Code : 105101

B.Tech 1st Semester Exam., 2019
(New Course)

PHYSICS

(Semiconductor Physics and Introduction
to Quantum Mechanics)

Time : 3 hours   Full Marks : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are **NINE** questions in this paper.

(iii) Attempt **FIVE** questions in all.

(iv) Question No. **1** is compulsory.

(v) Symbols used (if any) have their usual meanings.

1. Answer any *seven* of the following questions :

                                   2×7=14

   (a) What is diffusion?

   (b) Define Fermi level.

   (c) What is the physical significance of wave function?

   (d) What do you mean by indirect band gap semiconductor?

   (e) Define carrier generation.

   (f) What is stimulated emission?

   (g) Define occupation probability.

   (h) Define Heisenberg's uncertainty principle.

   (i) Write down rate equations for carrier density.

   (j) Define expectation values.

2. Discuss free electron theory, density of state and energy band diagrams.   14

3. Derive rate equations for carrier density. Also write a short note on LED.   14

4. Derive an expression for effective mass of an electron. What do you mean by 'negative' effective mass?   12+2=14

5. Discuss laser dynamics, relaxation oscillations and input-output characteristics of lasers.   14

6. Write short notes on the following : 14

   (a) Photoelectric effect

   (b) Wave and group velocity

   (c) Time dependent and independent Schrödinger equation

7. Write short notes on the following : 5+5+4=14

   (a) PIN and AVALANCHE

   (b) Probability current density

   (c) Intrinsic and extrinsic semiconductors

8. Write short notes on the following : 5+5+4=14

   (a) Carrier transport

   (b) Kronig-Penney model

   (c) Types of electronic materials

9. Write short notes on the following : 7+7=14

   (a) Radiative and non-radiative recombination mechanism in semiconductors

   (b) Semiconductor laser

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