

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

**B.Tech. (ECE) / (CSE) (Sem.-1,2)**  
**SEMI-CONDUCTOR AND OPTOELECTRONICS PHYSICS**

Subject Code : BTPH-105-18

M.Code : 75363

Date of Examination : 09-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

**1. Write briefly :**

- a) What are the basic assumptions of free electron gas model?
- b) What do you mean by knee voltage in p-n junction diode?
- c) What do you mean by occupation probability?
- d) What is the importance of carrier generation and recombination in semiconductors?
- e) What do you understand by the term density of states?
- f) What is non-radiative recombination mechanism in semiconductors?
- g) What do you mean by temporal coherence?
- h) What is the working principle of light emitting diodes?
- i) What do you understand by resistivity?
- j) What is the working principle of semiconductor LASER?

## SECTION-B

2. What do you mean by Fermi energy? Obtain an expression for the Fermi energy of a free electron gas in three dimensions.
3. Explain the periodicity character of the potential in crystals. State and prove Bloch theorem in this reference.
4. What is the difference between intrinsic and extrinsic semiconductors? Discuss in detail the dependence of Fermi level on carrier concentration and temperature.
5. a) What do you mean by metal-semiconductor junction? Discuss in detail Schottky metal-semiconductor junction.  
b) Explain the mechanism of diffusion and drift of charge carries in detail.

## SECTION-C

6. a) Discuss stimulated emission, absorption and spontaneous emission in detail.  
b) Derive the Einstein coefficients describing the probabilities of stimulated absorption and stimulated emission.
7. a) What is population inversion? How is it achieved?  
b) Write a note on Fermi's golden rule.
8. a) Discuss van der Pauw method for resistivity measurement in detail.  
b) Discuss Hot-point probe measurement method.
9. a) Write a note on capacitance-voltage measurements.  
b) How can we extract different parameters from I-V characteristics of diode?

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**