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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

2. (a) Explain Kroning–Penny model to introduce origin of band gap. (10)

(b) Prove that for Kroing–Penny potential with $p << 1$, 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 Heterojuctions 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)
