2025

(CBCS)

(2nd Semester)

ELECTRONICS

SECOND PAPER

(Semiconductor Physics)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

Simple calculator may be used in this paper

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. The random motion of holes and free electrons due to thermal agitation is called

(a) diffusion ( )

(b) pressure ( )

(c) ionization ( )

(d) polarization ( )

2. The leakage current across a *p-n* junction is due to

(a) minority carriers ( )

(b) majority carriers ( )

(c) junction capacitance ( )

(d) impurity ( )

3. The filter circuit which results in the best voltage regulation is

(a) simple capacitor filter ( )

(b) choke input filter ( )

(c) resistance input filter ( )

(d) -filter ( )

4. If the PIV rating of a diode is exceeded

(a) the diode conducts poorly ( )

(b) the diode is destroyed ( )

(c) the diode behaves as Zener diode ( )

(d) the diode stops conducting ( )

5. The device associated with voltage-controlled capacitance is

(a) LED ( )

(b) photodiode ( )

(c) varactor diode ( )

(d) Zener diode ( )

6. A semiconductor which operates with a forward biased metal-semiconductor junction is called

(a) Schottky diode ( )

(b) tunnel diode ( )

(c) varactor diode ( )

(d) PIN diode ( )

7. The emitter of a transistor is

(a) lightly doped ( )

(b) heavily doped ( )

(c) moderately doped ( )

(d) undoped ( )

8. Thermal runaway occurs when

(a) collector is reverse biased ( )

(b) junction capacitance is high ( )

(c) emitter is forward biased ( )

(d) transistor is not biased ( )

9. If the collector current flows at all times during the full cycle of the input signal, the amplifier is called _____ amplifier.

(a) class B ( )

(b) class C ( )

(c) class A ( )

(d) class AB ( )

10. The lower and upper cut-off frequencies of transistor amplifier are also called

(a) sideband frequencies ( )

(b) resonant frequencies ( )

(c) half-resonant frequencies ( )

(d) half-power frequencies ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

Answer the following : 3×5=15

UNIT—I

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

OR

2. Write a brief note on the formation of energy bands in solids.

UNIT—II

3. What do you understand by the d.c. and a.c. resistances of a crystal diode? How will you determine them from the *V-I* characteristic of a crystal diode?

OR

4. What are the advantages of full-wave rectification over half-wave rectification?

UNIT—III

5. Explain how Zener diode maintains constant voltage across the load.

OR

6. What are the advantages of *p-i-n* diode as compared to an ordinary *p-n* junction diode?

UNIT—IV

7. What is thermal runaway? How will you avoid thermal runaway in a transistor?

OR

8. What do you understand by transistor biasing? Why is it needed?

UNIT—V

9. Write a short note on bandwidth and frequency response curve of an amplifier.

OR

10. Explain how transistor can be used as an amplifier.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer the following : 10×5=50

UNIT—I

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

(b) What are the differences between Zener and avalanche breakdowns? 3

(c) How is junction capacitance formed in a diode? 2

OR

2. *(a)* Discuss the behaviour of a *p-n* junction under forward and reverse biasing. 2+2=4

(b) Explain the salient features of Bohr's atomic model. 4

(c) Which are the most commonly used semiconductors and why? 2

UNIT—II

3. *(a)* What do you understand by the d.c. and a.c. resistances of a semiconductor diode? How will you determine them? 2+4=6

(b) Describe the filtering action of a capacitor filter. 4

OR

4. *(a)* Explain with a diagram, how semiconductor diode can be used as a half-wave rectifier. Show that its maximum efficiency is 40·6%. 3+3=6

(b) Explain different equivalent circuits of a semiconductor diode. 4

UNIT—III

5. *(a)* Describe the construction, resistance curve and applications of thermistor. 2+2+2=6

(b) Explain the working and *V-I* characteristics of Schottky diode. 2+2=4

OR

6. *(a)* Describe the construction and *V-I* characteristics of Zener diode. 2+3=5

(b) What is LED? Explain its working principle. 1+2=3

(c) Write and explain any two applications of photodiode. 2

UNIT—IV

7. *(a)* Explain common emitter (CE) static characteristics of a transistor. 5

(b) With diagram, discuss the working of *p-n-p* transistor. 3

(c) A CB transistor has 0 96 and I_E 2 mA. Calculate I_C and I_B. 2

OR

8. *(a)* Write a short note on the leakage currents in a transistor for CB configuration. 4

(b) Show the relation $\frac{\quad}{1}$, where the symbols have their usual meanings. 3

(c) Following measurements are made in a transistor :

I_C 5 202 mA, I_B 50 A and I_{CO} 2 A

Compute the values of , and I_E. 3

UNIT—V

9. *(a)* Write the steps of construction of d.c. load line. 3

(b) Describe the performance of transistor amplifier. 7

OR

10. *(a)* Explain the classification of amplifier according to the mode of operation (class A, B, C and AB). 6

(b) Write a short note on *Q*-point of a transistor amplifier. 4

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