
Contents

PREFACE	ix
CHAPTER A1 Passive Components and Networks	A1
Summary of Basic Concepts	A2
Review of dc Circuits	A3
Ohm's Law	A3
Batteries	A4
Power in Electrical Circuits	A6
Resistors	A6
Series and Parallel Networks and Kirchhoff's Laws	A10
Voltage Divider	A15
Review of ac Circuits	A16
Basic Concepts	A17
Capacitors and Capacitance	A20
RC Circuits	A24
Capacitive Reactance	A25
Inductors	A27
Inductive Reactance	A28
RL Circuit	A30
Transformers	A31
Series Alternating-Current RC Circuit	A33
Low-Pass/High-Pass RC Filters	A35
Network Analysis	A37
Thevenin's Theorem	A37
Networks Requiring Kirchhoff's Laws or Thevenin's Theorem for Solution	A39
Supplement to Chapter: Derivation of Exponential RC Charging Law	A42
Review Exercises	A44
Problems	A46

CONTENTS

CHAPTER A2	Important Electronic Instruments	A55
	Basic Meters	A56
	D'Arsonval Meter	A56
	Ammeter	A56
	Voltmeter	A57
	Ohmmeter	A58
	Measuring Instruments	A59
	VOM, FTVM, and VTVM	A59
	Wheatstone Bridge	A59
	Potentiometer	A61
	Digital Voltmeter (DVM)	A62
	Oscilloscope	A63
	Recorders	A69
	Strip-Chart Recorder	A69
	X-Y Recorder	A71
	Magnetic Tape Recorder	A71
	Other Instruments and Instrument Aspects	A73
	Signal Generator	A73
	Frequency Counter	A74
	Attenuator	A75
	Decibel	A76
	Interconnecting Cables	A78
	Review Exercises	A81
	Problems	A83
CHAPTER A3	Transducers	A89
	General View of Electric Systems	A90
	Resistive Input Transducers	A91
	Photoresistor	A91
	Thermistor	A93
	Platinum Resistance Thermometer	A95
	Strain Gauge	A95
	Conductivity Cell	A96
	Voltage Input Transducers	A97
	Thermocouple	A97
	Ion-Selective Electrode and pH Measurement	A98
	Electromagnetic Induction Transducers	A100
	Piezoelectric Transducer	A101
	Photovoltaic Cell and Photodiode	A103
	Other Transducers	A105
	Snap-Action Switch	A105
	Magnetic Reed Switch	A105
	Electromagnetic Relay	A107
	Solenoid and Solenoid Valve	A108
	Review Exercises	A109
	Problems	A110

CHAPTER A4	Diodes and Power Supplies	A113
	Ideal Diode	A114
	Real Diodes	A115
	Vacuum Diode	A115
	Semiconductor Diode	A116
	Characteristic of a PN Junction: Real Devices	A120
	Rectification and Filtering	A123
	Half-Wave Rectification	A123
	Full-Wave Rectification Using a Center-Tapped Transformer	A124
	Full-Wave Rectification Using a Bridge of Rectifiers	A126
	Filtering to Obtain dc	A127
	Other Filter Schemes	A129
	Electronic Voltage Regulators	A131
	Three-Terminal Regulators	A132
	Regulated Power Supplies	A134
	Review Exercises	A136
	Problems	A138
CHAPTER A5	Amplifier Behavior	A143
	Fundamental Amplifier Properties	A143
	Black-Box Models: Input Transducer, Amplifier, and Output Transducer	A143
	Power Gain with an Ideal Voltage Follower	A147
	Impedance Matching and Maximum Power Transfer	A148
	Cascaded Amplifiers	A150
	Fundamental Amplifier Types	A151
	Amplifier-Stage Model	A151
	ac and dc Amplifiers	A153
	Amplifier Bandwidth	A155
	Noninverting and Inverting Amplifiers	A155
	Difference or Differential Amplifiers	A156
	A Differential Amplifier Application	A160
	Noise in Electronic Systems	A160
	Thermal or Johnson Noise	A162
	Amplifier Noise	A166
	Summary	A168
	Review Exercises	A168
	Problems	A170
CHAPTER A6	Operational Amplifier and Electronic Function Blocks	A177
	Properties of the Operational Amplifier	A178
	Ideal Operational Amplifier and Basic Circuits	A179
	Inverting Amplifier	A180
	Noninverting Amplifier	A185
	Voltage-Follower Amplifier	A188
	Summing Amplifier	A188

