2017

(CBCS)

(2nd Semester)

ELECTRONICS

SECOND PAPER

(Semiconductor Physics)

Full Marks :75

Time : 3 hours

(PART : A - OBJECTIVE)
(*Marks*:25)

The figures in the margin indicate full marks for the questions

SECTION – A
(*Marks*:l0)

Put a Tick (✓) mark against the correct answer in the brackets provided for it : 1×10 =10

1. Silicon has Z = 14. Its outermost orbit is
   (a) partially filled ( ) (b) half-filled ( )
   (c) completely occupied ( ) (d) empty ( )

2. Addition of impurity to a pure semiconductor is called
   (a) rectification ( ) (b) drift current ( )
   (c) doping ( ) (d) extrinsic semiconductor ( )

3. The knee voltage of a diode is approximately equal to
   (a) applied voltage ( ) (b) breakdown voltage ( )
   (c) forward voltage ( ) (d) barrier potential ( )

4. The ripple factor of a full-wave rectifier is
   (a) 2 ( ) (b) 1.21 ( )
   (c) 2.5 ( ) (d) 0.48 ( )

5. When used in a circuit, Zener diode is always
   (a) forward biased ( ) (b) connected in series ( )
   (c) reversed biased ( ) (d) overheated ( )

6. A semiconductor device that resembles a voltage variable capacitor is known as
   (a) tunnel diode ( ) (b) varactor diode ( )
   (c) Schottky diode ( ) (d) PIN diode ( )

7. The operating point of a transistor is also called
   (a) quiescent point ( ) (b) cut-off point ( )
   (c) saturation point ( ) (d) intersection point ( )

8. The output impedance of a transistor is
   (a) low ( ) (b) high ( )
   (c) very low ( ) (d) zero ( )

9. The maximum distortion is found in
   (a) class A amplifier ( ) (b) class B amplifier ( )
   (c) class C amplifier ( ) (d) class AB amplifier ( )

10. A transistor converts
   (a) d.c. power to a.c. power ( )
   (b) a.c. power to d.c. power ( )
   (c) high resistance to low resistance ( )
   (d) low resistance to high resistance ( )

SECTION – B
(*Marks*: 15)

Answer the following questions: $3 \times 5=15$

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

   Or

   Explain the capacitive effects of junction diode.

2. A crystal diode having internal resistance r_f = 20 Ω is used for half-wave rectification. If the applied voltage V = 50 sin ωt and load resistance R_L = 800 Ω, find the efficiency of rectification.

   Or

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

3. Explain how Zener diode can be used as a peak clipper.

   Or

   What are the advantages of PIN diode over *p-n* junction diode?

4. What is transistor? Write the symbols of *p-n-p* and *n-p-n* transistors.

   Or

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

5. Explain bandwidth of an amplifier with necessary diagram.

   Or

   Draw a frequency response curve for RC coupled transistor amplifier.

(PART: B – DESCRIPTIVE)
(*Marks*: 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Describe with a diagram the atomic model proposed by Niels Bohr. What do you mean by valence electrons? 3+1 = 4

   (b) What is energy band? Classify solids in terms of energy band. 1+3=4

   (c) Determine the electronic distribution of xenon atom having Z = 54. 2

Or

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

   (b) Explain the *V-I* characteristics of *P-N* junction diode with suitable diagrams. 4

   (c) What is Zener breakdown? 1

3. *(a)* What do you understand by the d.c. and a.c. resistances of a semiconductor diode? How will you determine them? 2+3=5

   (b) Explain with a diagram how semiconductor diode can be used as a full-wave rectifier. Show that its maximum efficiency is 81.2%. 2+3= 5

Or

4. *(a)* What is ripple factor? Derive the value of ripple factor for half-wave rectifier. 1+3= 4

   (b) Describe the filtering action of capacitor-input filter. 2

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

5. *(a)* What is Zener diode? Explain how Zener diode maintains constant voltage across the load. 1+3=4

   (b) What is tunneling effect? Explain the *V-I* characteristics of tunnel diode. Mention some important applications of tunnel diode. 1+3+2=6

Or

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

   (b) What is photodiode? How is current reduced to zero in photodiode? 2+2=4

7. *(a)* What is meant by transistor biasing? What are the essentials of the transistor biasing circuit? 1+3=4

   (b) Explain with a diagram, the input characteristics of a CE transistor. State the advantages of a CE mode over other mode of operations. 3+3=6

Or

8. *(a)* Show that $\beta = \frac{\alpha}{1 - \alpha}$

where the symbols have their usual meanings. 3

(b) Explain with a diagram the leakage current in CB circuit of a transistor. 3

(c) Discuss the transistor action in *n-p-n* mode with a diagram. 4

9. *(a)* Explain how transistor can be used as an amplifier. What do you mean by operating point of a transistor circuit? 3+1=4

(b) Describe class A, class B, class C, and class AB amplifiers. Illustrate your answer with suitable diagrams. 6

Or

10. *(a)* Explain in brief the frequency response curve of an amplifier. What do you mean by resonant frequency? 3+1=4

(b) Write down the steps for construction of d.c. load line. Also explain the terms 'cut-off point' and 'saturation point'. 3+2=5

(c) Define bandwidth of an amplifier. 1

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