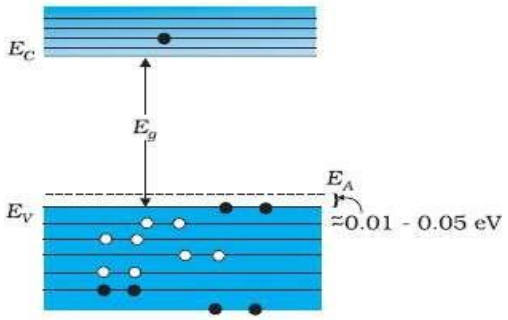
CHAPTER-14
Semiconductor Electronics, Materials, Devices and Simple Circuits
ASSIGNMENT-3
MCQ- 1 MARKS SECTION

1. In the energy band diagram of a material shown below, the open circles and filled circles denoteholes and electrons respectively. The material is



(a) insulator (b)metal (c)n-type semiconductor (d)p-type semiconductor

2. As the temperature increases, the electrical resistance

(a)Increases for both conductors and semiconductors

(b)Decreases for both conductors and semiconductors

(c)Increases for conductors but decreases for semiconductors

(d) Decreases for conductors but increases for semiconductors

3. If a small amount of antimony is added to germanium crystal

(a)it becomes a p-type semiconductor

(b) the antimony becomes an acceptor atom

(c) there will be more free electrons than holes in the semiconductor

(d) its resistance is increased

4. In a n-type semiconductor, which of the following statement is true

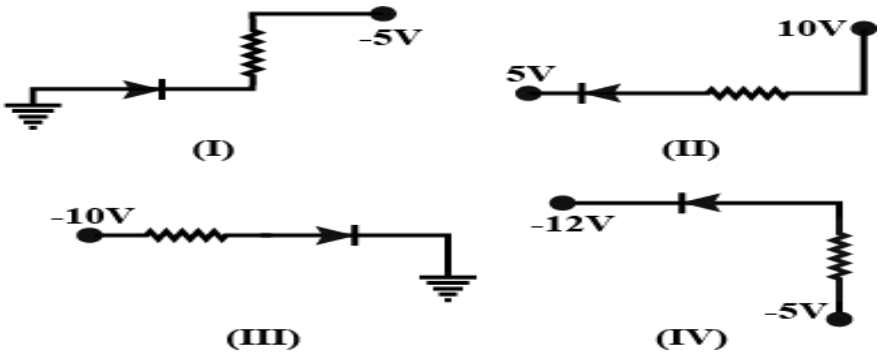
(a)Holes are minority carries and pentavalent atoms are dopants.

(b)Holes are majority carries and trivalent atoms are dopants.

(c)Electrons are majority carries and trivalent atoms are dopants.

(d)Electrons are minority carriers and pentavalent atoms are dopants

5. Which of the following diode is reverse biased?



(a) I (b) II (c) III (d) IV

ASSERTION AND REASONING QUESTIONS

6. **Assertion**: A Pure semiconductor has negative temperature coefficient of resistance.

   Reason: On raising the temperature, more charge carriers are released, conductance increases and resistance decreases.

7. **Assertion:** The number of electrons in a p-type silicon semiconductor is less than the number of electrons in a pure silicon semiconductor at room temperature.

   Reason: It is due to law of mass action.

8. **Assertion:** The diffusion current in a p-n junction is from the p-side to the n-side.

   Reason: The diffusion current in a p-n junction is greater than the drift current when the junction is in forward biased.

9. **Assertion :** The drift current in a p-n junction is from the n-side to the p-side.

   Reason : It is due to free electrons only.

10. **Assertion**: When diode is used as a rectifier, its specified reverse breakdown voltage should not be exceeded.

