

**2 0 1 9**

( Pre-CBCS )  
( 2nd Semester )

**ELECTRONICS**

SECOND PAPER

**( Semiconductor Physics )**

*Full Marks : 55*

*Time : 2½ hours*

**( PART : A—OBJECTIVE )**

( Marks : 20 )

*The figures in the margin indicate full marks for the questions*

SECTION—A

( Marks : 5 )

Tick (✓) the correct answer in the brackets provided :

1×5=5

**1.** The energy gap between valence and conduction bands in a semiconductor is about

(a) 10 eV ( )

(b) 1.0 eV ( )

(c) 0 eV ( )

(d) 0.5 eV ( )

2. Which of the following is correct statement?
- (a) Electrons are majority carriers in p-type semiconductors ( )
  - (b) The potential barrier increases in forward biasing  $p-n$  junction ( )
  - (c) Zener diode can be used for filtering ( )
  - (d) Capacitor passes a.c readily but blocks d.c. ( )
3. In an  $N-P-N$  transistor, the emitter to collector carrier is/are
- (a) electrons ( )
  - (b) electrically neutral ( )
  - (c) holes ( )
  - (d) both electron and holes ( )
4.  $I_C$   $I_B$  .....
- (a)  $I_{CBO}$  ( )
  - (b)  $I_C$  ( )
  - (c)  $I_{CEO}$  ( )
  - (d)  $I_E$  ( )
5. The dimension of the  $h_{oe}$  parameters is
- (a) mho ( )
  - (b) ohm ( )
  - (c) farad ( )
  - (d) dimensionless ( )

SECTION—B

( Marks : 15 )

Answer any *five* questions :

3×5=15

1. Explain formation of hole current in a semiconductor.
2. What are the two mechanisms of junction breakdown?
3. In a  $p-n-p$  CB transistor, if  $\beta = 0.95$  and  $I_E = 1\text{mA}$ , find the values of  $I_C$  and  $I_B$ .

4. What is a transistor? Write the symbol of *P-N-P* and *N-P-N* transistors.
5. What is thermal runaway?
6. Define bandwidth of an amplifier.
7. What do you understand by hybrid parameters? What are their dimensions?
8. What are the advantages and disadvantages of a transformer-coupled amplifier?

**( PART : B—DESCRIPTIVE )**

( Marks : 35 )

*The figures in the margin indicate full marks for the questions*

1. (a) What is energy band? Classify solid in terms of energy bands with suitable diagrams. 1+3=4
- (b) Explain *V-I* characteristics of a *P-N* junction diode. 3

**OR**

2. (a) Write down the important properties of a semiconductor? Describe the fabrication of *n*-type semiconductor. 2+3=5
- (b) Explain the methods of biasing a *p-n* junction diode. 2
3. (a) What is rectification? Explain with a diagram, how semiconductor diode can be used as a half-wave rectifier. 1+3=4
- (b) Show that the ripple factor of a full-wave rectifier is 0.48. 3

**OR**

4. (a) What do you mean by a filter circuit? Describe the action of choke input filter circuit. 1+2=3
- (b) What is Zener diode? Explain how Zener diode maintains constant voltage across the load. 1+3=4

5. (a) Define  $\beta$  of a transistor. Show that  $I_E = (1 + \beta)I_B$ . 1+2=3  
 (b) Explain with the help of a diagram the leakage current in CB circuit of a transistor. 4

**OR**

6. (a) State and explain the transistor biasing for normal operation. 2  
 (b) Explain with diagram the input and output characteristics of CB configuration in an *N-P-N* transistor. 5
7. (a) Explain the action of a transistor as an amplifier. 3  
 (b) Write the step of construction of d.c. load line. Also explain cut off and saturation point. 2+2=4

**OR**

8. (a) Explain class-A amplifier with graphical representation. 3  
 (b) Differentiate between the following : 2×2=4  
 (i) Voltage gain and current gain  
 (ii) Input resistance and output resistance
9. (a) Name some factors on which *h*-parameters of an ideal transistor depends? Discuss the *h*-parameters of an ideal CB transistor. 5  
 (b) Compare *R-C* coupled transistor amplifier with transformer coupled amplifier. 2

**OR**

10. (a) Write the limitations of *h*-parameters. 4  
 (b) Describe the frequency response of *R-C* coupled amplifier in the mid-, high- and low-frequency ranges. 5

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