Contents

xiv

xv

xix

Foreword

Preface to the Fourth Edition

Roadmap to the Syllabus

1.	INTE	RODUCTION TO ELECTRIC CIRCUITS	1.1-1.66
	1.1	Voltage 1.1	
	1.2	Current 1.2	
	1.3	Power and Energy 1.3	
	1.4	The Circuit 1.3	
		Resistance Parameter 1.5	
	1.6	Inductance Parameter 1.6	
	1.7	Capacitance Parameter 1.7	
	1.8	Energy Sources 1.9	
	1.9	Kirchhoff's Voltage Law 1.11	
	1.10	Voltage Division 1.14	
		Power in Series Circuit 1.16	
	1.12	Kirchhoff's Current Law 1.17	
	1.13	Parallel Resistance 1.20	
	1.14	Current Division 1.21	
		Power in Parallel Circuit 1.22	
	1.16	Star-Delta Transformation 1.22	
		Additional Solved Problems 1.27	
		PSpice Problems 1.44	
		Practice Problems 1.49	
		Objective-type Questions 1.54	
		Extra solved problems 1.58	
		Extra Objective Questions 1.65	
2.	AC C	CIRCUITS I	2.1-2.163
	2.1	The Sine Wave 2.1	
	2.2	Angular Relation of a Sine Wave 2.3	
	2.3	=	
	2.4	Voltage and Current Values of a Sine Wave 2.6	
	2.5	Phase Relation in Pure Resistor 2.10	

viii Contents

3.

2.6	Phase Relation in a Pure Inductor 2.10
2.7	Phase Relation in Pure Capacitor 2.11
2.8	Impedance Diagram 2.12
2.9	Phasor Diagram 2.14
2.10	Series Circuits 2.16
2.11	Parallel Circuits 2.22
2.12	Compound Circuits 2.24
	Instantaneous Power 2.25
2.14	Average Power 2.27
2.15	Apparent Power and Power Factor 2.28
2.16	Reactive Power 2.30
2.17	The Power Triangle 2.30
2.18	Introduction to Coupled Circuits 2.31
2.19	Conductively Coupled Circuit and Mutual Impedance 2.32
2.20	Mutual Inductance 2.33
2.21	Dot Convention 2.35
2.22	Coefficient of Coupling 2.37
2.23	Ideal Transformer 2.40
2.24	Analysis of Multi-Winding Coupled Circuits 2.46
2.25	Series Connection of Coupled Inductors 2.47
	Parallel Connection of Coupled Coils 2.49
	Tuned Circuits 2.50
2.28	Analysis of Magnetic Circuits 2.55
	Series Magnetic Circuit 2.57
	Comparison of Electric and Magnetic Circuits 2.58
	Magnetic Leakage and Fringing 2.60
	Composite Series Circuit 2.61
	Parallel Magnetic Circuit 2.62
2.34	Electromagnetic Induction 2.63
	Additional Solved Problems 2.64
	PSpice Problems 2.107
	Practice Problems 2.114
	Objective Type Questions 2.131
	Extra Solved problems 2.140
	Extra Objective Questions 2.161
100	IDCHITCH 21 212150
AC C	IRCUITS II 3.1-3.150
3.1	Series Resonance 3.1
3.2	Impedance and Phase Angle of a Series Resonant Circuit 3.3
3.3	Voltages and Currents in a Series Resonant Circuit 3.5
3.4	Bandwidth of an RLC Circuit 3.9
3.5	The Quality Factor (Q) and its Effect on Bandwidth 3.12
3.6	Magnification in Resonance 3.14
3.7	Parallel Resonance 3.14

3.8 Resonant Frequency for a Tank Circuit 3.15

Contents ix

20	
	Variation of Impedance with Frequency 3.17
	Q Factor of Parallel Resonance 3.17
	Magnification 3.19 Reactance Curves in Parallel Resonance 3.20
	Locus Diagrams 3.20
	Polyphase System 3.31
	Advantages of Three-Phase System 3.32
	Generation of Three-Phase Voltages 3.33
	Phase Sequence 3.34
	Interconnection of Three-Phase Sources and Loads 3.36
	Star to Delta and Delta to Star Transformation 3.41
	Voltage, Current and Power in a Star Connected System 3.45
	Voltage, Current and Power in a Delta Connected System 3.51
	Three-Phase Balanced Circuits 3.57
3.23	Three-Phase Unbalanced Circuits 3.62
3.24	Power Measurement in Three-Phase Circuits 3.73
3.25	Effects of Harmonics 3.85
3.26	Effects of Phase-Sequence 3.91
3.27	Power Factor of an Unbalanced System 3.91
	Additional Solved Problems 3.92
	PSpice Problems 3.117
	Practice Problems 3.125
	Objective Type Questions 3.131
	Extra Objective Problems 3.135
	Extra Objective Type Questions 3.149
NET	WORK TOPOLOGY 4.1-4.84
4.1	Introduction 4.1
4.2	Tree and Co-Tree 4.3
4.3	Twigs and Links 4.4
4.4	Incidence Matrix (A) 4.5
4.5	Properties of Incidence Matrix A 4.6
	Incidence Matrix and KCL 4.8
	Link Currents: Tie-Set Matrix 4.9
4.8	Cut-Set and Tree Branch Voltages 4.14
4.9	Mesh Analysis 4.21
	Mesh Equations by Inspection Method 4.24
	Supermesh Analysis 4.26
	Nodal Analysis 4.28
	Nodal Equations by Inspection Method 4.31
	Supernode Analysis 4.33 Source Transformation Technique 4.35
	Source Transformation Technique 4.35 Duals and Duality 4.38
4.10	Additional Solved Problems 4.40
	PSpice Problems 4.56
	1 spice 1 robiens 7.50

4.

x Contents

5. NETWORK THEOREMS

6.

