2.17 30296 NETWORK THEORY

UNIT-1. SIGNALS AND WAVEFORM SYNTHESIS

1.1 Introduction
1.2 Classification of Signals
 1.2.1 Continuous- Time and Discrete- Time Signals
 1.2.2 Even and Odd Signals
 1.2.3 Periodic and Unperiodic Signals
1.3 Standard Signals or Singularity functions
 1.3.1 Step Signal
 1.3.2 Ramp Signal
 1.3.3 Impulse Signal
 1.3.4 Relationship between Standard Signals
1.4 Other Basic Signals
 1.4.1 Unit Doublet Signal
 1.4.2 Exponential Signal
 1.4.3 Sinusoidal Signal
 1.4.4 Gate Signal (or Gate Function)
1.5 Direct Formula (or K.M. Formula)
1.6 Concept of Complex Frequency

UNIT-2 INTRODUCTION TO NETWORK

2.1 Introduction
2.2 Circuit Elements
 2.2.1 Unilateral or Bilateral Elements
 2.2.2 Lumped or Distributed Elements
 2.2.3 Linear or Non – linear Elements
 2.2.4 Active or Passive Elements
2.3 Electrical Energy Sources
 2.3.1 Independent Sources
 2.3.2 Dependent or Controlled Sources
2.4 Network Definitions
 2.4.1 Linear Network
 2.4.2 Passive Network
 2.4.3 Reciprocal Network
 2.4.4 Casual Network
 2.4.5 Time Invariant Network
2.5 Ideal Models of Linear System
 2.5.1 Amplifier
 2.5.2 Differentiator
 2.5.3 Integrator
 2.5.4 Time Delayer

UNIT-3 NETWORK ANALYSIS BY CLASSICAL METHOD

3.1 Introduction
3.2 Differential Equations
3.3 Initial Conditions in Circuits
3.4 Various Responses
3.4.1 Transient Response
3.4.2 Steady State Response 3.4.3 Zero Input Response
3.4.5 Step and Impulse Responses
3.5 Transient Response of Series R-L-C Circuit having DC excitation
3.6 Transient Response of Series R-L Circuit having DC excitation
3.7 Transient Response of Series R-C Circuit having DC excitation

UNIT-4 LAPLACE TRANSFORMS

4.1 Introduction
4.2 Definition of Convergence
4.2.1 Region of Convergence
4.2.2 Role of the Region of Convergence
4.3 Definition of the Unilateral Laplace transform
4.3.1 Existence of the Laplace Transform
4.4 Inverse Laplace Transform
4.5 Properties of Laplace Transform
4.5.1 Multiplication by a Constant
4.5.2 Sum and Different
4.5.3 Differentiation with respect to "t" (Time Differention)
4.5.4 Integration by "t" (Time-Integration)
4.5.5 Differentiation with respect to "s" (Frequency Differentiation)
4.5.6 Integration by "s" (Frequency Integration)
4.5.7 Shifting Theorem
4.5.8 Initial Value Theorem
4.5.9 Final Value Theorem
4.5.10 Theorem for Periodic Functions
4.5.11 Convolution Theorem
4.5.12 Time Scaling
4.6 Application of Laplace Transform
4.7 Solution of Linear Differential Equations
4.8 Transformed Circuit Components Representation
4.8.1 Independent Sources
4.8.2 Resistance Parameter
4.8.3 Inductance Parameter
4.8.4 Capacitance Parameter
4.9 Transfer Functions
4.10 Convolution Integral
4.11 Thevenin's and Norton's Theorems

4.11.1 Procedure to obtain Vth and Zth or IN and ZN
4.11.2. Application of Thevenin's and Norton's Theorems
4.11.3 Limitations of Thevenin's and Norton's Theorems