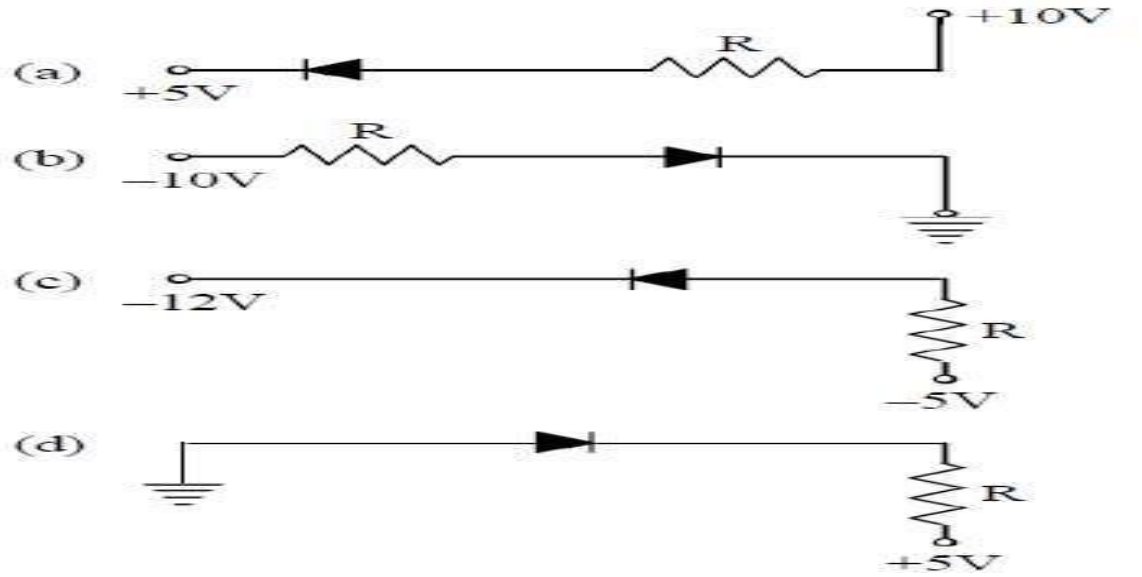
    Reason: When p-n junction diode crosses the reverse break down voltage, it gets destroyed

CASEBASED / SOURCE BASED QUESTIONS

11. When the diode is forward biased, it is found that beyond forward voltage $V = V_k$, called knee voltage, the conductivity is very high. At this value of battery biasing for p-n junction, the potential barrier is overcome and the current increases rapidly with an increase in forwarding voltage. When the diode is reverse biased, the reverse bias voltage produces a very small current about a few microamperes which almost remains constant with bias. This small current

is reverse saturation current.

i) In which of the following figures, the p-n diode is forward biased



(a) a,b and d (b) c only (c) c and a (d) b and d

ii) Based on the V-I characteristics of the diode, we can classify diode a**s**

(a) bi-directional device(b) ohmic device

(c) non-ohmic device(d) passive element

iii) In the case of forwarding biasing of a p-n junction diode, which one of the following statementis correct**?**

(a) effective barrier potential decreases

(b) majority charge carriers begins to flow away from junction

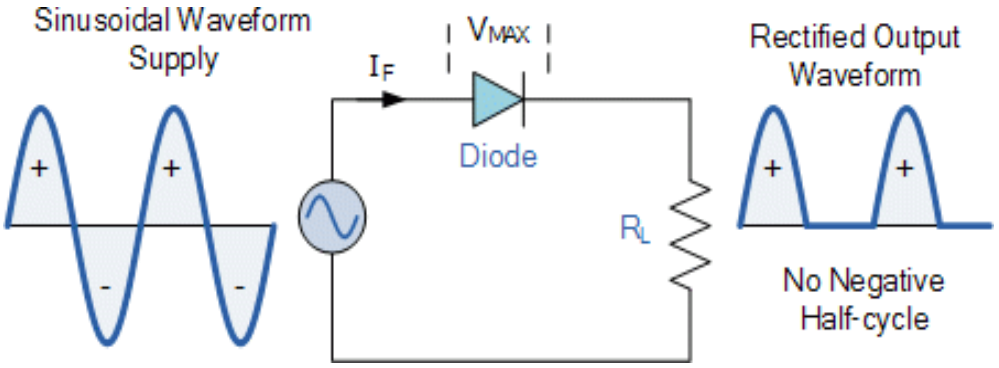
(c) width of depletion layer increases

(d) effective resistance across the junction increases

iv) If an ideal junction diode is connected as shown, then the value of the current I is

(a) 0.005 A (b) 0.02 A (c) 0.01 A (d) 0.1A

12. If an alternating voltage is applied across a diode in series with a load and a pulsating voltage will appear across the load only during the half cycles of the ac input during which the diode is forward biased. Such rectifier circuit is called a half-wave rectifier. The reverse saturation current of a diode is negligible and can be considered equal to zero for practical purposes.



i) If input frequency of signal in half wave rectifier is 50 Hz then the output frequency will be

(a) 25 Hz (b) 50 Hz (c) 100 Hz (d) Uncertain

ii) In a half wave rectifier, the r.m.s. value of the a.c. component of the wave is

