

3003

B.Tech. (CSE) 2nd Semester (G-Scheme)
Examination, July-2022
SEMICONDUCTOR PHYSICS
Paper- BSC-(PHY-103-G)

Time allowed : 3 hours] [Maximum marks : 75

Note : *Question number 1 is compulsory. Student have to attempt five questions in all, selecting at least one from each unit. All questions carry equal marks.*

15 Marks

1. (i) How does the free electron gas differ from ordinary gas in some respects? $6 \times 2.5 = 15$
- (ii) Explain the heat developed in current carrying conductor.
- (iii) Why a pure semi conductor behave like an insulator at absolute zero?
- (iv) What do you mean by effective mass?
- (v) What is the effect of temperature on the conductivity of semiconductors?
- (vi) Write about photovoltaic effect.

Unit-I

2. (a) Derive an expression for the density of states and based on that calculate the carrier concentration in metals. 12

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- (b) Find the drift velocity of the copper wire whose cross-sectional area is 1 mm^2 when the wire carries a current of 20A. Assume that each atom contributes one electron to the electron gas. ($n = 8.5 \times 10^{28} \text{ m}^{-3}$) 3
3. (a) What are E-K diagrams? Explain. 6
- (b) Distinguish between metals, insulators and semi conductors. 9

Unit-II

4. (a) Derive an expression for intrinsic conductivity of semi conductor. 7
- (b) Show the energy band structure of an intrinsic semi conductor at 0 K and at room temperature. 8
5. (a) What are opto electronic devices? Give the principle, construction and working of a light sensitive device. 12
- (b) find the conductivity of copper at 300K. The collision time for electron Scattering in copper at 300K is $2 \times 10^{-14} \text{ S}$. Given that density of copper 8960 Kg/m^3 . Atomic weight of copper 63.54amu and mass of an electron is $9.1 \times 10^{-31} \text{ Kg}$. 3

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6. (a) What are excitons? Discuss the energy band model of a material containing excitons. 9
- (b) Write about spontaneous emission and stimulated emission. 6
7. What are the assumptions of Drude Model for free electron theory and derive the plasma frequency and dielectric function. 15

Unit-IV

8. (a) Discuss four probe method and Van der Pauw method for measurement of conductivity in semi-conductor materials. 12
- (b) What do you mean by density of states in 2D, 1D and 0D? 3
9. (a) Draw Volt-ampere characteristic of pn junction and find different parameters such as Δn_p , Δp_n , I_n , I_p and I_x . 12
- (b) A light emitting diode have a band gap of 1.9eV. Calculate the wavelength and colour of radiation emitted. 3

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