

APRIL/MAY 2019

MPH42 — CONDENSED MATTER PHYSICS

Time : Three hours

Maximum : 75 marks

SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

1. (a) Deduce an expression for the cohesive energy of an ionic crystal.
Or
(b) Write the procedure for finding Miller indices of a given plane. Also write the important features of Miller indices.
2. (a) What do you understand by phonons? Mention some important characteristics of phonons.
Or
(b) Discuss the inelastic scattering of photons by phonons.
3. (a) Describe an experiment for the determination of Hall coefficient.
Or
(b) Give the characteristics of Fermi surfaces.

4. (a) State and explain Hund's rule.
Or
(b) Explain the Heisenberg's exchange interactions in ferromagnets.
5. (a) State and explain Meissner effect.
Or
(b) Find the critical current for a wire of lead having a diameter of 1mm at 4.2K. The critical temperature for lead is 7.18K and $H_c(0) = 6.5 \times 10^4$ A/m.

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. Obtain the boundaries of the primitive unit cell for BCC and FCC lattices using reciprocal lattice vector.
7. Derive the vibrational modes of one dimensional monoatomic lattice.
8. Give an account of de Hass-Van Alphen effect.
9. Give the theory of ferromagnetism.
10. Discuss the thermodynamics of superconducting transitions. Obtain an expression for the difference in specific heat between normal and superconducting states near absolute zero.

