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Total No. of Pages: 02

Total No. of Questions: 09

**B.Tech (Sem. – 1,2)**  
**SEMI-CONDUCTOR PHYSICS**  
**Subject Code: BTPH-104-18**  
**M Code: 75360**  
**Date of Examination : 20-01-23**

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, carrying **EIGHT** marks each.
3. Attempt any **FIVE** questions from **SECTION B & C**, selecting atleast **TWO** questions from each of these **SECTIONS B & C**.

**SECTION-A**

**1. Write briefly:**

- a) Describe the main drawbacks of classical free electron theory.
- b) What do you understand by Fermi level? Explain its significance in semiconductors.
- c) What do you mean by effective mass of an electron?
- d) Enumerate some of the properties of semiconductors.
- e) What are Brillouin zones?
- f) Explain the terms: spontaneous and stimulated emission of radiation.
- g) What property of materials can be measured with Hot-point probe?
- h) Discuss salient characteristics of laser beam.
- i) What do you mean by population inversion?
- j) What do you mean by photovoltaic effect?

### SECTION-B

2. Derive an expression for Fermi energy of a system of free electrons. Discuss briefly the effect of temperature. (6+2)
3. Discuss the Kronig-Penny model. Using the model show the energy spectrum of electron consisting of a number of allowed energy bands separated by forbidden bands. (8)
4. Derive an expression for the densities of electrons and holes in the conduction and valence bands respectively of an intrinsic semiconductor. (8)
5. a) Distinguish between intrinsic and extrinsic semiconductors with suitable examples. (4)  
b) What do you mean by direct and indirect band gaps materials. (4)

### SECTION-C

6. Discuss Einstein's coefficient. Derive relation between them. (8)
7. How does a semiconductor laser differ from other laser? Explain main features of the semiconductor laser and its applications. (8)
8. Describe a method for the measurement of divergence and wavelength of light. What physical parameters can be extracted from current-voltage characteristics. (5+3)
9. Explain with a proper diagram about the measurement of carrier density and resistivity by four probe method. (8)

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