# CONTENTS

**CHAPTER 1: FUNDAMENTALS OF ELECTRICAL ENGINEERING** **01-26**

**1.1** Introduction to Electrical Engineering
**1.2** Basic Electrical Quantities, Units and Measurements
**1.3** Electrical Circuit Elements and Sources
**1.4** Ohm's Law and Basic Circuit Concepts
**1.5** Electrical Power, Energy and Efficiency
**1.6** Series, Parallel and Combination Circuits

**CHAPTER 2: DC CIRCUIT ANALYSIS AND NETWORK THEOREMS** **27-55**

**2.1** Kirchhoff's Current and Voltage Laws
**2.2** Mesh and Nodal Analysis
**2.3** Star–Delta and Delta–Star Transformations
**2.4** Superposition Theorem
**2.5** Thevenin's and Norton's Theorems
**2.6** Maximum Power Transfer Theorem

**CHAPTER 3: AC CIRCUIT FUNDAMENTALS** **56-83**

**3.1** Generation and Characteristics of Alternating Quantities
**3.2** Sinusoidal Voltage, Current and Phasor Representation
**3.3** AC Circuits with Resistance, Inductance and Capacitance
**3.4** Series and Parallel RLC Circuits
**3.5** Resonance in AC Circuits
**3.6** Power and Power Factor in AC Circuits

**CHAPTER 4: THREE-PHASE CIRCUITS AND ELECTRICAL POWER SYSTEMS** **84-111**

**4.1** Fundamentals of Three-Phase Systems
**4.2** Star and Delta Connections
**4.3** Three-Phase Power Measurement
**4.4** Power Factor Improvement
**4.5** Generation, Transmission and Distribution of Electrical Power
**4.6** Renewable Energy and Modern Power Systems

**CHAPTER 5: MAGNETIC CIRCUITS AND TRANSFORMERS** **112-138**

**5.1** Fundamentals of Magnetic Circuits
**5.2** Magnetic Materials and Electromagnetic Induction
**5.3** Faraday's and Lenz's Laws
**5.4** Construction and Working Principle of Transformers
**5.5** Transformer Losses, Efficiency and Voltage Regulation
**5.6** Applications of Transformers in Electrical Systems

**CHAPTER 6: ELECTRICAL MACHINES** **139-165**
**6.1** Fundamentals of Electrical Machines and Energy Conversion
**6.2** DC Generators and Motors
**6.3** Construction and Operation of Induction Motors
**6.4** Characteristics and Applications of Three-Phase Induction Motors
**6.5** Synchronous Machines and Special Electrical Machines
**6.6** Electrical Machines in Industrial and Electric Vehicle Applications

**CHAPTER 7: SEMICONDUCTOR DEVICES** **166-196**
**7.1** Semiconductor Materials and PN Junctions
**7.2** PN Junction Diodes and V–I Characteristics
**7.3** Rectifiers, Filters and DC Power Supplies
**7.4** Zener Diodes and Voltage Regulation
**7.5** Bipolar Junction Transistors and Their Applications
**7.6** Field-Effect Transistors and MOSFETs

**CHAPTER 8: ANALOG ELECTRONICS AND OPERATIONAL AMPLIFIERS** **194-223**
**8.1** Fundamentals of Analog Electronic Circuits
**8.2** Transistor Biasing and Amplifier Circuits
**8.3** Transistor as a Switch and Amplifier
**8.4** Operational Amplifier Fundamentals
**8.5** Inverting, Non-Inverting and Summing Amplifiers
**8.6** Comparator, Signal Conditioning and Practical Applications

**CHAPTER 9: DIGITAL ELECTRONICS AND LOGIC CIRCUITS** **222-249**
**9.1** Number Systems and Digital Codes
**9.2** Boolean Algebra and Logic Gates
**9.3** Logic Simplification and Karnaugh Maps
**9.4** Combinational Logic Circuits
**9.5** Sequential Logic Circuits and Flip-Flops
**9.6** Registers, Counters and Basic Digital Applications

**CHAPTER 10: ELECTRICAL MEASUREMENTS, INSTRUMENTATION AND EMERGING TECHNOLOGIES** **248-278**
**10.1** Fundamentals of Electrical and Electronic Measurements
**10.2** Analog and Digital Measuring Instruments
**10.3** Digital Multimeter, Oscilloscope and Signal Generator
**10.4** Sensors, Transducers and Signal Conditioning
**10.5** Power Electronics, Embedded Systems and Automation
**10.6** Electric Vehicles, Renewable Energy, IoT and Smart Electrical Systems