

# **CONTENTS**

---

---

---

---

---

## **I. INTRODUCTION TO ELECTRONICS**

---

*What is Electronics*

*Applications of Electronics*

*Modern Trends in Electronics*

*Electronic Components*

## **U N I T I**

---

---

## **2. SEMICONDUCTOR MATERIALS AND PROPERTIES**

---

<i>Introduction .....</i>
<i>Structure of Solids .....</i>
<i>Classification of Solid .....</i>
<i>Group IV Materials .....</i>
<i>Bonding in Solids .....</i>
<i>Characteristics of Covalent Compounds .....</i>
<i>Covalent Solids .....</i>
<i>Comparison of Bonds .....</i>
<i>Electron Energy, Energy Level and Energy Bands .....</i>
<i>Energy Band Theory of Solids .....</i>
<i>Semiconductor Physics .....</i>
<i>Energy Band Description of Semiconductors .....</i>
<i>Types of Semiconductors .....</i>

---

<i>Charges on N-type and P-type Semiconductors</i> .....
<i>Mobility Charge Carriers immobilizations</i> .....
<i>Mechanism of Current Flow in N-TYPE Semiconductor</i> .....
<i>Intrinsic Concentration</i> .....
<i>Electrical Properties of Semiconductor</i> .....
<i>Energy Band Diagram of Semiconductor</i> .....
<i>Fermi Level</i> .....
<i>Solved Examples</i> .....
<i>Summary</i> .....
<i>Exercise</i> .....
<i>Answers</i> .....

---

### **3. JUNCTION DIODE**

---

<i>Introduction</i> .....
<i>Formation of p-n junction</i> .....
<i>The Concept of Depletion Layer</i> .....
<i>The Potential Barriers</i> .....
<i>Biassing of a p-n junction</i> .....
<i>V-I characteristics of P-N junction diode</i> .....
<i>Diode Current Equation</i> .....
<i>Effect of temperature on V-I Characteristics</i> .....
<i>Important terms used in p-n junction</i> .....
<i>Diode Resistance</i> .....
<i>Diode Capacitance</i> .....
<i>Diode Rating</i> .....
<i>Solved Example</i> .....
<i>Summary</i> .....
<i>Exercise</i> .....

---

## **U N I T   I I**

---

### **4. DIODE APPLICATIONS**

---

<i>Unregulated Power Supplies</i> .....
<i>Regulated Power Supplies</i> .....

---

<i>Rectifier Circuits</i> .....
<i>Comparative Study of Various Rectifiers</i> .....
<i>Solved Examples based on Rectifier</i> .....
<i>Diode Ratings</i> .....
<i>Filters</i> .....
<i>Solved Examples based on Filters</i> .....
<i>Bleeder-Resistance</i> .....
<i>Clippers</i> .....
<i>Clampers</i> .....
<i>Voltage Multipliers</i> .....
<i>Solved Examples</i> .....
<i>Exercises</i> .....
<i>Answers</i> .....

---

## 5. BREAKDOWN DIODES

---

<i>Break Down Mechanism</i> .....
<i>Zener Diode</i> .....
<i>Applications of Zener Diode</i> .....
<i>Solved Examples</i> .....

# U N I T      I V

---

## 6. BIPOLAR JUNCTION TRANSISTORS (BJTs)

---

<i>Introduction</i> .....
<i>BJT Structure</i> .....
<i>Size and Doping Density of Transistor Layers</i> .....
<i>Actual Construction of Transistor</i> .....
<i>Why a transistor is called a Transistor</i> .....
<i>Working of a Transistor</i> .....
<i>Transistor Current Equation</i> .....
<i>Transistor Biasing</i> .....
<i>Transistor Circuit Configurations</i> .....
<i>Common-Base (CB) Configuration</i> .....
<i>Common-Emitter (CE) Configuration</i> .....
<i>Common-Collector (CC) Configuration</i> .....

