

**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. <http://www.akubihar.com>
- (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
