

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (AI & ML/CSE/DS/AI&DS/IT/Internet of Things and Cyber Security including Block Chain Technology) (Sem.-1,2)

SEMI-CONDUCTOR PHYSICS

Subject Code : BTPH-104-18

M.Code : 75360

Date of Examination : 31-05-2025

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 at least TWO questions from SECTION - B & C.**

SECTION - A

1. **Write briefly :**
 - a. Define Bloch's theorem.
 - b. Distinguish between direct and indirect bandgaps.
 - c. In a solid, consider the energy level lying 0.01 eV above Fermi level. What is the probability of this level being occupied by an electron at 200 K?
 - d. What are Ohmic junctions?
 - e. Classify metals in Conductor, semiconductor and insulator on the basis of energy band.
 - f. Define population inversion.
 - g. What is Fermi's golden rule?
 - h. Explain Photovoltaic effect.
 - i. When a laser has 3 V applied to it, it draws 30 mA and produce 3 mW of optical power. What is the efficiency of laser?
 - j. What are the necessary conditions for applying Van der Pauw method?

SECTION - B

2. What are the special features of Classical free electron theory of metals? Derive an expression for the thermal conductivity of a metal.
3. What is Kronig-Penny model? Solve Schrödinger wave equation for periodic potential and explain the origin of energy bands in solids.
4. Obtain the expression for electron density in an intrinsic semiconductor. Estimate the fraction of electrons in conduction band at room temperature in Ge with band gap 0.50eV.
5. What is the need of extrinsic semiconductors? Discuss the effect of temperature on the Fermi level in extrinsic semiconductors.

SECTION - C

6. What is joint density of states? Derive the expression for joint density of states.
7. What are Einstein coefficients? Obtain the relation between Einstein coefficients and discuss its importance.
8. Explain any method to measure the wavelength of monochromatic light. Can the same method be used for measuring wavelength of white light?
9. (a) What is Four-point probe method? Explain the measurement of band gap using it.
(b) The resistivity of an intrinsic semiconductor is $5.5 \Omega \text{ m}$ at 30°C and $3.0 \Omega \text{ m}$ at 42°C . Find the band gap.

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.