7.

Practice Problems 4.58

Objective-Type Questions 4.63 Extra Solved Problems 4.67

Useful Theorems – DC Analysis 5.1

5.2	Steady State AC Analysis 5.16 Additional Solved Problems 5.33 PSpice Problems 5.71 Practice Problems 5.78 Objective-Type Questions 5.88 Extra Solved Problems 5.93	
TWO	P-PORT NETWORKS	6.1-6.82
6.11	Two-Port Network 6.1 Open Circuit Impedance (Z) Parameters 6.2 Short Circuit Admittance (Y) Parameters 6.5 Transmission (ABCD) Parameters 6.9 Inverse Transmission (A' B' C' D') Parameters 6.12 Hybrid (h) Parameters 6.13 Inverse Hybrid (g) Parameters 6.16 Inter-relationships of Different Parameters 6.17 Inter-connection of Two-Port Networks 6.22 T and π Representation 6.25 Terminated Two-Port Network 6.29 Lattice Networks 6.35 Image Parameters 6.39 Additional Solved Problems 6.44 PSpice Problems 6.62 Practice Problems 6.64 Objective-Type Questions 6.70 Extra Solved Problems 6.74	
TRA	NSIENT ANALYSIS	7.1-7.175
7.1 7.2 7.3 7.4 7.5 7.6 7.7 7.8 7.9 7.10	Steady State and Transient Response 7.1 DC Response of an R-L Circuit 7.2 DC Response of an R-C Circuit 7.6 DC Response of an R-L-C Circuit 7.8 Sinusoidal Response of R-L Circuit 7.11 Sinusoidal Response of R-C Circuit 7.14 Sinusoidal Response of R-L-C Circuit 7.18 Definition of the Laplace Transform 7.23 Step Function 7.24 Impulse Function 7.28	

5.1-5.104

Contents xi

	Functional Transforms 7.32
	Operational Transforms 7.35
	Laplace Transform of Periodic Functions 7.45
	Inverse Transforms 7.46
7.15	Initial and Final Value Theorems 7.52
7.16	Circuit Elements in the S-Domain 7.55
	Applications 7.58
7.18	Transfer Function 7.67
7.19	Use of Transfer Function in Circuit Analysis 7.68
7.20	The Transfer Function and the Convolution Integral 7.69
7.21	The Transfer Function and the Steady State Sinusoidal
	Response 7.73
7.22	The Impulse Function in Circuit Analysis 7.74
	Additional Solved Problems 7.79
	PSpice Problems 7.132
	Practice Problems 7.139
	Objective-Type Questions 7.151
	Extra Solved Problems 7.159
FILT	ERS AND ATTENUATORS 8.1-8.78
8.1	
8.2	
8.3	
8.4	Classification of Pass Band and Stop Band 8.9
8.5	1
8.6	Constant—K Low Pass Filter 8.13
8.7	Constant K-High Pass Filter 8.17
8.8	<i>m</i> -Derived <i>T</i> -section 8.21
8.9	Band Pass Filter 8.29
8.10	Band Elimination Filter 8.34
8.11	Composite Filter 8.38
8.12	Terminating Half-Sections 8.39
8.13	Attenuators 8.42
8.14	<i>T</i> -Type Attenuator 8.43
8.15	π -Type Attenuator 8.45
8.16	Lattice Attenuator 8.46
8.17	Bridged-T Attenuator 8.49
8.18	L-Type Attenuator 8.51
	Additional Solved Problems 8.52
	PSpice Problems 8.61
	Practice Problems 8.67
	Objective-Type Questions 8.69
	Extra Solved Problems 8.72

8.

xii Contents

9.	AN I	NTRODUCTION TO PSPICE	9.1-9.28
	9.1	Introduction 9.1	
	9.2	What is PSpice? 9.1	
	9.3	Getting Started with PSpice 9.2	
	9.4	Simulation Steps 9.3	
	9.5	Component Values 9.3	
	9.6	D.C. Analysis and Control Statements 9.4	
	9.7	Dependent Sources 9.7	
	9.8	D.C. Sweep 9.10	
	9.9	A.C. Analysis and Control Statements 9.12	
	9.10	Transient Analysis 9.13	
		Additional Solved Problems 9.17	
		Practice Problems 9.25	
		Answers	1-9
		Appendix A	A.1-A.4
		Appendix B	B.1-B.2
		Appendix C	C.1-C.4
		Solved Question Papers — 4 Sets May/June 2008	1-47