ELEC161 (MAJOR/MINOR) **Student's Copy**

2 0 2 4

(NEP–2020)

(2nd Semester)

ELECTRONICS (MAJOR/MINOR)

(Basic Semiconductor)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

Use of Simple Calculator is allowed

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

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

1. What happens to the resistance of a pure semiconductor when heated?

(a) The resistance increases ( )

(b) The resistance decreases ( )

(c) The temperature remains the same ( )

(d) Can't say ( )

2. Which of the following is created when trivalent impurities are added to a semiconductor?

(a) Free electrons ( )

(b) Valence electrons ( )

(c) Bound electrons ( )

(d) Holes ( )

3. What is the random motion of free electrons and holes due to thermal agitation called?

(a) Pressure ( )

(b) Diffusion ( )

(c) Ionization ( )

(d) Drifting ( )

4. The resistivity of pure silicon is

(a) 100 cm ( )

(b) 6000 cm ( )

(c) 3 106 cm ( )

(d) 6 108 cm ( )

5. Which of the following does the resistivity of a semiconductor depend upon?

(a) Length of the semiconductor ( )

(b) Shape and atomic nature of the semiconductor ( )

(c) Atomic nature of the semiconductor ( )

(d) Shape of the semiconductor ( )

6. What is the sign of the temperature coefficient of resistance in a semiconductor?

(a) Negative ( )

(b) Positive ( )

(c) Zero ( )

(d) 1 ( )

7. Schottky diodes are also known as

(a) PIN diodes ( )

(b) Step-recovery diodes ( )

(c) tunnel diodes ( )

(d) hot-carrier diodes ( )

8. You have an application for a diode to be used in a tuning circuit. A type of diode to be used might be

(a) an LED ( )

(b) a Schottky diode ( )

(c) a varactor ( )

(d) a Gunn diode ( )

9. The ripple factor of a bridge rectifier is

(a) 0·482 ( )

(b) 0·812 ( )

(c) 1·11 ( )

(d) 1·21 ( )

10. The PIV of a full-wave center-tapped rectifier circuit is

(a) V ( )

(b) V_m ( )

(c) 2 V_m ( )

(d) 3 ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

Answer *five* questions, taking at least *one* from each Unit : 3×5=15

UNIT—I

1. Explain in detail the formation of an *N*-type and a *P*-type semiconductor.

2. Derive the drift and diffusion current in a semiconductor.

UNIT—II

3. Describe how a barrier potential is developed in a junction diode.

4. Explain the concept and formation of Avalanche breakdown in a diode.

UNIT—III

5. Prove that the efficiency of a half-wave rectifier is 40·6%.

6. Explain the various types of filters used in power supplies.

UNIT—IV

7. Explain the construction and working of a tunnel diode.

8. Why is a varactor diode suitable for voltage-controlled tuning?

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer *five* questions, taking at least *one* from each Unit : 10×5=50

UNIT—I

1. Prove that the conductivity of a semiconductor is given by $e(p_p \quad n_n)$.

2. Explain Hall effect. Derive a Hall coefficient. How can Hall effect be used to determine some of the properties of a semiconductor?

UNIT—II

3. Explain how a *p-n* junction works as a diode. Draw and explain its *V-I* characteristics. Discuss the behavior of *p-n* junction when subjected to

(a) no bias;

(b) forward bias;

(c) reverse bias.

4. Draw and describe a full set-up of a power supply system.

UNIT—III

5. With diagram and relevant waveforms, describe a full-wave and a bridge rectifier. Prove that the ripple factor, of a full-wave centre-tapped rectifier is 0·482.

6. Draw different types of clipper circuits including positive clipper, biased clipper and combination clipper. Give their circuit and explain their operation. Mention how a Zener diode can be configured as a symmetrical shunt clipper.

UNIT—IV

7. Design a Zener regulator for the following specifications :

Output voltage = 5 V

Load current = 10 mA

Zener wattage = 400 mA

Input voltage = 10 V 2 V

8. Write short notes on the following : 2½×4=10

(a) PIN diode

(b) Gunn diode

(c) IMPATT diode

(d) Shockley diode

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