



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

SIXTH SEMESTER – APRIL 2017

PH 6612- SOLID STATE PHYSICS

Date: 22-04-2017
09:00-12:00

Dept. No.

Max. : 100 Marks

PART-A

Answer ALL questions:

(10X2=20 Marks)

1. Define Unit cell and lattice.
2. What is dislocation?
3. Why X-ray diffraction is observed only in crystals?
4. Mention any two applications of Laue's method.
5. State Dulong and Petit's law.
6. Write Gruneisen relation and mention its significance.
7. What are the merits of free electron theory?
8. Define Hall coefficient.
9. What is Meissner effect?
10. What are Cooper pairs?

PART-B

Answer any FOUR questions:

(4X7.5=30 Marks)

11. (a) Explain vacancy and interstitial defects in crystals. (5)
(b) What are the effects of defects in solids? (2.5)
12. (a) State and Explain Bragg's law. (4)
(b) A beam of X-rays is diffracted by the (111) plane of nickel crystal at an angle $28^{\circ}30'$. Calculate the wavelength of the X-rays. Nickel has face centered cubic structure and its lattice parameter is 3.52\AA . (3.5)
13. Calculate the number of possible modes of vibrations in the frequency range $\nu+d\nu$ in a solid.
14. Derive an expression for thermal conductivity in terms of the electronic properties of the metal and deduce Wiedemann-Franz law.
15. (a) Differentiate between Type I and Type II superconductors. (5)
(b) Explain the role of superconductivity phenomena in levitation. (2.5)
16. (a) What is crystal symmetry? Explain the translation symmetry elements exhibited by crystals. (4)
(b) Show that five-fold symmetry is not compatible with a lattice. (3.5)

PART-C

Answer any FOUR questions:

(4X12.5=50 Marks)

17. (a) Explain the fourteen Bravais lattices with suitable diagrams. (10)
(b) Illustrate the planes (100), (010), (001), (111) and (110) in a simple cubic structure. (2.5)
18. Discuss powder diffraction method of investigating the structure of crystalline solids with necessary diagrams.
19. How does the Debye model differ from Einstein model? Mention the essential differences and note the consequences.
20. Show that Pauli's spin paramagnetism of a free electron metal is given by $\chi_p = \frac{3}{2} \left(\frac{n\mu_B^2}{kT_F} \right)$
21. (a) Obtain London equation by applying Meissner effect. (6)
(b) Explain Josephson Effect. (6.5)
22. (a) Write a note on neutron diffraction. (5)
(b) Calculate the frequency which the Josephson junction emits when the voltage across is 5 V. (2)
(c) Estimate the Debye temperature of gold if its atomic weight is 197, density is $1.9 \times 10^4 \text{ kgm}^{-3}$ and the velocity of sound is 2100 ms^{-1} . (5.5)
