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(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 β 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
