

18. (a) How does the band theory of solid lead to the classification of solids into conductors, semiconductors and insulators.

Or

- (b) Derive the magnitude of energy gap from the nearly free electron model of an electron in a solid.

19. (a) Calculate the specific heat of a free electron gas by using Fermi-Dirac distribution. Explain the physical significance.

Or

- (b) Derive the electronic specific heat capacity and explain how this agree with the experimental results.

20. (a) Give an account of Weiss theory of ferromagnetism. On the basis of this theory how will you explain hysteresis and Curie point?

Or

- (b) Obtain an expression for paramagnetic susceptibility of free electrons on the basis of the classical laws. Discuss its inadequacy using Pauli's spin paramagnetism.

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M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2011.

Third Semester

Physics

SOLID STATE PHYSICS – I

(For those who joined in July 2008 and afterwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

1. What is exchange interaction?
2. Define crystal lattice and basis.
3. What is polariton?
4. What are phonons?
5. What do you mean by energy gap?
6. What do you understand by effective mass of charge carrier?

7. Write down the Ohm's law in terms of current density.
8. What are significance of Fermi level in metals and semiconductors?
9. Draw the B-H curve for a ferromagnetic material.
10. What are the origins of ferromagnetic domains?

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) What is coordination number? Obtain the coordination number for SC, BCC, and FCC lattices.
Or
(b) Describe the hydrogen bonded crystals with suitable example.
12. (a) Draw the polariton dispersion curve of coupled modes of photons and transverse optical phonons in an ionic crystals Explain.
Or
(b) Explain the vibration of linear mono-atomic lattice.
13. (a) Classify materials into metals, semiconductors and insulators. Explain the basis on which this classification is made.
Or
(b) Discuss the number of orbitals in a band.

14. (a) Explain free electron theory of electrical conductivity in metals.
Or
(b) Write down the Fermi-Dirac distribution function. Plot it as function of energy at different temperature.
15. (a) Explain the phenomenon of hysteresis in ferromagnets.

Or

- (b) Write a note on thermal excitation of magnons.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Describe the sodium chloride structure and hexagonally close packed structure and give examples.
Or
(b) Describe the ionic crystals and then derive the Madelung energy.
17. (a) Describe the phonon-photon interaction and hence derive the LST relation.
Or
(b) Describe the theory of phonons in a linear diatomic lattice.