(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2483 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VI) EVEN THEORY EXAMINATION 2012-13

ADVANCED SEMICONDUCTOR DEVICES

Time : 2 Hours *Total Marks : 50*

Note :– (1) Attempt **all** questions.

(2) Marks are indicated for each question.

(3) Assume the missing data, if any.

1. Attempt any two parts of the following : **(6×2=12)**

(a) (i) Find the nearest neighbour distance in a zincblende lattice.

(ii) Distinguish between unipolar and ambipolar semiconductors. Explain with examples.

(b) Calculate the hole and electron concentrations in a silicon sample at 300 K, which has a Hall coefficient of zero. What percentage change in conductivity would you expect if 2×10^{12} Boron atoms/cm^3 is added in the sample ?

(c) Excess holes are somehow injected into a semi-infinite semiconductor bar at $x = 0$, and the steady state hole injection maintains a constant excess hole concentration at the injection point. Prove that the diffusion current at any position x is just proportional to excess concentration at that position.

2. Attempt any two parts of the following : (6×2=12)

(a) What do you mean by minority carrier injection and extraction ? Find the expression for the electron current in the n-type material of a forward biased p-n junction.

(b) State the condition for which the junction between a metal and p-type semiconductor will work as a ohmic contact. Explain the contact and draw the energy band diagram of a ohmic contact formed between a metal and p-type semiconductor at equilibrium condition.

(c) In a p^+-n junction, the n-doping Nd is doubled. How do the following change if everything else remains unchanged ?

(i) Junction capacitance

(ii) Built-in-potential

(iii) Breakdown voltage.

Give the proper justification for your answer.

3. Attempt any two parts of the following : (6×2=12)

(a) What is BNDC (Bulk Negative Differential Conductivity) effect ? Discuss the construction, operation and characteristics of the device based on this effect with suitable diagrams.

(b) What is tunneling phenomenon ? Explain the V-I characteristics of Tunnel diode. Discuss the semiconductor material required for its fabrication. How do they differ from conventional semiconductors ?

(c) Why a solar cell must operate in the fourth quadrant of the p-n junction V-I characteristics ? A Si solar cell has a short-circuit current of 10 mA and an open-circuit voltage of 0.8 V under full solar illumination. The fill-factor is 0.7. What is the maximum power delivered to a load by this cell ?

4. Attempt any two parts of the following : (7×2=14)

(a) What are the various models to describe the behaviour of the short-channel MESFETs devices ? Explain them.

(b) Define and derive the expression for the threshold voltage for MOS transistor. What are the factors which affect it ?

(c) Describe the storage and charge transfer processes in charge-coupled devices with suitable schematic diagrams. Also draw the schematic diagrams to illustrate the operation of a three phase charge-coupled device.