TB256709Q

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025

2018, 2019, 2020, 2021 ADMISSIONS SUPPLEMENTARY

SEMESTER VI - CORE COURSE (PHYSICS)

PH6B12B18 - Condensed Matter Physics

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 mark **(10x1=10)**

1. Explain the term Bravais lattices.
2. Distinguish between primitive and non primitive translation vectors.
3. Why is not practical to determine the structure of the crystal by Laue's method?
4. Explain how conductivity varies with temperature in metals and semiconductors.
5. Discuss the difference in the nature of potential used in free electron theory and band theory
6. Draw the energy level diagram of a p type and semiconductor and label it.
7. Distinguish between intrinsic and extrinsic semiconductors.
8. Give a short note on polymers.
9. Give an expression for Weiss field.
10. Explain Polarization catastrophe.
11. Superconducting state is more ordered that normal state. Justify this result based on the results of entropy measurements.
12. Explain the term persistent current in superconductors.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Mention the steps to calculate the Miller indices of a plane. Also calculate the Miller indices of a plane that makes intercepts of 1$\mathring{A}$, 2$\mathring{A}$ and 3$\mathring{A}$ on the crystallographic axes of an orthorhombic crystal with a:b:c = 3:2:1.
14. Find the interplanar spacing of (321) planes of Copper which has an fcc structure having atomic radius 0.1278 nm.
15. Compare the wave functions of an electron moving through a constant potential and periodic potential. Express the wave functions mathematically.
16. Give the postulates of Drude - Lorentz theory. Discuss any three properties of metals that could be explained with this theory.
17. Obtain the conductivity of a pure germanium crystal at 300K assuming that the intinsic carrier concentration at this temperature is $2.5 \times 10^{13}/cm^3$. Given that the electron and hole mobilities are $3600cm^2/Vs$ and $1700cm^2/Vs$ respectively.
18. Describe the electron beam deposition technique of thin films.
19. Determine the percentage of ionic polarizability in Sodium Chloride Crystal which has the optical index of refraction and the static dielectric constant as 1.5 and 5.6 respectively.
20. Explain the transition of Ferromagnets into paramagnets.
21. The transition temperature of a superconducting material with an average mass of 200amu is 4K. Determine the transition temperature of its isotope having an atomic mass 206 amu.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Discuss the principle behind X-ray diffraction and explain powder method of X-ray diffraction.
23. Discuss the concept of effective mass and also explain its significance. Show that the effective mass of an electron in a crystal is inversely proportional to the second derivative of the E-k curve.
24. Explain the significance of Hall effect and obtain an expression for Hall voltage.
25. Describe the factors that led to the development of London equations and derive the equations. Explain how these equations could explain the flux penetration observed in thin film superconductors.