(a) equal to d.c. value (b) more than d.c. value (c) less than d.c. value (d) Zero

iii) Rectifier converts-

(a) AC to DC (b) DC to AC (c) AC to AC of different waveform

(d) All of these

iv) Full wave rectifier can be used over half wave rectifier because Full wave rectifier is-

(a) More energy efficient (b) More energy consuming

(c) More handy to use (d) More cost effective to manufacture

13. There are different techniques of fabrication of p-n junction. In one such technique, called fused junction techniques, an aluminium film is kept on the wafer of n-type semiconductor and the combination is then heated to a high temperature (about 600°C). As a result, aluminium fused into silicon and produces p-type semiconductor and in this way a p-n junction is formed.

i) When a p-n junction is reverse biased, then

a) No current flows. c) Height of potential barrier is decreased.

b) The depletion region is reduced. d) Height of potential barrier is increased.

ii) The cause of potential barrier in p-n junction is :

a) Depletion of positive charges near the junction.

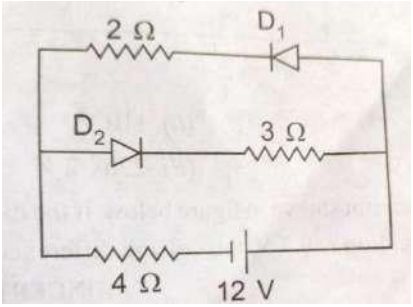
b) Concentration of –ve charges near the junction.

c) Concentration of +ve charges near the junction.

d) Concentration of +ve and –ve charges near the junction.

iii) The circuit has two oppositely connected ideal diodes in parallel. What is the current

flowing in the circuit ?



a) 1.17 A c) 2.0 A
b) 2.0 A d) 1.33 A

iv) When a pn junction is forward biased, then

a) Only diffusion current flows.

b) Both diffusion current and drift current flow but diffusion current is more than drift current.

c) Only drift current flows.

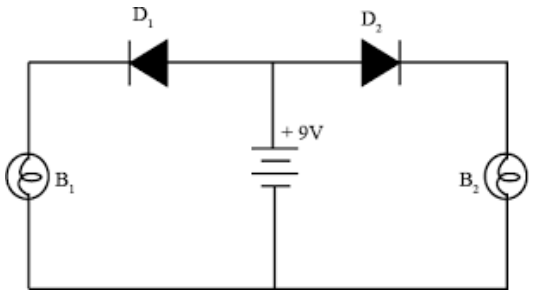
d) Both diffusion and drift current flow but drift current exceeds the diffusion current

.2 MARKS QUESTIONS

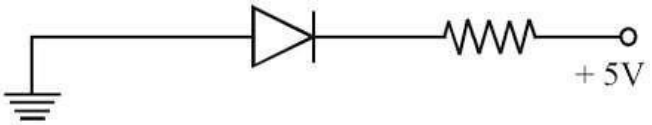
14. What are energy bands? Write any two distinguish features between conductors, semiconductors and insulators on the basis of energy band diagrams.
15. What is the result of doping germanium metal with a little quantity of indium?
16. Who are the major charge carriers in n-type and p-type semiconductors?
17. Explain with the help of a diagram how the depletion region and potential barrier are formedin a junction diode.

3 MARKS QUESTIONS

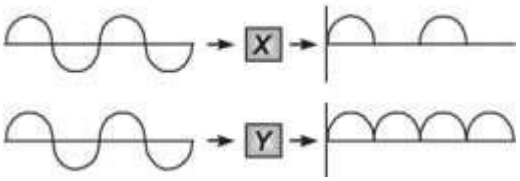
18. Draw V-I characteristics of a p-n junction diode. Answer the following questions, giving reasons:
    (i) Why is the current under reverse bias almost independent of the applied potential up to a critical voltage?
    (ii) Why does the reverse current show a sudden increase at the criticalvoltage.
19. (i)In the following diagram, which bulb out of B_1 and B_2 will glow and why ?



(ii) In the following diagram,is the junction diode forward biased or reverse biased?



20. An a.c. signal is fed into two circuits X and Y and the corresponding output in the two cases have the wavefront shown in figure. Name the circuit X and Y. Also draw their detailed circuit diagram.



5 MARKS QUESTIONS

21.(a)Explain with the help of a diagram, how depletion region and potential barrier are formed in a junction diode.

(b)If a small voltage is applied to a p-n junction diode how will the barrier potential be affected when it is (i) forward biased, and (ii) reverse biased ?

22. Draw the circuit diagram of a full-wave rectifier using p-n junction diode. Explain its working and show the output and input waveforms.