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(CBCS)

(2nd Semester)

ELECTRONICS

SECOND PAPER

(Semiconductor Physics)

Full Marks : 75

Time : 3 hours

INSTRUCTIONS TO CANDIDATES

(Please read the instructions carefully before you start writing your answers)

1. Questions should be attempted as per instructions.
2. Do not copy the Questions. Indicate the Section and Question No. clearly while attempting the answer.
3. For Multiple choice answer, candidate should indicate the **Question No., Sub. No., (if any) and the correct answer. For example :**

   1. Name the State capital of Mizoram.

   (a) Lunglei

   (b) Aizawl

   (c) Champhai

   Candidate should provide answer as—Q. No. *1* : *(b) Aizawl*
   [Candidate should **avoid** writing only *(b)*]
4. The figures in the margin indicate full marks for the questions.

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Choose the correct answer from the options provided : 1×10=10

1. In insulator, the energy gap between valence and conduction band is

(a) very large

(b) zero

(c) very small

(d) less than one

2. The most commonly used semiconductor is

(a) germanium

(b) silicon

(c) carbon

(d) sulphur

3. The battery connections required to a forward biased *p-n* junction are

(a) + ve terminal to *p* and ve terminal to *n*

(b) ve terminal to *p* and ve terminal to *n*

(c) ve terminal to *p* and ve terminal to *n*

(d) ve terminal to *p* and ve terminal to *n*

4. A reverse biased *p-n* junction has

(a) very narrow depletion region

(b) almost no current

(c) very low resistance

(d) large current flow

5. Breakdown occurs in Zener diode under

(a) forward bias

(b) unbiased condition

(c) reverse bias

(d) both forward and reverse bias

6. When the reverse bias voltage increases in varactor diode, the depletion layer

(a) increases

(b) stays the same

(c) decreases

(d) becomes zero

7. The leakage current I_{CBO} flows in

(a) the emitter, base and collector leads

(b) the emitter and base leads

(c) the emitter and collector leads

(d) the base and collector leads

8. The emitter base of a given transistor is forward biased and its collector base is reverse biased. If the base current is increased, then its

(a) I_C will decrease

(b) V_{CE} will increase

(c) I_C will increase

(d) V_{CC} will increase

9. When the signal is applied to the transistor amplifier, the ratio of change of collector current to the ratio of change of base current is called

(a) a.c. current gain

(b) base current amplification factor

(c) emitter current amplification factor

(d) d.c. current gain

10. In determining the load line, for I_C 0

(a) V_{CE} V_{CB}

(b) V_{CE} 0

(c) V_{CE} V_{CC}

(d) V_{CC} 0

(SECTION : B—SHORT ANSWER)

(*Marks* : 15)

Answer the following questions : 3×5=15

1. Explain the capacitive effects of junction diode.

OR

Discuss the formation of hole current with suitable diagram.

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

OR

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

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

OR

What do you mean by thermal runaway in a transistor?

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

OR

What is *Q*-point for any transistor configuration?

5. Write a note on the characteristics of class A amplifier.

OR

Define bandwidth of an amplifier.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer the following questions : 10×5=50

1. *(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

OR

2. *(a)* Discuss the behavior 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 is the most commonly used semiconductor and why? 2

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)* Explain how Zener diode maintains constant voltage across the load in the breakdown region. 2

(b) What is PIN diode? Write its two advantages over the normal *p-n* junction diode. 3

(c) What is tunnel diode? Explain the *V-I* characteristics of a tunnel diode. 1+4=5

OR

6. *(a)* What is LED? 2

(b) Explain photo-diode operation. 3

(c) What is Shockley diode? Explain its working. 1+4=5

7. *(a)* State and explain the transistor biasing for normal operation. 2

(b) What are the important biasing rules? 3

(c) Explain with diagram, the input, output and current transfer characteristics of CE configuration in an *n–p-n* transistor. 5

OR

8. *(a)* Define and for a transistor. 2

(b) Discuss the working of *n–p-n* transistor with diagram. 3

(c) Describe with suitable diagram, the transistor static characteristics of CE configuration. Mention its difference with CB characteristics. 3+2=5

9. *(a)* What is frequency response of an amplifier? 2

(b) Explain how transistor amplifies. 3

(c) Describe class A and class B of amplifiers. Illustrate your answer with suitable diagrams. 5

OR

10. *(a)* Why is common collector amplifier called emitter-follower? 2

(b) Which amplifier configuration is most popularly used and why? 3

(c) Derive the expressions for input resistance, output resistance, current gain, voltage gain and power gain of a CE amplifier. 5

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