<i>D-C-Load Line</i> .....
<i>Operating Point or Q-Point or Fixed Point or Q Quiescent Point</i> .....
<i>Stabilisation</i> .....
<i>Stability Factor(s)</i> .....
<i>Fixed Bias</i> .....
<i>Emitter Resistance Bias</i> .....
<i>Collector to Base Bias</i> .....
<i>Voltage Divider Bias</i> .....
<i>Solved Exampl</i> .....
<i>Answer Yourself</i> .....
<i>Unsolved Problems</i> .....
<i>Answer to Unsolved Problems</i> .....
<i>Summary</i> .....

---

## 7. HYBRID PARAMETERS AND TRANSISTOR AMPLIFIERS

---

<i>Introduction</i> .....
<i>Two-Port Devices and the Hybrid Model</i> .....
<i>Transistor Hybrid Model</i> .....
<i>Experimental Determination of Hybrid Parameters</i> .....
<i>Variations of Hybrid-Parameters of a Transistor</i> .....
<i>Conversion of Hybrid Parameters in Transistor Three Configurations</i> .....
<i>Transistor Amplifier Circuit Performance in h-Parameters</i> .....
<i>Limitations of h-Parameters</i> .....
<i>Transistor Amplifier Configuration Comparision</i> .....
<i>Variation in Amplifier Gain with Frequency</i> .....
<i>Transistor cut-off Frequencies</i> .....
<i>Classification of Amplifiers</i> .....
<i>Distortion in Amplifiers</i> .....
<i>Noise in Amplifiers</i> .....
<i>Exercise</i> .....
<i>Problems</i> .....

# U N I T      I V

---

## 8. FIELD EFFECT TRANSISTORS

---

<i>Introduction</i> .....
<i>Junction Field-Effect Transistor (JFET)</i> .....
<i>Pinch off Voltage</i> .....
<i>FET Parameters</i> .....
<i>Comparison Between FET and BJT</i> .....
<i>Biasing of FET</i> .....
<i>FET as an Amplifier</i> .....
<i>FET Application</i> .....
<i>Metal-Oxide Semiconductor FETs</i> .....
<i>Depletion-Type MOSFET (DE MOSFET)</i> .....
<i>Enhancement-Type MOSFET (E MOSFET)</i> .....
<i>Complementary MOS (CMOS)</i> .....
<i>VMOS Technology</i> .....
<i>Dual-Gate MOSFET</i> .....
<i>Comparison of JFETs and MOSFETs</i> .....
<i>Comparison of P-Channel and N-Channel MOSFETs</i> .....
<i>Comparison of JFET and MOSFET</i> .....
<i>Comparison of JFFET and DMOSFET</i> .....
<i>The MOSFET as a Resistor</i> .....
<i>Solved Examples</i> .....
<i>Summary</i> .....
<i>Exercises</i> .....

# U N I T      V

---

## 9. OPERATIONAL AMPLIFIERS

---

<i>The OP AMP</i> .....
<i>OP AMP Development</i> .....
<i>Analog Integrated Circuits Design</i> .....
<i>Inside AN OP AMP</i> .....
<i>Block Diagram of Op Amp</i> .....

<i>Common Mode Rejection Ratio</i> .....
<i>Ideal OP AMP</i> .....
<i>Equivalent Circuit of AN OP AMP</i> .....
<i>Ideal Voltage Transfer Curve</i> .....
<i>Some Related Definitions</i> .....
<i>The Parameters Dependent on Various Factors</i> .....
<i>OP AMP as Open Loop/Closed Loop</i> .....
<i>Feedback Components</i> .....
<i>The Concept of Virtual Ground</i> .....
<i>Open loop Op amp Configuration</i> .....
<i>Linear Inverting Amplifier</i> .....
<i>Non-Inverting Amplifier:</i> .....
<i>Applications of Op-AMP</i> .....
<i>Integrator</i> .....
<i>Differentiator</i> .....
<i>Buffer</i> .....
<i>The Comparator</i> .....
<i>Solved Example</i> .....
<i>Exercises</i> .....
<i>Answers</i> .....
<i>Student Assignment I</i> .....
<i>(Numerical Questions)</i>

## 10. SWITCHING THEORY AND LOGIC GATES

<i>Number System</i> .....
<i>Decimal Number System</i> .....
<i>Binary Number of System</i> .....
<i>Decimal to Binary Conversion</i> .....
<i>Hexadecimal Number System</i> .....
<i>Octal Number System</i> .....
<i>Octal weight</i> .....
<i>Conversion from octal to decimal number</i> .....
<i>Conversion from decimal to octal number</i> .....
<i>Binary Codes</i> .....
<i>Binary Coded Decimal System</i> .....
<i>Boolean Algebra</i> .....

