24000641

QP CODE: 24000641

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, MARCH 2024

Sixth Semester

CORE COURSE - PH6CRT12 - SOLID STATE PHYSICS

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

D2B6CF18

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What is primitive cell?
2. Discuss the NaCl structure.
3. List the properties of a reciprocal lattice.
4. What is Wiedemann-Franz law?
5. What is Bloch theorem?
6. Write down an expression for the electron concentration in the conduction band of an intrinsic semiconductor.
7. Explain the working principle of an LED?
8. Define piezoelectricity.
9. Write down the characteristics of diamagnetism in solids.
10. Show that diamagnetic susceptibility is independent of temperature.
11. Draw the temperature dependence of the resistance of a normal and superconducting material.
12. Prove that Superconductors are perfect diamagnets.

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. The Miller indices of a plane in a cubic crystal are (110). Find the ratio of the intercepts on the three axes.

14. The smallest angle for strong reflection of a beam of neutrons with a family of crystallographic planes of spacing 3.84 Å is 30 deg. Calculate the speed of the neutron beam required.

15. Evaluate the Medelung constant for a linear ionic crystal.

16. Determine the probability of occupancy of an energy level $2k_BT$ above the Fermi energy.

17. The resistivity of intrinsic silicon at room temperature is 3000 ohm m. Calculate the intrinsic carrier density. Given electron mobility = 0.14 m^2/V-s and hole mobility = 0.05 m^2/V-s.

18. A solid contains 5×10^{28} atoms/m^3 each with a polarisability of 2×10^{-40} F m^2. Assume that the internal field is given by Lorentz formula. Calculate the ratio of internal field to the external field $\varepsilon_o = 8.854 \times 10^{-12}$ Fm^{-1}.

19. For a specimen of V_3Ga the critical fields are respectively 1.3×10^5 A/m and 4.2×10^5 A/m at 15 K and 13 K respectively. Calculate its transition temperature and the critical field for 0 K and 5 K.

20. A Josephson junction having a voltage of 8.50 μV across its terminals, then calculate the frequency of the alternating current. [Planck's constant = 6.626×10^{-34} J-sec]

21. Briefly explain the concepts of BCS theory.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Determine the coordination number and packing density for a hexagonal close-packed structure. Show that an hcp structure demands an ideal value of 1.63.

23. Write short note on the origin of (a) covalent bonding (b) metallic bonding (c) hydrogen bonding and (d) van der Waals bonding.

24. Obtain an expression for the effective mass of an electron in a crystal. Explain the reason for the negative effective mass.

25. Explain ferromagnetism. Discuss the Weiss theory of ferromagnetism and obtain the Curie-Weiss law in ferromagnetism.

(2×10=20)