Contents

Preface Roadmap to the Syllabus		xi xiii
1.	BASIC CIRCUIT CONCEPTS	1.1
	1.1 Introduction 1.1 1.2 Resistance 1.1 1.3 Inductance 1.2 1.4 Capacitance 1.3 1.5 Sources 1.4 1.6 Some Definitions 1.6 1.7 Series and Parallel Combination of Resistors 1.7 1.8 Series and Parallel Combination of Inductors 1.9 1.9 Series and Parallel Combination of Capacitors 1.10 1.10 Star-Delta Transformation 1.10 1.11 Source Transformation 1.13 1.12 Source Shifting 1.19 Exercises 1.21 Objective-Type Questions 1.22	
2.	Answers to Objective-Type Questions 1.23 ANALYSIS OF DC CIRCUITS	2.1
	2.1 Introduction 2.1 2.2 Kirchhoff's Laws 2.1 2.3 Mesh Analysis 2.2 2.4 Supermesh Analysis 2.15 2.5 Node Analysis 2.23 2.6 Supernode Analysis 2.36 2.7 Superposition Theorem 2.42 2.8 Thevenin's Theorem 2.62 2.9 Norton's Theorem 2.82 2.10 Maximum Power Transfer Theorem 2.106 2.11 Reciprocity Theorem 2.118 2.12 Millman's Theorem 2.122 Exercises 2.127 Objective-Type Questions 2.130 Answers to Objective-Type Questions 2.132	
3.	ANALYSIS OF AC CIRCUITS	3.1
	3.1 Introduction 3.1 3.2 Mesh analysis 3.1	

VIII	Contents
VIII	Contents

	3.4 3.5 3.6 3.7	Node Analysis 3.9 Superposition Theorem 3.14 Thevenin's Theorem 3.27 Norton's Theorem 3.41 Maximum Power Transfer Theorem 3.51 Reciprocity Theorem 3.64	
		Millman's Theorem 3.68 Exercises 3.72 Objective-Type Questions 3.74 Answers to Objective-Type Questions 3.75	
4.	MA	GNETIC CIRCUITS	4.1
		Introduction 4.1	
		Self-Inductance 4.1	
		Mutual Inductance 4.2	
		Coefficient of Coupling (k) 4.2	
		Inductances in Series 4.3 Inductances in Parallel 4.4	
		Dot Convention 4.9	
		Coupled Circuits 4.15	
		Conductively Coupled Equivalent Circuits 4.37	
		Exercises 4.41	
		Objective-Type Questions 4.43	
		Answers to Objective-Type Questions 4.44	
5.	GR/	APH THEORY	5.1
5.		APH THEORY Introduction 5.1	5.1
5.	5.1		5.1
5.	5.1 5.2	Introduction 5.1	5.1
5.	5.1 5.2 5.3 5.4	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6	5.1
5.	5.1 5.2 5.3 5.4 5.5	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24 Kirchhoff's Current Law 5.24	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24 Kirchhoff's Current Law 5.24 Relation Between Branch Voltage Matrix V_b , Twig Voltage Matrix V_t and Node	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 5.10	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24 Kirchhoff's Current Law 5.24 Relation Between Branch Voltage Matrix V_b , Twig Voltage Matrix V_t and Node Voltage Matrix V_n 5.25	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 5.10	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24 Kirchhoff's Current Law 5.24 Relation Between Branch Voltage Matrix V_b , Twig Voltage Matrix V_t and Node Voltage Matrix V_n 5.25 Relation Between Branch Current Matrix I_b and Loop Current Matrix I_l 5.26	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 5.10	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24 Kirchhoff's Current Law 5.24 Relation Between Branch Voltage Matrix V_b , Twig Voltage Matrix V_t and Node Voltage Matrix V_n 5.25	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 5.10	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24 Kirchhoff's Current Law 5.24 Relation Between Branch Voltage Matrix V_b , Twig Voltage Matrix V_t and Node Voltage Matrix V_n 5.25 Relation Between Branch Current Matrix I_b and Loop Current Matrix I_t 5.26 Network Equilibrium Equation 5.26	5.1
5.	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 5.10	Introduction 5.1 Graph of a Network 5.1 Graph Terminologies 5.2 Incidence Matrix 5.6 Loop Matrix or Circuit Matrix 5.8 Cutset Matrix 5.10 Relationship Among Submatrices of A, B and Q 5.12 Kirchhoff's Voltage Law 5.24 Kirchhoff's Current Law 5.24 Relation Between Branch Voltage Matrix V_b , Twig Voltage Matrix V_t and Node Voltage Matrix V_n 5.25 Relation Between Branch Current Matrix I_b and Loop Current Matrix I_t 5.26 Network Equilibrium Equation 5.26 Exercises 5.53	5.1

