ELECTRICAL CIRCUIT ANALYSIS

Course Code: 22EE1101 **L T P C**

3 0 0 3

Prerequisites: Physics, Differential Equations and Laplace transforms

Course Outcomes: At the end of the Course the student shall be able to

CO1: Analyze electrical circuits with DC excitation.
CO2: Analyze single phase and three phase AC circuits.
CO3: Define and Understand Network Theorems and apply them for solving electrical Circuits.
CO4: Analyze Two Port Networks and study frequency response of electrical circuits including resonance.
CO5: Evaluate transient behavior of electrical circuits using Differential equation approach and Laplace Transforms approach.

UNIT-I 10 Lectures

DC CIRCUITS

Types of sources and their characteristics, Network elements, Voltage - Current Relationship for Passive Elements, Source Transformation, Network Reduction Techniques: Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation, Analysis with dependent current and voltage sources, Node and Mesh Analysis.

Learning Outcomes: Students should be able to

1. learn network elements, types of sources, source transformation and network reduction techniques (L2)
2. analyze the network by obtaining solution through mesh and nodal analysis (L4)
3. understand star to delta and delta to star transformations (L3)

UNIT-II 10 Lectures

SINGLE PHASE AC CIRCUITS

R.M.S, Average Values and Form Factor for Different Periodic Waveforms: Sinusoidal Alternating Quantities. Phase and Phase Difference, Complex and Polar Forms Of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) With Sinusoidal Excitation, Concept of Power Factor, Concept of Reactance, Impedance, Susceptance and Admittance-Real and Reactive Power and Complex Power.

THREE PHASE AC CIRCUITS

Relation between Line and Phase Voltages and Currents, Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems, Mutual coupled circuits, Dot convention in coupled circuits.

Learning Outcomes: Students should be able to

1. analyze RL, RLC series parallel circuits with sinusoidal excitation (L4)
2. analyze 3-phase circuits with balanced and unbalanced loading (L3)

UNIT-III 10 Lectures

NETWORK THEOREMS

Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem, Theorems for DC and Sinusoidal Excitations, Concept of duality and dual networks.

Learning Outcome: Students should be able to

1. application of Network theorems to dc and ac circuits (L3)

UNIT-IV 10 Lectures

TWO PORT NETWORKS & RESONANCE

Two Port Network Parameters: Impedance, Admittance, Transmission and Hybrid Parameters and their Relations, Interconnection of two port networks.

Resonance: Series, Parallel Circuits, Concept of Bandwidth and Q Factor.

Learning Outcomes: Students should be able to

1. obtain the parameters for a given two port network. (L3)
2. understand resonance frequency and Q factor of an AC Circuit (L3)
3. determine Q factor and resonant frequency of ac circuits (L3)

UNIT-V 10 Lectures

TRANSIENT RESPONSE ANALYSIS

D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms, Response of R-L & R-C Networks to Pulse Excitation.

A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms

Learning Outcomes: Students should be able to

1. evaluate the transient response of R-L, R-C, R-L-C Series circuits with ac and dc excitation (L3)
2. determine the transient response of AC and DC circuits using differential equations and Laplace transforms (L3)

TEXT BOOKS:

1. Charles K. Alexander and Mathew N.O. Sadiku, *Fundamentals of Electric Circuits*, 6th Edition, McGraw Hill Publications, 2019.
2. John Bird, Rovtledge, *Electrical Circuit Theory and Technology,* 4th Edition, T&F, 2011.

REFERENCES:

1. M. E. Van Valkenberg, *Network Analysis*, 3rd Edition, Pearson Publication 2015.
2. William H. Hayt, Jr., Jack E. Kemmerly and Steven M. Durbin, *Engineering Circuit Analysis*, 9th Edition, McGraw Hill Publications, 2019.
3. A. Sudhakar and Shyammohan S Palli, *Circuits & Networks*, 5th Edition, Tata McGraw- Hill, New Delhi 2017.