<i>Demorgan's Theorem</i> .....
<i>Theorem of Boolean Algebra</i> .....
<i>Evaluation of Boolean Expressions Using Truth Table</i> .....
<i>Logic Gates</i> .....
<i>The OR Gate</i> .....
<i>The AND Gate</i> .....
<i>The NOT Gate</i> .....
<i>Universal Gate</i> .....
<i>NAND Gate</i> .....
<i>NOR Gate</i> .....
<i>X-OR Gate (Exclusive OR Gate)</i> .....
<i>Basic Duality of Boolean Algebra</i> .....
<i>Derivation of Boolean Expression</i> .....
<i>Minterms</i> .....
<i>Maxterms</i> .....
<i>Karnaugh Maps (K-Map)</i> .....
<i>Sum-of-Products (SOP)</i> .....
<i>Don't Care Condition</i> .....
<i>Product of Sum (POS)</i> .....
<i>Two Variable K-map Representing Maxterms :</i> .....
<i>Three Variable K-map Representing Maxterms :</i> .....
<i>Four Variable K-map Representing Maxterms :</i> .....
<i>Method to Drive P-O-S Boolean Expression Using K-Map</i> .....
<i>Application of Logic Gates in STLD</i> .....
<i>Half Adder</i> .....
<i>Full Adder</i> .....
<i>Half Subtractor</i> .....
<i>Full Subtractor</i> .....
<i>Multipliers</i> .....
<i>Solved Examples</i> .....
<i>Summary</i> .....

## II. ELECTRONICS INSTRUMENTS

<i>Digital Voltmeters</i> .....
<i>Ramp Technique</i> .....
<i>Dual Slope Integrating Type DVM (Voltage to Time Conversion)</i> .....

<i>Integrating Type DVM (Voltage to Frequency Conversion)</i> .....	.....
<i>Most Commonly Used Principles of ADC (Analogto Digital Conversion)</i> .....	.....
<i>The Staircase Ramp</i> .....	.....
<i>Operation of the Circuit</i> .....	.....
<i>Successive Aproximations</i> .....	.....
<i>Resolution and Sensitivity of Digital Meters</i> .....	.....
<i>Resolution</i> .....	.....
<i>Sensitivity of Digital Meters</i> .....	.....
<i>Digital Multimeters</i> .....	.....
<i>Exercises</i> .....	.....

---

## 12. SWITCHING THEORY AND LOGIC GATES

---

<i>Introduction</i> .....	.....
<i>Types/Specifications of CRO</i> .....	.....
<i>Wiorking of an Oscilloscope (CRO)</i> .....	.....
<i>The CRT</i> .....	.....
<i>The Horizontal Deflection Section</i> .....	.....
<i>The Vertical Deflection Section</i> .....	.....
<i>The Trigger Circuit</i> .....	.....
<i>Power Requirements</i> .....	.....
<i>Type Operating Voltage Range required in CRO are as follows</i> .....	.....
<i>Measurement Techniques</i> .....	.....
<i>The Display</i> .....	.....
<i>Voltage Measurements</i> .....	.....
<i>Time and Frequency Measurements</i> .....	.....
<i>Pulse and Rise Time Measurements</i> .....	.....
<i>Phase Shift Measurements</i> .....	.....
<i>CRO as Component Tester</i> .....	.....
<i>Procedure for Component Testing is as follows</i> .....	.....
<i>CRO Calibration</i> .....	.....
<i>Moder Questions</i> .....	.....