2018

(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* : 10)

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

1. The electrons in the outermost orbit which determine its electrical and chemical properties are called _____ electrons.

(a) valence ( ) *(b)* free ( )

(c) revolving ( ) *(d)* active ( )

2. The depletion region of a semiconductor diode is due to

(a) reverse biasing ( )

(b) forward biasing ( )

(c) absence of current carriers ( )

(d) crystal doping ( )

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

(a) 40·6% ( ) *(b)* 81·2% ( )

(c) 50% ( ) *(d)* 25% ( )

4. The filter circuit results in the best voltage regulation is

(a) choke input filter ( ) *(b)* capacitor filter ( )

(c) resistance input filter ( ) *(d)* -filter ( )

5. 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 ( )

6. A semiconductor device that has an intrinsic material between *P* and *N* materials is called

(a) Schottky diode ( ) *(b)* Tunnel diode ( )

(c) Varactor diode ( ) *(d)* PIN diode ( )

7. In a transistor

(a) I_C I_E I_B ( ) *(b)* I_B I_C I_E ( )

(c) I_E I_C I_B ( ) *(d)* I_E I_C I_B ( )

8. Thermal runaway occurs when

(a) collector is reverse biased ( )

(b) transistor is not biased ( )

(c) emitter is forward biased ( )

(d) junction capacitance is high ( )

9. The point of intersection of d.c. and a.c. load lines is called

(a) saturation point ( ) *(b)* cutoff point ( )

(c) operating point ( ) *(d)* checkpoint ( )

10. In determining the load line, for I_C 0, we have

(a) V_{CE} V_{CB} ( ) *(b)* V_{CE} 0 ( )

(c) V_{CC} 0 ( ) *(d)* V_{CE} V_{CC} ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. Give the electronic distribution of copper having atomic number 29.

OR

Explain the two types of biasing of a *p-n* junction.

2. Explain the different equivalent circuits of a semiconductor diode.

OR

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

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

OR

Explain the *V-I* characteristics of tunnel diode.

4. Write a short note on the leakage currents in a transistor for CB and CE configuration.

OR

Show that $\frac{}{1}$, where the symbols have their usual meanings in a transistor.

5. What are the different classifications of transistor amplifier?

OR

Write the steps of construction of d.c. load line.

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* What is a hole? Discuss the formation of hole current with suitable diagram. 1+4=5

(b) Explain the different types of atomic bonds available in solids giving examples. 3

(c) What are the two basic rules governing the electronic distribution in an atomic shell? 2

OR

(a) What do you mean by doping in semiconductor physics? Write down the formation of *n*-type extrinsic semiconductor. 1+3=4

(b) Explain the reverse *V-I* characteristics of a junction diode. What are the differences between Zener and avalanche breakdowns? 3+3=6

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 maximum efficiency of a half-wave rectifier is 40·6%. The applied input a.c. power to a half-wave rectifier is 100 watts. The d.c. output power obtained is 40 watts.

(i) What is the rectification efficiency?

(ii) What happens to remaining 60 watts? 3+3=6

OR

(a) Describe the action of the following filter circuits : 6

(i) Capacitor filter

(ii) Choke input filter

(iii) -filter

(b) What is ripple factor? Show that the ripple factor for a full-wave rectifier is 0·48. 1+3=4

3. *(a)* Write a short note on the reverse characteristics of a Zener diode with suitable diagram. Explain how Zener diode can be used as a peak clipper. 3+3=6

(b) What is Shockley diode? Explain its working. 1+3=4

OR

(a) How does LED differ from an ordinary diode? Explain the working of LED. What value of series resistor is required to limit the current through an LED to 20 mA with a forward voltage drop of 1·6 V when connected to a 10 V supply? 1+2+2=5

(b) Explain how Zener diode can be used as meter protection. Explain the working of varactor diode. 2+3=5

4. *(a)* Define of a transistor. Show that I_E (1)I_B. What is thermal runaway? 1+2+2=5

(b) Explain with diagram the input and output characteristics of CB configuration in an *N-P-N* transistor. 5

OR

(a) In CB configuration, show that I_C I_E and I_B (1)I_E. Explain with diagram the leakage current in CE circuit of a transistor. 1+2+3=6

(b) Explain the working of *P-N-P* transistor. In a transistor, if I_E 5 mA and I_B 0 1 mA, what is the value of ? 3+1=4

5. *(a)* Differentiate between the following : 2+2=4

(i) Voltage gain and Current gain

(ii) Input resistance and Output resistance

(b) What is a linear amplifier? Explain quiescent point of a transistor amplifier with suitable diagram showing cutoff and saturation. 1+3=4

(c) Write in brief power relation for class B amplifier. 2

OR

(a) Derive an expression for voltage gain of a transistor amplifier from its a.c. equivalent circuit. 3

(b) What do you mean by power gain? Explain how transistor amplifies. 1+2=3

(c) Write short notes on the following : 2+2=4

(i) Classification of amplifiers

(ii) Operating point

★ ★ ★