

B. Tech. (CSE) 2nd Semester (G-Scheme)

Examination, May-2023

SEMICONDUCTOR PHYSICS

Paper-BSC-PHY-103-G

*Time allowed : 3 hours]*

*[Maximum marks : 75*

*Note : Attempt five questions in all, selecting at least one question from each unit. Question No. 1 is compulsory.*

1. (a) Discuss briefly the density of states.
- (b) State Bloch theorem and write Bloch function.
- (c) Draw Fermi levels for n-type and p-type semiconductors.
- (d) What are drift and diffusion current ?
- (e) Differentiate between spontaneous emission and stimulated emission.
- (f) What are heterojunction devices ?

$6 \times 2\frac{1}{2} = 15$

#### Unit-I

2. Explain the formation of energy bands separated by forbidden energy gap in solids on the basis of Kronig-Penney model. 15
3. Explain free electron model of metals ? What is meant by Fermi energy ? Calculate its value for free electron gas at 0K and discuss its significance. 15

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**Unit-II**

4. Derive an expression for the carrier concentration in extrinsic semiconductors and discuss the position of Fermi level. 15
5. (a) Discuss the quantitative theory of p-n junction diode. 10  
(b) Write a short note on Metal semiconductor junction (Ohmic and Schottky). 5

**Unit-III**

6. (a) What are Einstein's coefficients? Derive relation between them. 10  
(b) What is population inversion? Explain. 5
7. Drive an expression for the conductivity of metals on the basis of Drude model. 15

**Unit-IV**

8. Discuss UV-visible spectroscopy and how this technique can be used to determine the band gap of a semiconductor material. 15
9. What are 3D, 2D, 1D and 0D solids? Write density of states and explain the variation of density of states with energy in each case. 15