### G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (For Women)

(AUTONOMOUS) Shaikpet, HYDERABAD - 500 104

II Year B. Tech. EEE I-Semester

#### CIRCUITS THEORY

Prerequisites: Basic Electrical Engineering

## Course Objectives:

1. To introduce the basic concepts of circuit analysis, which is the foundation for all subjects of the electrical engineering.

2. To introduce basic analysis of circuits which includes three phase circuits, magnetic circuits, theorems, transient analysis, network parameters, filters and network topology.

3. To introduce basic analysis of various types of filters.

## UNIT 1: (~10 Lecture Hours)

Faraday's laws of electromagnetic Induction-Self and Mutual Inductances-Types of induced EMFs-Series and Parallel Magnetic Circuits-Dot Convention-Coupled circuits-coefficient of coupling -Comparison of electric and magnetic circuits-problems.

Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem and Millman's Theorem with DC and AC Excitation.

#### **UNIT 2**: (~8 Lecture Hours)

Network Topology:

Definitions- Graph, Tree, Basic Cut-set and Basic Tie-set matrices for planar networks - Loop and Nodal methods of analysis of Networks with dependent & independent voltage and current sources - Duality & Dual networks.

Three Phase Circuits: Phase sequence - Star and delta connection - Relation between line and phase voltages and currents in balanced systems -Analysis of balanced and Unbalanced 3 phase circuits - Measurement of active and reactive power.

## **UNIT 3:** (~9 Lecture Hours)

Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for D.C. and sinusoidal excitations - Initial conditions -Classical method and Laplace transforms methods of solutions. Transient response of the above circuits for different inputs such as step, ramp, pulse and impulse by using Laplace transforms method.

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UNIT 4: (~10 Lecture Hours)

Network functions: Driving Point and Transfer Functions - Poles and Zeros - necessary conditions for Driving Point functions and Transfer functions. Two Port Network parameters: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

UNIT 5: (~8 Lecture Hours)

Locus diagrams- Series and parallel combination of R-L, R-C, R-L-C circuits. Filters: Introduction to filters -low pass - high pass and band pass - RC, RL filters- constant K and m-derived filters and composite filter design.

#### Text Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.

2. "N. C. Jagan& C. Lakshminarayana", "Network Theory", B.S. Publications, 2014.

3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.

#### Reference Books:

- 1. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
- 2. "A. Chakrabarthy", Circuit Theory, Dhanpat Rai, 2005.

#### Course Outcomes:

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

1. Analyze magnetic circuits.

2. Apply network theorems for the analysis of electrical circuits.

3. Obtain the transient and steady-state response of electrical circuits.

4. Analyze two-port circuit behavior.

5. Construct and analyze locus diagrams for RL, RC and RLC networks.

6. Apply the concept of different types of basic filters to construct composite filters.

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