

300212**May, 2019****B.Tech. (CE/CSE/IT) II SEMESTER
PHYSICS (SEMICONDUCTOR PHYSICS) - BSC-101-D**

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Define density of states. (1.5)
- (b) What is direct and indirect bandgaps? (1.5)
- (c) Define Intrinsic and Extrinsic semiconductor. (1.5)
- (d) What is hole? How it is created? (1.5)
- (e) Define spontaneous emission and stimulated emission. (1.5)
- (f) What is joint density of states? (1.5)

- (g) Define Hall mobility and Hall coefficient. (1.5)
- (h) To calculate the probability that an energy state above E_F occupied by an electron at $T = 300$ K. Determine the probability that an energy level $3 kT$ above the Fermi energy is occupied by an electron. (1.5)
- (i) Define quantum wells, wires and dots. (1.5)
- (j) What is fabrication? (1.5)

PART-B

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2. (a) Explain Kroning–Penny model to introduce origin of band gap. (10)
- (b) Prove that for Kroing–Penny potential with $p \ll 1$, the lowest energy band at $k = 0$ is

$$E = \hbar^2 p / ma^2 \quad (5)$$

3. (a) What are transition rates? Explain Fermi's golden rule. (10)
- (b) Write short notes on photovoltaic effect. (5)
4. Explain distribution of electrons and holes in pure semiconductor and obtained the n_0 and p_0 equation. (15)
5. (a) What is the Van der Pauw method? How carrier density, resistivity and Hall mobility measured by this method? (10)
- (b) Explain Hot -point probe measurement. (5)

6. (a) What is Heterojunction solar cell? Explain Heterojunctions and associated band-diagrams. (10)
- (b) Explain (qualitatively) density of states in 1d, 2D and 0D. (5)
7. Write short notes on the following :
- (a) Metal-semiconductor junction.
- (b) Absorption /transmission measurement.
- (c) Drude model. (15)
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