

Pertinent

Part I — Fundamentals of Electrical Circuit Analysis

1. **Introduction to Electrical Circuits**
 - Basic electrical quantities
 - Voltage, current and power
 - Ohm's Law
 - Kirchhoff's Current and Voltage Laws
 - Series and parallel circuits
 2. **Network Analysis Techniques**
 - Mesh analysis
 - Nodal analysis
 - Loop and cut-set analysis
 - Network equations
 - Applications to DC and AC circuits
 3. **Network Theorems**
 - Superposition theorem
 - Thevenin's theorem
 - Norton's theorem
 - Maximum power transfer theorem
 - Reciprocity theorem
 - Compensation theorem
 - Millman's theorem
 4. **Magnetically Coupled Circuits**
 - Mutual inductance
 - Coefficient of coupling
 - Dot convention
 - Series and parallel coupled circuits
 - Ideal transformers
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Part II — Analysis of AC Circuits

5. **Sinusoidal Steady-State Analysis**
 - Sinusoidal waveforms
 - Phasor representation
 - Impedance and admittance
 - AC circuit analysis
 - Power and power factor
6. **Resonance**
 - Series resonance
 - Parallel resonance
 - Resonant frequency
 - Bandwidth

- Quality factor
 - Frequency response
 - 7. **Three-Phase Circuits**
 - Balanced three-phase systems
 - Star and delta connections
 - Line and phase quantities
 - Power measurement
 - Unbalanced three-phase circuits
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Part III — Transient and Frequency-Domain Analysis

- 8. **Transient Analysis of Electrical Circuits**
 - First-order RL and RC circuits
 - RLC circuits
 - Natural and forced response
 - Initial and final conditions
 - Step and impulse responses
 - 9. **Laplace Transform Method**
 - Definition and properties of the Laplace transform
 - Inverse Laplace transform
 - Circuit elements in the s-domain
 - Network equations in the s-domain
 - Analysis of circuits with initial conditions
 - 10. **Fourier Analysis**
 - Fourier series
 - Periodic signals
 - Harmonic analysis
 - Fourier transform
 - Frequency-domain representation
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Part IV — Two-Port Networks and Network Functions

- 11. **Two-Port Networks**
 - Two-port network representation
 - Impedance parameters (**Z-parameters**)
 - Admittance parameters (**Y-parameters**)
 - Hybrid parameters (**h-parameters**)
 - Transmission parameters
 - Relationships between two-port parameters
 - Interconnection of two-port networks

12. Network Functions

- Driving-point impedance and admittance
 - Transfer impedance and admittance
 - Voltage and current transfer functions
 - Poles and zeros
 - Frequency response
 - Stability considerations
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Part V — Network Topology and Graph Theory

13. Network Topology

- Graphs and oriented graphs
- Nodes, branches and links
- Trees and co-trees
- Incidence matrices
- Tie-set matrices
- Cut-set matrices

14. Graph-Theoretic Analysis of Networks

- Loop analysis
 - Cut-set analysis
 - Fundamental loops
 - Fundamental cut-sets
 - Network equations using graph theory
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Part VI — Passive Network Synthesis

15. Introduction to Network Synthesis

- Concept of network synthesis
- Network functions
- Realizability conditions
- Passive and lossless networks
- Causality and stability

16. Positive Real Functions

- Positive real functions
- Properties of positive real functions

- Necessary and sufficient conditions for realizability
- Hurwitz polynomials

17. LC Network Synthesis

- Properties of LC driving-point immittances
- LC network realization
- Foster forms
- Cauer forms

18. RC and RL Network Synthesis

- RC impedance functions
- RC admittance functions
- RL impedance functions
- RL admittance functions
- Network realization procedures

19. Elementary Network Synthesis Procedures

- Driving-point synthesis
- Continued-fraction expansion
- Partial-fraction expansion
- Foster and Cauer realizations