## **Circuit Analysis**

## **Chapter 1: Basic Circuit Analysis**

- 1.1. Introduction and Network Terminology
- 1.2. Classification of Electrical Circuits
- 1.3. Energy Sources
- 1.4. Ohm's Law
- 1.5. Basic Circuit Parameters
- 1.6. Analysis of Series Circuits
- 1.7. Analysis of Parallel Circuits
- 1.8. Kirchhoff's Laws
- 1.9. Electrical Work, Power and Energy
- 1.10. A.C. Fundamentals
- 1.11. Effective Value or R.M.S. Value
- 1.12. Average Value, Form Factor and Crest or Peak Factor
- 1.13. Phasor Representation of an Alternating Quantity
- 1.14. Concept of Phase and Phase Difference
- 1.15. Mathematical Representation of Phasor
- 1.16. Addition and Subtraction of Phasors
- 1.17. Multiplication and Division of Phasors

- 1.18. Impedance in A.C Circuits
- 1.19. Power in A.C Circuits
- 1.20. Series R-L-C Circuit
- 1.21. A.C. Parallel Circuit
- 1.22. Concept of Loop Current
- **1.23.** Loop Analysis or Mesh Analysis
- 1.24. Node Analysis

**Chapter 2: Network Topology** 

- 2.1. Introduction to Network Topology
- 2.2. Basic Definitions and Terminologies of Network Graph
- 2.3. Incidence Matrix
- 2.4. Loop Matrix (or Circuit Matrix)
- 2.5. Cutset Matrix and Fundamental Cutset Matrix

2.6. Orthogonal Relationship between Matrix A and B and Matrix Q

- 2.7. Relation between Submatrices A, B and Q
- 2.8. Network Analysis using Graph Theory
- 2.9. Network Equilibrium Equations in Matrix Form
- 2.10. Duality
- 2.11. Construction of Dual Networks

## **Chapter 3: Network Theorems for DC & AC Circuits** 3.1. Voltage Division in Series Circuit of Resistors

- 3.2. Current Division in Parallel Circuit of Resistors
- 3.3. Source Transformation
- 3.4. Delta-Star and Star-Delta Transformations
- 3.5. Short and Open Circuits
- 3.6. Superposition Theorem
- 3.7. Thevenin's Theorem
- 3.8. Norton's Theorem
- 3.9. Maximum Power Transfer Theorem
- 3.10. Reciprocity Theorem
- 3.11. Millman's Theorem

## **Chapter 4: Resonance**

- 4.1. Introduction to Resonance
- 4.2. Q-Factor or Figure of Merit
- 4.3. Series Resonance
- 4.4. Properties of Series Resonant Circuit
- 4.5. Bandwidth and Selectivity of Series Resonant Circuit
- 4.6. Properties and Applications of Series Resonant Circuit
- 4.7. Parallel Resonance (Antiresonance)

- 4.8. Properties of Parallel Resonance Circuit
- 4.9. Bandwidth and Selectivity of Antiresonant Circuit

4.10. Properties and Applications of Parallel Resonant Circuit

**Chapter 5: Coupled Circuits** 

5.1. Introduction to Coupled Circuits

5.2. Magnetically Coupled Circuit

- 5.3. Faraday's Laws of Electromagnetic Induction
- 5.4. Self-Induced E.M.F. and Self-Inductance (L)
- 5.5. Mutually Induced E.M.F. and Mutual Inductance (M)
- 5.6. Coefficient of Coupling or Magnetic Coupling
- 5.7. Dot Conventions or Dot Rules
- 5.8. Inductive Coupling in Series and Parallel
- 5.9. Energy in a Pair of Coupled Coils
- 5.10. Conductively Coupled Equivalent Circuit
- 5.11. Linear Transformer
- 5.12. Ideal Transformer
- 5.13. Single Tuned Circuit
- **Practice Problems**