UNIT-5 TWO- PORT NETWORKS

5.1 Introduction
5.1.1 Characterization of Linear Time-Invariant (LTI) Two Port Networks
5.1..2 Relationship of Two Port Variables
5.2 Open Circuit Impedance (Z) Parameters
5.3 Short Circuit Admittance (Y) Parameters
5.4 Transmission (T) or Chain or ABCD Parameters
5.5 Inverse Transmission (T) Parameters
5.6 Hybrid (h) Parameters 5.7 Inverse Hybrid (h) Parameters
5.8 Condition for Reciprocity
5.9 Condition for Symmetry
5.10 Relationship between Parameter Sets
5.10.1 Z-parameters in Terms of Other Parameters
5.10.2 Y-parameters in Terms of Other Parameters
5.10.3 T-parameters in Terms of Other Parameters
5.10.4 T-parameters in Terms of Other Parameters
5.10.5 h-parameters in Terms of Other Parameters
5.10.6 g-parameters in Terms of Other Parameters
5.11 Interconnections of Two Port Networks
5.11.1 Series Connection
5.11.2 Parallel Connection
5.11.3 Cascade Connection
5.11.4 Series- Parallel Connection
5.11.5 Parallel- Series Connection

UNIT-6 NETWORK FUNCTIONS

6.1 Introduction
6.2 Terminal Pairs or Ports
6.3 Network Functions
6.4 poles and Zeros of Network Functions
6.4.1 Necessary Conditions for driving point Immittance Functions (with common factors in N(s) and D(s) cancelled):
6.4.2 Necessary Conditions for Transfer Functions (with common factors in N(s) and D(s) cancelled):

UNIT-7 NETWORK SYNTHESIS

7.1 Introduction
7.2 Elements of Reliability Theory
7.2.1 Causality and Stability

7.2.2 Hurwitz Polynomial
7.2.3 Positive Real Functions
7.3 Synthesis of One Port Networks with Two Kinds of Elements
7.4 L-C Immittance Function
7.5 R-C Impedance or R-L Admittance Function
7.6 R-L Impedance or R-C Admittance Function

UNIT-8 TRANSFER FUNCTION SYNTHESIS
8.1 Introduction
8.2 Zeros of Transmission
8.3 Synthesis of Y21 and Z21 with a 1-… Termination

UNIT-9 INTRODUCTION TO ACTIVE NETWORK SYNTHESIS
9.1 Introduction
9.2 Factored Forms of the Approximation Function
9.3 Second Order Filter Functions
9.4 The Cascade Approach
9.5 Realization of Real poles and Zeros
9.5.1 Inverting Amplifier
9.5.2 Non- Inverting Amplifier
9.6 Negative feedback Topology
9.7 Positive feedback Topology
9.8 Impedance Scaling
9.9 Frequency Scaling
9.10 Active Filters
9.10.1 First Order Active Low Pass Filter
9.10.2 First Order Active High Pass Filter
9.10.3 Active Band Pass Filter
9.10.4 Active Band Stop Filter

UNIT-10 GRAPH THEORY
10.1 Introduction
10.2 Elements of Graph Theory
10.2.1 Branch and Node
10.2.2 Graph
10.2.3 Path
10.2.4 Tree (twigs) and Co-tree (links or chords)
10.2.5 Loop or Circuit
10.2.6 Cut- Set
10.3 Incidence Matrix [A]
10.4 Loop Matrix or Circuit Matrix [B]
10.5 Cut-Set Matrix [Q]
10.6 Submatrices of A,Bf and Of

10.7 Inter-Relation among Various Matrices
10.7.1 Relation between A and Bf
10.7.2 Relation between A and Of 10.7.3 Relation between Bf and Of
10.8 Relationships among Parameters
10.8.1 Relation between Co-tree Branch (link) Voltages and Tree-branch (twig) Voltages
10.8.2 Relation between Branch Voltages and Twig Voltages
10.8.3 Relation between Branch Voltages and Node Voltages
10.8.4 Relation between Twig Currents and Link Currents
10.9 Network Analysis
10.9.1 Loop Analysis
10.9.2 Nodal Analysis
10.9.3 Cut-Set Analysis
10.10 Network with mutual Inductance
10.11 Duals and Duality

Reference book:

1. Network Theory BY K.M. Soni