[This question paper contains 2 printed pages.]

Sr. No. of Question Paper : 1797 **C** **Roll No.....**

Unique Paper Code : 251203

Name of the Course : B.Sc. (H) Electronics

Name of the Paper : Semiconductor devices : ELHT-202

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all.
3. Question No. **1** is compulsory.
4. **All** questions carry equal marks.
5. Use of non-programmable scientific calculator is allowed.

1. Attempt any **five** of the following :

   (a) What is the difference between direct and indirect band semiconductor ?

   (b) The barrier potential across a pn junction diode cannot be measured by placing a voltmeter across the diode terminals. Why ?

   (c) Explain intrinsic stand-off ratio in UJT.

   (d) Draw the minority carrier distribution of pnp transistor in CB configuration for active mode.

   (e) What is the difference between Ohmic and rectifying contacts ?

   (f) Differentiate between ion-implantation and diffusion.

   (g) Determine the probability that an energy level is occupied by an electron at 300 K, if it is located above the Fermi level by

   (i) 0.026 eV (=kT)

   (ii) 0.078 eV (=3kT) (5×3=15)

P.T.O.

2. (a) Derive the expression for the concentration of electrons in conduction band. (8)

   (b) A silicon sample is doped with 10^{17} As atoms/cm^3. Find the carrier concentration in Fermi level at 300 K. Also draw the energy band diagram showing Fermi level (E_F) and intrinsic Fermi-level (E_i). (7)

3. (a) Show that in case of pn junction the Fermi level remains constant that is

$$\frac{dE_F}{dx} = 0 \text{ at thermal equilibrium.} \quad (8)$$

   (b) Calculate the built-in potential for a silicon p-n junction with $N_A = 10^{18}\,cm^{-3}$ and $N_D = 10^{15}\,cm^{-3}$ at 300 K. (7)

4. (a) Derive the expression for collector terminal current for pnp transistor in active mode for operation. (8)

   (b) Define emitter efficiency, common base current gain and base transport factor and show that $I_C = \alpha_0 I_E + I_{CBO}$ (5)

   (c) In a transistor circuit $I_E = 5$ mA, $I_C = 4.95$ mA, $I_{CEO} = 200\ \mu A$. Calculate β and leakage current I_{CBO}. (2)

5. (a) What is the difference between unipolar and bipolar devices ? (2)

   (b) Derive the expression for static I-V characteristic of junction field effect transistor and show that channel conductance in saturation region is zero. (8)

   (c) Explain the accumulation and inversion case for an ideal MOS diode. (5)

6. (a) Explain the working and construction of silicon controlled rectifier (SCR). Also draw its I-V characteristics. (8)

   (b) Explain the operation of enhancement mode-MOSFET. Also draw its I-V characteristics. (7)

7. (a) Define the various steps involved in the fabrication of a bipolar junction transistor. (8)

   (b) Explain the photolithography process. (7)