3003

B. Tech. 2nd Semester (CSE) Examination – July, 2021

SEMICONDUCTOR PHYSICS

Paper : BSC-PHY-103-G

Time : Three hours] *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. Attempt any *six* parts : $2.5 \times 6 = 15$

(a) When does an intrinsic semiconductor behaves as an insulator ? Explain.

(b) Explain the variation of conductivity of semiconductor with temperature.

(c) What is the phonon scattering ? Explain.

(d) What is the value of surface potential under flat band condition ?

(e) What is the difference between Ohmic and Rectifying junction ?

(f) What do you mean by effective mass of an electron ?

(g) What are heterojunctions ?

UNIT – I

2. Discuss the Kronig-Penny model for the motion of an e^- in a periodic potential. What is meant by the density of energy states ? Derive an expression. 15

3. (a) What is phonon scattering ? Explain how this scattering mechanism affects mobility of carrier. 5

(b) Explain direct and indirect band gaps and also give examples of materials related with these band gaps. 10

UNIT – II

4. (a) Obtain an expression for carrier density of an intrinsic semiconductors. Explain how the resistivity of an intrinsic semiconductor varies with temperature. 10

(b) Calculate the intrinsic carrier concentration in GaAs at T = 450 K. Given that $N_C = 4.7 \times 10^{17}$ c/ m^3; $N_V = 7 \times 10^{18}$ cm^{-3} at T = 300 K, Eg = 1.42 eV. 5

5. (a) Explain Schottky effect. Show that actual Schottky barrier height proportionately related to position of maximum barrier height due to Schottky effect. 10

(b) Desine an Ohmic contact for n-type GaAs using InAs with an intervening graded in InGaAs region. 5

UNIT – III

6. (a) Explain the concept of density of states for photons. https://www.mdustudy.com 7

(b) Define spontaneous, stimulated emission and absorption. 4

(c) How optical transitions takes place in bulk s/c ? 4

7. (a) State and explain Fermi's Golden Rule. 9

(b) What is photovoltaic effect ? 6

UNIT – IV

8. (a) What are Vander Paw measurements for carrier density, resistivity and hall mobility ? 9

(b) Write parameter extraction from diode I–V characteristics. 6

9. Write and explain design fabrication and characterization techniques for quantum wells, wires and dots. 15