

Contents

Preface

v

| | |
|---|------------|
| 1. Physical Properties of Elements | 1.1 |
| 1.1 Introduction | 1.1 |
| 1.2 Atomic Structure | 1.1 |
| 1.3 Bohr's Atomic Model | 1.2 |
| 1.4 Atomic Energy Level Diagram | 1.5 |
| 1.5 Electronic Configuration of Elements | 1.6 |
| 1.6 Energy Band Theory of Solids | 1.9 |
| 1.7 Classification of Solids on the Basis of Energy Bands | 1.12 |
| 1.8 Commonly used Semiconductor Materials | 1.15 |
| 2. Semiconductor Diodes | 2.1 |
| 2.1 Introduction | 2.1 |
| 2.2 Theory of <i>P-N</i> -Junction Diode | 2.3 |
| 2.3 Limitations in the Operating Conditions of <i>P-N</i> -Junction | 2.15 |
| 2.4 Diode Current Equation | 2.16 |
| 2.5 Effect of Temperature on <i>P-N</i> -Junction Diode Characteristics | 2.20 |
| 2.6 Breakdown in <i>P-N</i> -Junction Diode | 2.21 |
| 2.7 Diode Resistance | 2.22 |
| 2.8 Space Charge Capacitance or Transition Capacitance (C_T) | 2.26 |
| 2.9 Diffusion Capacitance (C_D) | 2.32 |
| 2.10 Zener Diode | 2.32 |
| 2.11 Diode Clippers | 2.34 |
| 2.12 Diode Clamper | 2.37 |

| | |
|--|------------|
| 3. Special Purpose Electronic Devices | 3.1 |
| 3.1 Introduction | 3.1 |
| 3.2 Tunnel Diode | 3.1 |
| 3.3 Varactor Diode | 3.6 |
| 3.4 Silicon Controlled Rectifier (SCR) | 3.9 |
| 3.5 Semiconductor Photodiode | 3.14 |
| 4. Rectifiers, Filters and Power Supplies | 4.1 |
| 4.1 Introduction | 4.1 |
| 4.2 Rectifiers | 4.1 |
| 4.3 Filter Circuits | 4.19 |
| 4.4 Power Supply | 4.24 |
| 4.5 Zener Diode as a Voltage Regulator | 4.24 |
| 5. Bipolar Junction Transistor | 5.1 |
| 5.1 Introduction | 5.1 |
| 5.2 Transistor | 5.1 |
| 5.3 Transistor Terminals | 5.2 |
| 5.4 Modes of Operation | 5.3 |
| 5.5 Operation of <i>P-N-P</i> Transistor | 5.3 |
| 5.6 Operation of <i>N-P-N</i> Transistor | 5.4 |
| 5.7 Transistor Current Components | 5.4 |
| 5.8 Transistor Circuit Configurations | 5.5 |
| 5.9 Common Base Configuration | 5.6 |
| 5.10 Common Emitter Configuration | 5.8 |
| 5.11 Characteristics of Common-emitter Configuration | 5.13 |
| 5.12 Common Collector Configuration | 5.15 |
| 5.13 Comparative Study of CB, CE and CC Configurations | 5.16 |
| 5.14 Transistor as an Amplifier | 5.17 |
| 6. Transistor Biasing and Stabilization | 6.1 |
| 6.1 Introduction | 6.1 |
| 6.2 Location of the Operating Point: The Load Line | 6.1 |
| 6.3 Operating Point or Quiescent Point | 6.2 |
| 6.4 Need for Biasing | 6.5 |
| 6.5 Thermal Runaway | 6.6 |
| 6.6 Stability Factor | 6.6 |
| 6.7 Different Biasing Circuits | 6.6 |
| 6.8 Bias Stability | 6.19 |

| | | |
|-----------|--|------------|
| 6.9 | Stabilisation Against Variation in V_{BE} , and β | 6.19 |
| 6.10 | BIAS Compensation | 6.20 |
| 7. | Hybrid Parameters and UJT | 7.1 |
| 7.1 | Introduction | 7.1 |
| 7.2 | The Hybrid Equivalent Model | 7.1 |
| 7.3 | Hybrid Model | 7.3 |
| 7.4 | Determination of h -Parameters from Transistor Characteristics | 7.5 |
| 7.5 | Performance of Linear Circuit in h -Parameters | 7.7 |
| 7.6 | Transistor Circuit Performance in h -Parameters | 7.10 |
| 7.7 | Comparison of Three Types of Amplifier Circuits | 7.11 |
| 7.8 | Unijunction Transistor (UJT) | 7.12 |
| 7.9 | UJT Parameters | 7.12 |
| 7.10 | Operation of UJT | 7.13 |
| 7.11 | Characteristics of UJT | 7.14 |
| 8. | Field Effect Transistors | 8.1 |
| 8.1 | Introduction | 8.1 |
| 8.2 | Field Effect Transistor (FET) | 8.1 |
| 8.3 | Construction of JFET | 8.1 |
| 8.4 | Operation of JFET | 8.4 |
| 8.5 | Volt-Ampere Characteristics of JFET | 8.5 |
| 8.6 | JFET Parameters | 8.9 |
| 8.7 | Relation Between μ , r_d and g_m | 8.10 |
| 8.8 | Mathematical Expression for g_m | 8.11 |
| 8.9 | The FET Small Signal Model | 8.12 |
| 8.10 | Merits and Demerits of JFET | 8.14 |
| 8.11 | Application of JFET | 8.14 |
| 8.12 | Metal Oxide Semiconductor Field Effect Transistor (MOSFET) | 8.15 |
| 8.13 | Construction of Depletion Type MOSFET | 8.15 |
| 8.14 | Working of Depletion Type MOSFET | 8.16 |
| 8.15 | Characteristics of Depletion Type MOSFET | 8.17 |
| 8.16 | Construction of Enhancement Type MOSFET | 8.18 |
| 8.17 | Working of Enhancement Type MOSFET | 8.19 |
| 8.18 | Characteristics of Enhancement Type MOSFET | 8.20 |
| 8.19 | Advantages of <i>N</i> -channel MOSFETs over <i>P</i> -channel | 8.22 |

| | |
|--|----------------|
| 8.20 Comparison Between the JFET and MOSFET | 8.22 |
| 8.21 Applications of MOSFET | 8.23 |
| 9. FET Amplifiers | 9.1 |
| 9.1 Introduction | 9.1 |
| 9.2 Biasing the JFET | 9.1 |
| 9.3 Field Effect Transistor Amplifier | 9.5 |
| 9.4 Fet as a Voltage Variable Resistor (VVR) | 9.13 |
| 9.5 Comparison Between Field Effect Transistor and Bipolar Junction Transistor | 9.14 |
| Index | I.I-I.8 |