Roll No. | | | | | | | | | | | | | **Total No. of Pages: 02**

Total No. of Questions: 09

B.Tech (Sem. – 1,2)

SEMI-CONDUCTOR & OPTOELECTRONICS PHYSICS

Subject Code: BTPH-105-18

M Code: 75363

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) What are the main drawbacks of classical free electron theory?

b) What do you understand by Fermi level? Explain its significance in semiconductors.

c) State Bloch's theorem for a periodic system.

d) Explain why the conductivity of a pure semiconductor increases with temperature while that ofa metal decreases.

e) The energy gap in an LED is 1.5 eV. Find the wavelength of electromagnetic radiation it wouldemit.

f) Explain the terms: spontaneous and stimulated emission of radiation.

g) What property of materials can be measured with Hot-point probe?

h) What physical parameters can be extracted from I-V characteristics of the diode?

i) What do you mean by negative effective mass of electron?

j) What are the types of semiconductor photo detectors?

SECTION B

2. Define Fermi energy. Derive an expression for Fermi energy of a system of free electrons. (2+6)

3. Discuss the Kronig-Penny model for the motion of an electron in a periodic potential. (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) What do you mean by intrinsic and extrinsic semiconductors? (4)

   b) What do you mean by direct and indirect band gaps materials? (4)

SECTION-C

6. Describe the construction and working of a semiconductor laser with necessary diagram. (8)

7. What are light emitting diodes? Discuss the structure and characteristics of LEDs. (2+6)

8. What are photodiodes? Find an expression for total steady state diode photocurrent density for long diode. (2+6)

9. Illustrate with 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.