6. TIM	ME DOMAIN ANALYSIS OF RLC CIRCUITS	6.1
6.2 6.3 6.4	Introduction 6.1 Initial Conditions 6.1 Resistor—Inductor Circuit 6.27 Resistor—Capacitor Circuit 6.49 Resistor—Inductor—Capacitor Circuit 6.66 Exercises 6.79 Objective-Type Questions 6.82 Answers to Objective-Type Questions 6.85	
7. FR	EQUENCY DOMAIN ANALYSIS OF RLC CIRCUITS	7.1
7.2 7.3 7.4 7.5 7.6 7.7 7.8 7.9	Introduction 7.1 Laplace Transformation 7.1 Laplace Transforms of Some Important Functions 7.2 Properties of Laplace Transform 7.4 Inverse Laplace Transform 7.7 Frequency Domain Representation of RLC Circuits 7.12 Resistor—Inductor Circuit 7.13 Resistor—Capacitor Circuit 7.19 Resistor—Inductor—Capacitor Circuit 7.25 Response of RL Circuit to Various Functions 7.31 Response of RC Circuit to Various Functions 7.39 Exercises 7.49 Objective-Type Questions 7.52 Answers to Objective-Type Questions 7.53	
8. NE	TWORK FUNCTIONS	8.1
8.2 8.3 8.4 8.5 8.6 8.7 8.8	Introduction 8.1 Driving-Point Functions 8.1 Transfer Functions 8.2 Analysis of Ladder Networks 8.5 Analysis of Non-Ladder Networks 8.15 Poles and Zeros of Network Functions 8.20 Restrictions on Pole and Zero Locations for Driving-Point Functions [Common Factors and D(s) Cancelled] 8.21 Restrictions on Pole and Zero Locations for Transfer Functions [Common Factors in N D(s) Cancelled] 8.21 Time-Domain Behaviour from the Pole-Zero Plot 8.39 Graphical Method for Determination of Residue 8.42 Exercises 8.50 Objective-Type Questions 8.53 Answers to Objective-Type Questions 8.55	

9. TWO-PORT NETWORKS

9.1	Introduction 9.1	
9.2	Open-Circuit Impedance Parameters (Z Parameters) 9.2	
	Short-Circuit Admittance Parameters (Y Parameters) 9.8	
	Transmission Parameters (ABCD Parameters) 9.18	
	Hybrid Parameters (h Parameters) 9.24	
	Inter-relationships between the Parameters 9.29	
9.7	Interconnection of Two-Port Networks 9.47	
9.8	<i>T</i> -Network <i>9.61</i>	
9.9	$Pi(\pi)$ -Network 9.61	
9.10	Lattice Networks 9.66	
9.11	Terminated Two-Port Networks 9.69	
	Exercises 9.79	
	Objective-Type Questions 9.82	
	Answers to Objective-Type Questions 9.85	
10. SYN	NTHESIS OF RLC CIRCUITS	10.1
10.1	Introduction 10.1	
10.2	Hurwitz Polynomials 10.1	
10.3	Positive Real Functions 10.16	
10.4	Elementary Synthesis Concepts 10.24	
10.5	Realisation of <i>LC</i> Functions 10.30	
10.6	Realisation of <i>RC</i> Functions 10.47	
10.7	Realisation of <i>RL</i> Functions 10.63	
	Exercises 10.72	
	Objective-Type Questions 10.74	
	Answers to Objective-Type Questions 10.76	
11. FIL	TERS	11.1
11.1	Introduction 11.1	
11.2	Classification of Filters 11.1	
11.3	T-Network 11.1	
11.4	π-Network 11.4	
11.5	Characteristic of Filters 11.6	
11.6	Constant-k Low Pass Filter 11.7	
11.7	Constant-k High-pass Filter 11.14	
11.8	Band-pass Filter 11.18	
11.9	Band-stop Filter 11.22	
11.10	Terminating Half Sections 11.25	
	Exercises 11.27	
	Objective-Type Questions 11.27	
	Answers to Objective-Type Questions 11.28	
Index		I.

9.1