CONTENTS

Difference Amplifier	A191	
Instrumentation Amplifier	A194	
Current-to-Voltage Converter	A194	
Voltage-to-Current Converter (Constant Current Source)	A198	
Logarithm Function Block	A199	
Antilogarithm Function Block	A201	
Multipliers and Square Root Functions	A202	
Integrating Function Block	A202	
Limitations and Operation of Real Operational Amplifiers	A206	
Finite Voltage Gain	A206	
Finite Bandwidth	A206	
Input Offset Voltage	A209	
Op-Amp Connections	A210	
Input Bias Current	A213	
Output Capabilities of an Op Amp	A219	
Selecting an Op Amp	A220	
Op-Amp Packages (Circuit Construction Comments)	A222	
Summary	A226	
Review Exercises	A227	
Problems	A229	
CHAPTER A7	Waveform-Shaping Circuits	A239
Comparator	A240	
Schmitt Trigger	A242	
Multivibrators	A246	
Monostable (One-Shot) Multivibrator	A248	
Bistable Multivibrator or Flip-Flop	A248	
Astable (Free-Running) Multivibrator	A250	
555 Timer Integrated Circuit	A250	
555 Multivibrators	A253	
Capabilities of the 555	A259	
Some Multivibrator Applications	A260	
Sequence Timing Control	A260	
Frequency-to-Voltage Converter or Ratemeter	A261	
General Ratemeter Instrument	A262	
Review Exercises	A265	
Problems	A267	
CHAPTER A8	Discrete Electronic Devices	A273
General Amplifier Model	A274	
General Electronic Current-Controlling Element	A274	
General Discrete Amplifiers	A275	
Vacuum Tubes	A278	
Vacuum Triode	A278	
Vacuum Tetrode and Pentode	A280	

Field-Effect Transistors and Amplifiers	A280
N-Channel Junction FET	A280
General Electrical Behavior of N-Channel JFET	A282
Electrical Characteristics of N-Channel JFET	A283
JFET Operating Limitations	A283
N-Channel JFET in an Amplifier	A284
Self-Biased JFET Amplifier	A287
P-Channel JFET	A287
Metal-Oxide-Silicon FET (MOSFET)	A289
Bipolar Transistors and Amplifiers	A289
NPN Bipolar Transistor	A290
General Electrical Behavior of NPN Transistor	A292
Electrical Characteristics of NPN Transistor	A293
Basic Grounded-Emitter Amplifier	A295
Input and Output Impedance of Grounded-Emitter Amplifier	A297
Transistor as a Switch	A298
Graphical View of Transistor Amplifier and Switch	A300
Some Practical Transistor Considerations	A301
PNP Bipolar Transistor	A302
Transistor Biasing	A303
Transistor Current Amplifier/Switch Application	A303
Darlington Connection	A305
Emitter Follower or Grounded-Collector Amplifier	A306
Basic Differential Amplifier	A307
Other Semiconductor Devices	A309
Phototransistor	A309
Optocoupler	A310
Silicon-Controlled Rectifier (SCR)	A310
Triac and Diac	A315
Solid-State Relay	A317
Supplement to Chapter: Triode Characteristics and Basic Circuit	A318
Supplement to Chapter: MOSFET Construction and Operation	A320
N-Channel Depletion-Type MOSFET	A320
N-Channel Enhancement-Type MOSFET	A320
P-Channel MOSFETs	A324
Review Exercises	A324
Problems	A328

MANUFACTURERS' SPECIFICATIONS	A337
BIBLIOGRAPHY	A352
ANSWERS TO PROBLEMS	A354
INDEX	A358