

**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**B.Sc. DEGREE EXAMINATION – PHYSICS**

**SIXTH SEMESTER – NOVEMBER 2015**

**PH 6612 - SOLID STATE PHYSICS**

Date : 11/09/2015

Dept. No.

Max. : 100 Marks

Time : 09:00-12:00

**PART - A**

Answer **ALL** the questions.

(10×2=20)

1. Define the term Space lattice.
2. What is Burgers vector?
3. What are Laue spots?
4. Explain the advantages of neutron diffraction over electron diffraction?
5. State Dulong and Petit's law.
6. What are the merits of Einstein's theory of specific heat of solids?
7. What are the drawbacks of classical free electron theory of metals?
8. State and explain Wiedemann Franz law.
9. State any four important properties of superconductors.
10. What is a Cooper pair?

**PART - B**

Answer any **FOUR** questions.

(4×7.5=30)

11. Classify the 14 Bravais lattices into 7 crystal systems together with their specifications.
12. Briefly describe the powder X-ray diffraction method.
13. Derive an expression for lattice heat capacity in Einstein's model.
14. Obtain an expression for the density of states for a free electron gas in three dimensions.
15. Prove that the susceptibility of a superconductor is -1 and relative permeability is zero. (4.5+3)
16. (a) Distinguish between Type I and Type II superconductors. (5)  
(b) State and explain classical Hall effect in metals. (2.5)

**PART - C**

Answer any **FOUR** questions.

(4×12.5=50)

17. (a) What are Miller indices? Describe the general procedure in finding Miller indices. (2+8)  
(b) A crystal plane cuts at 3a, 4b and 2c along the crystallographic axes. Find the Miller indices. (2.5)

18. Explain (i) Laue method and (ii) Rotating crystal method to determine the crystal structure. (6+6.5)
19. (a) How does the Debye model differ from the Einstein model? (2.5)  
(b) Obtain an expression for the specific heat capacity of a solid on the basis of Debye model. (10)
20. (a) What are the assumptions of Sommerfeld model? (2.5)  
(b) Derive an expression for the electrical conductivity based on Sommerfeld model. (10)
21. (a) Explain BCS theory of superconductivity. (5.5)  
(b) Discuss (i) dc Josephson effect and (ii) ac Josephson effect. (3.5+3.5)
22. Write notes on:
- (i) Magnetic levitation (4.5)
  - (ii) Crystal imperfections (4)
  - (iii) Paramagnetism of free electron (4)

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