

Enrolment No.

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S<sub>3</sub>UEEC03B03DCE

**B.TECH, 3rd SEMESTER, Mid Term EXAMINATION, 2018**

Semiconductor Physics & Devices

UEC03B03

Full Marks: 50

Time: 2 Hrs

-(Ans any 5 questions)

Q1. ~~X~~ Classify semiconductor materials.

~~X~~ What is a point lattice. What are the different symmetry elements underlying a point lattice

~~X~~ What is unit cell? Classify the different types of unit cells.

Q2. ~~X~~ Explain the structure of the unit cell of Silicon.

(ii) With reference to the bond model of intrinsic semiconductor

~~X~~ What are the different Particles that move about in the crystal at temperature greater than 0°K

b. Justify the statement "Free electrons and hole concentration at room temperature is very small fraction of the concentration of silicon atoms and their concentration increases with the increase in temperature"

~~X~~ What is the difference between Impact Ionization and Auger recombination?

Q3. With reference to the bond model of extrinsic semiconductor

~~X~~ Explain

a. Uniformly doped extrinsic semiconductor

b. Dilution approximation and its consequence

(ii) Plot and explain the pattern of the equilibrium concentration of majority carriers in a doped semiconductor as a function of temperature. Also identify and explain the different regions

~~X~~ State and explain the expression of the majority carriers in the different regions identified in Q3.(ii)

Q4. ~~X~~ Plot and discuss the location of fermi level with change in

a. impurity concentration

b. temperature

~~X~~ What is intrinsic temperature and state its significance. Discuss the dependence of intrinsic temperature on Energy gap and the doping level

(iii) A Si Sample is doped with  $10^{17}$  As atoms/cm<sup>3</sup>. What is the equilibrium hole concentration  $p_0$  at 300°K? What is the location of  $E_F$  relative to  $E_i$ ? Given  $n_i = 1.5 \times 10^{10}/\text{cm}^3$ .

Q5. (i) What is the difference between drift and diffusion current? Derive Einstein relation.

(ii) Derive the continuity equation.

(iii) Considering steady state hole injection derive the expression of Diffusion Length.

Q6. (i) Derive the expression of contact potential for a open circuited graded and step graded semiconductor.

(ii) Consider an open-circuited p-n junction. Explain and sketch the following curves as a function of distance. Use mathematical equations wherever relevant.

a. Space charge density

b. Electrostatic potential

c. Electron Energy band diagram

d. Electric field intensity