



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

SIXTH SEMESTER – APRIL 2013

PH 6610/PH 6606 - SOLID STATE PHYSICS

Date: 27/04/2013
Time: 1:00 - 4:00

Dept. No.

Max. : 100 Marks

PART – A

Answer all questions. All questions carry equal marks:

(10x2=20 marks)

1. Define primitive cell.
2. Iron crystallizes in BCC structure and its atomic radius $r = 0.62\text{\AA}$. Calculate the lattice parameter and hence the primitive cell volume.
3. State Bragg's law.
4. How neutron diffraction differs from x-ray diffraction?
5. State Dulong-Petit's law.
6. Write the Debye temperature in terms of number of phonon modes in a 3D solid.
7. Define electrical conductivity in Sommerfeld theory.
8. What are the failures of free electron theory?
9. What is Meissner effect?
10. What are Cooper pairs?

PART – B

Answer any FOUR questions:

(4x7.5=30marks)

11. Describe the Bravais lattices in three dimension along with the restrictions on cell axes and angles.
12. Explain the condition for diffraction to occur by deriving the Laue's equations.
13. Derive an expression for specific heat capacity using Einstein model. Explain its behavior in high and low temperature range.
14. Explain how the mobility of electrons is determined using Hall effect.
15. Explain in the theoretical reasoning the Type I and Type II super conductivity.

PART – C

Answer any FOUR questions:

(4x12.5=50marks)

16. a) What are Miller indices? Write the procedure for finding the Miller indices of a given plane.
b) Determine the Miller indices of a plane that makes intercepts of 2\AA , 3\AA , 4\AA on the coordinate axes of an orthorhombic crystal with $a:b:c = 4:3:2$. (7.5 +5)

17. a) Explain the determination of crystal structure using powder method.
- b) Determine the Lattice parameter of nickel (FCC) if the Bragg's angle for its (2 2 0) reflection is $38^{\circ}12'$ and the wavelength of the x-ray used is 1.54\AA . (9 + 3.5)
18. a) Explain the thermal expansion of a solid which has an harmonic potential energy.
- b) Obtain an expression for the coefficient of thermal conductivity of a solid. (6 + 6.5)
19. Obtain an expression for the Fermi energy of a free electron gas in 3 dimensions and deduce the expression for density of states. (8 + 4.5)
20. Write notes on:
- a) BCS theory of superconductivity
- b) Josephson effect. (6 + 6.5)

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