis of Transient Response in Circuits: Initial and steady state condition of various networks, general and particular solution, time constant. Transient response of R-L, R-C and R-L-C network in time domain, analyzing transient response through simulation.

Analysis of Transient Response in Circuits: Laplace transform approach: standard test inputs as step, ramp, impulse and their Laplace transform, representation of R, L, C in s domain, transformed network, application of Laplace transform to solve series and parallel source free and source driven R-L, R-C and R-L-C circuits.

Laboratory Exercises / Practical:

1. Basic Operations on Matrices.
2. Generation of various signals and sequences (periodic and aperiodic), such as unit impulse, step, square, saw tooth, triangular, sinusoidal, ramp, sinc.
3. Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding, computation of energy, and average power.
4. Mesh and nodal analysis of electrical circuits.
5. Application of Network Theorems to Electrical Networks.
6. Waveform Synthesis using Laplace Transform.
7. Locating the zeros and poles and plotting the pole-zero maps in S plane and Z-Plane for the given transfer function.
8. Harmonic analysis of non-sinusoidal waveforms simulation of DC Circuits.
9. Design of Low Pass and High Pass filters.
10. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.

Learning Resources:

Text Books:

1. Singh R. R, *Network Analysis and Synthesis*. New Delhi: McGraw Hill Education India, 3rd edition, 2015.
2. Chakroborty A., *Circuit Theory*. New Delhi: Dhanpat Rai and Company, 7th edition, 2018.