

SEM	SET	PAPER CODE	TITLE OF THE PAPER
IV	2013	12PPH4113	CONDENSED MATTER PHYSICS

**SECTION – A****Answer all the questions:****20 x 1 = 20****Choose the correct answer:**

- The packing efficiency of simple hexagonal lattice
  - 60%
  - 68%
  - 74%
  - 100%
- The diffusion coefficient  $D$  depends on
  - Temperate
  - Nature of the medium
  - Nature of the diffusion atoms
  - All the above
- The value of Lorentz number in electrical conductivity is
  - $2.45 \times 10^8 \text{w}\Omega/\text{deg}^2$
  - $2.45 \times 10^{-8} \text{w}\Omega/\theta^2$
  - $2.45 \text{w}\Omega/\theta^2$
  - None
- The spontaneous polarization \_\_\_\_\_ with temperature.
  - Increase
  - Decrease
  - Remain independent
  - None
- The permanent magnetic moments arises by
  - Orbital electrons
  - Spin of electrons
  - Spin of nucleus
  - All the three

**Fill in the blanks:**

- The identification of material is done by \_\_\_\_\_ in physics.
- The Debye model gives \_\_\_\_\_ of frequencies.

8. For a thin insulating layer \_\_\_\_\_ electrons can tunnel even at zero potential difference.
9. The operating temperature limit for silicon devices \_\_\_\_\_.
10. The paramagnetism is found in \_\_\_\_\_ number of electrons system.

**State True or False:**

11. The edge and screw dislocations are line imperfections.
12. The number of modes must be equal to the number of degrees of freedom in the lattice during lattice vibration.
13. The electron orbit in r-space is similar in shape and scale factor in with the K-space.
14. At low temperatures, the phonon scattering is predominant.
15. The cluster of  $10^9$ - $10^{15}$  atoms forms a domain in ferromagnetism.

**Answer in one or two sentences:**

16. Define Identity Period.
17. Give an expression to interrelate coefficient of thermal expansion and specific heat of the solid.
18. Define carrier mobility in conductors.
19. Define polarization.
20. How ferri-magnetic materials are formed?

**SECTION – B**

**Answer all the questions:**

**5 x 6 = 30**

21. a. Show that the ratio between light and inter atomic distance of Hexagonal close packing system is 1.633.

**OR**

- b. Give the geometrical interpretation and physical meaning of Bragg's equation.
22. a. Obtain Fick's second law of diffusion.

**OR**

- b. What is Anharmonicity in Lattice vibrations? Discuss its effects.
23. a. Explain the variation of electrical conductivity with temperature and hence explain Matthiessen's rule.

**OR**

- b. List the characteristics feature of the Fermi surfaces.
24. a. What is Hall Effect? Derive an expression for the Hall Co-efficient of semiconductor.

**OR**

- b. Obtain Clausius – Mosotti equation.
25. a. Give the Langevin's classical theory of paramagnetism.

**OR**

- b. Explain in detail, the temperature dependence of spontaneous magnetization.

### **SECTION – C**

**Answer any FOUR questions:**

**4 x 12.5 = 50**

26. With schematic representation, give an account of powder method experimental set up and of crystal structure analysis.
27. On the basis of Debye model, derive an expression for the specific heat of solids. Also discuss the variation of Debye specific heat with temperature.
28. Describe the nearly free electron model to find the electron energy bands in solids. Also show that the energy bands are discontinuous at the zone boundaries.

29. Discuss in detail, semiconductor-semi conductor (P-N) junction properties.
30. Discuss in detail, the origin of permanent Magnetic Moments in materials.

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