

7. Write short notes on the following :

- (a) Photovoltaic effect 5
- (b) Optical loss and gain 5
- (c) Exciton. 5

Unit IV

8. (a) Explain, how can you determine band gap of UV-VIS absorption spectroscopy ?
10
- (b) What are quantum wells ? Give some practical examples of quantum wells. 5
9. (a) Describe Heterojunction and associated band diagrams. 10
- (b) Write short note on density of states in 2D, 1D and 0D. 5

18A9

B. Tech. EXAMINATION, 2022

(First Semester)

(C Scheme) (Main & Re-appear)

(CSE)

PHY109C

SEMICONDUCTOR PHYSICS

Time : 3 Hours]

[Maximum Marks : 75

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

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory.

1. (a) Explain free electron theory of electrical conductivity in metals.

- (b) What are E-K diagrams ?
- (c) Define mean life time of charge carriers in semiconductors.
- (d) Explain optical refractive index and relative dielectric constant.
- (e) What are quantum wires ? **5×3=15**

Unit I

- 2. (a) Discuss the origin of energy bands in solids. How does it explain the behaviour of metals, semiconductors and insulators ? **8**
- (b) What is Fermi level ? What does it signify ? Discuss, how it changes with temperature and concentration of electrons ? **7**
- 3. (a) State and explain Kronig-Penny model of solids. **8**
- (b) Show that the probability that a state ΔE above the Fermi level E_F is filled equals the probability that a state ΔE below is empty. **7**

Unit II

- 4. (a) What do you understand by drift and diffusion currents in a semiconductor ? Derive Einstein relation relating to these currents. **10**
- (b) If a sample of silicon is doped with 3×10^{23} Arsenic atoms and 5×10^{23} atoms of Boron, determine the electron concentration if the intrinsic charge carriers are $2 \times 10^{16}/m^3$. **5**
- 5. (a) Draw the energy band diagram of an unbiased PN junction. Explain the terms :
 - (i) barrier energy
 - (ii) barrier potential
 - (iii) depletion region. **10**
- (b) How is a Schottky diode different from a PN junction ? **5**

Unit III

- 6. (a) Explain the terms :
 - (i) absorption
 - (ii) spontaneous emission
 - (iii) stimulated emission. **6**
- (b) Derive Fermi-Golden rule. **9**