2015

(2nd Semester)

ELECTRONICS

SECOND PAPER

(Semiconductor Physics)

(PART : A—OBJECTIVE)

(*Marks* : 20)

SECTION—I

(*Marks* : 5)

Each question carries 1 mark

Answer **all** questions

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

1. The energy gap between valence and conduction bands in insulator is about

(a) 15 eV ( )

(b) 1·5 eV ( )

(c) 0 eV ( )

(d) 0·5 eV ( )

2. The maximum efficiency of a full-wave rectifier is

(a) 40·6% ( )

(b) 25% ( )

(c) 50% ( )

(d) 81·2% ( )

3. In an *N-P-N* transistor, the emitter to collector carriers are

(a) electrons ( )

(b) electrically neutral ( )

(c) holes ( )

(d) both electrons and holes ( )

4. $I_C = \beta I_B +$ ——.

(a) I_{CBO} ( )

(b) I_C ( )

(c) I_{CEO} ( )

(d) αI_E ( )

5. The dimension of h_{ie} parameters is

(a) mho ( )

(b) ohm ( )

(c) farad ( )

(d) Dimensionless ( )

SECTION—II

(*Marks* : 15)

Each question carries 3 marks

Answer *any* **five** questions

1. Explain the formation of depletion region in a *p-n* junction.

2. Draw a neat diagram of a full-wave bridge rectifier showing input and output voltage.

3. A half-wave rectifier is used to supply 50 V d.c. to a resistive load of 800 Ω. The diode has a resistance of 25 Ω. Calculate the percentage rectification efficiency.

4. What is a transistor? Write the symbols of *P-N-P* and *N-P-N* transistor.

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 transformer coupled amplifier?

★★★

(b) Compare *R-C* coupled transistor amplifier with transformer coupled amplifier, stating a few salient features and their uses. 2

Or

(a) Write the limitations of *h* parameters. 2

(b) Describe the frequency response of *R-C* coupled amplifier in the mid-, high- and low-frequency ranges. 5

★★★

2015

(2nd Semester)

ELECTRONICS

SECOND PAPER

(Semiconductor Physics)

Full Marks : 55

Time : 2½ hours

(PART : B—DESCRIPTIVE)

(*Marks* : 35)

The figures in the margin indicate full marks for the questions

1. (a) What is energy band? Discuss the important energy bands in a solid. 1+3=4

(b) Define hole current. Describe with suitable diagram the formation of hole current in a pure semiconductor. 3

Or

(a) What are intrinsic and extrinsic semiconductors? How is *n*-type of extrinsic semiconductor formed? 2+3=5

(b) Write down some important properties of a semiconductor. 2

2. (a) What is a rectifier? 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

(a) Discuss two capacitive effects of *p-n* junction diode. 2

(b) Describe the action of choke input filter circuit. 2

(c) Explain how Zener diode maintains constant voltage across the load. 3

3. (a) Define β of a transistor. Show that $I_E = (1+\beta) I_B$. 1+2=3

(b) Explain with diagram the leakage current in CB circuit of a transistor. 4

Or

(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

4. (a) Explain how a transistor acts as an amplifier. 3

(b) Write down the step for construction of d.c. load line. Also explain the terms cut-off and saturation point. 2+2=4

Or

(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

5. (a) A transistor used in CE arrangement has the following set of *h* parameters when the d.c. operating point is $V_{CE} = 10$ volts and $I_C = 1$ mA :

$h_{ie} = 2000\ \Omega$; $h_{oe} = 10^{-4}$ mho;

$h_{re} = 10^{-3}$; $h_{fe} = 50$.

Determine *(i)* input impedance, *(ii)* current gain, *(iii)* voltage gain, *(iv)* power gain and *(v)* output impedance. The a.c. load seen by the transistor is $r_L = 600\ \Omega$ and a source resistance of $R_S = 2\ k\Omega$. 5