Contents

11. Relay 1

Introduction 3
Identifying the Relay Terminals 5
Experiment 23: Continuity Test of Relay 6
Schematic Representation 8
Connecting a Relay on a Breadboard 8
Experiment 24: Alternate Switching of LEDs Using a Relay 10
Bump Switch 13
Experiment 25: Burglar Alarm 14
Experiment 26: Relay as an Oscillator 18
Momentary Push Button Switch 18
Applications 30

12. Diode 33

Introduction 35
Experiment 27: To Learn How a Diode Works 37
History of Diodes 39
Formation of Diode 39
Forward Biasing 43
Reverse Biasing 44
Types of Diodes 45
Experiment 28: Low Resistance Path Using a Diode 48
Experiment 29: Protecting a Circuit Using a Diode 50

13. Logic Gates 55

Introduction 57
Gate Types 58
NOT Gate 58
OR Gate 60
AND Gate 61
NOR Gate 62
NAND Gate 63

Experiment 30: OR Gate Using Diodes 65
Experiment 31: AND Gate Using Diodes 70
Experiment 32: NOR Gate Using Diodes 74
Experiment 33: NAND Gate Using Diodes 78
Rectification 87

14. Zener Diode 93

Introduction 94
Experiment 34: To Learn How a Zener Diode Works 96
Experiment 35: Zener Diode as Voltage Regulator 100
V-I Characteristic Curve 107

15. DC Motor 109

Introduction 111
DC Motors 111
Experiment 36: DC Motor as Generator 112
Experiment 37: Surgery of DC Motor 114
Experiment 38: Controlling Speed of DC Motor 120
Motor specification 122
Motor selection 122
Current capacity 123

16. Transistors 125

Introduction 127
Advantages 130
Physical Construction 130
Types 130
Identification of Legs 132
Experiment 39: Identifying the Type of BJT Transistor Using a Multimeter 133
Experiment 40: Measuring the Gain of a Transistor 135
Schematic symbol 137
Basics of NPN and PNP Transistor 138

17. Transistor Experiments 142

Experiment 41: B-E Junction as Diode 143
Experiment 42: Transistor as Amplifier and Switch 145
Experiment 43: Touch Activated Switch Using a Transistor 158
Experiment 44: Darlington Pair 160
Calculating Base and Collector Current in a Darlington Pair 162
Effective Transistor 163
Working of a BJT Transistor in Different Operating Regions Through Mathematics 164
Experiment 45: Automatic Night Lamp 167
Experiment 46: Transistor as Blinker (LED Flasher) 170
Esaki (Tunnel) Diode 172
Experiment 47: Alternate Blinking of LEDs using Transistors 174
Experiment 48: OR Gate Using Transistors 176
Experiment 49: AND Gate Using Transistors 182
Experiment 50: NOR Gate Using Transistors 190
Experiment 51: NAND Gate Using Transistors 197
Experiment 52: Transistor as an Inverter (NOT Gate) 204
Experiment 53: H-Bridge 208

18. Signals 213

Introduction 215
Types of Signals 216
Digital Signal 218
Analog Signal 221
Converting a Binary Number into a Decimal Number 222
Need of Digital Signals 223
Pulse 223
Wave 224
AC Sine Wave 224
Pulsed DC Wave 225
AC Square Wave 225
AC Triangle Wave 226

Complex Sine Wave	226
DC Ramp Wave	226
Voice	227
Different Wave Generated on CRO	227
Difference between Electrical and Electronics	228
Active and Passive Components in Electronics	228