Reg. No. : ....

Code No. : 6860　　　**Sub. Code : PPHM22**

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Second Semester

Physics — Core

CONDENSED MATTER PHYSICS

(For those who joined in July 2017 onwards)

Time : Three hours　　　　　　　Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. Which of the following metals crystallizes in fcc structures?

   (a) Aluminium　　　　　(b) Zinc

   (c) Sodium　　　　　　 (d) Caesium chloride

2. The number of diad axes of symmetry elements that are present in a cubic crystal are

   (a) 1　　　　　　　　　(b) 3

   (c) 2　　　　　　　　　(d) 6

3. Magnon is a quantized

   (a) Spinwave   (b) Thermal wave

   (c) Photon   (d) Neutron

4. The wavevector (K) range of the first Brillouin Zone is

   (a) $-\pi < K \leq \pi$

   (b) $\dfrac{-\pi}{a} < K \leq \dfrac{\pi}{a}$

   (c) $0 < K \leq \pi$

   (d) $0 < K \leq \dfrac{\pi}{a}$

5. Magnet recording tape is most commonly made from

   (a) small particles of iron

   (b) silicon-iron

   (c) ferric oxide

   (d) metallic glass

6. The Hall probe used to measure magnetic fields contains

   (a) only P-type semiconductor

   (b) only N-type semiconductor

   (c) metal sample

   (d) either (a) or (b)

7. In a ferromagnetic material, the spins are aligned parallel

   (a) below a critical temperature

   (b) at all temperatures

   (c) above a critical temperature

   (d) at a critical temperature

8. At Neel temperature

   (a) permeability is minimum

   (b) permeability is maximum

   (c) susceptibility is minimum

   (d) susceptibility is maximum

9. The factor responsible for spontaneous polarization is

   (a) free electrons   (b) atoms

   (c) permanent dipoles   (d) none of these

10. The transition temperature of most superconducting elements lie in the range

   (a) 10K to 20K   (b) Zero to 10K

   (c) 20K to 50K   (d) above 50K

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Explain the Brava's lattices in three dimensional.

    Or

    (b) Write a note on crystals of inert gases.

12. (a) Explain inelastic scattering by phonons.

    Or

    (b) Explain the vibrational modes of a finite one-dimensional lattice of identical atoms.

13. (a) Discuss in detail heat capacity of the electron gas.

    Or

    (b) What are the salient features of the "free electron gas" model? Obtain the Ohm's law based on it.

14. (a) Explain classical theory of diamagnetism.

    Or

    (b) State and explain Hand rules.

15. (a) Explain ferroelectric domains.

Or

(b) Give an account BCS theory on superconductivity.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain elastic waves in cubic crystals.

Or

(b) Explain elastic compliance and stiffness constants.

17. (a) Explain phonons momentum.

Or

(b) Derive the expression for optical and acoustic branch of phonon dispersion relations for case of two atoms for primitive basis.

18. (a) Give the theory of Hall effect in the case of a semiconductor.

Or

(b) Discuss the Kroning-Penney model for the motion of an electron in a periodic potential.

19. (a) Explain quantum theory of paramagnetism.

Or

(b) Explain antiferro magnetic order.

20. (a) Explain thermodynamics of superconducting transition.

Or

(b) Derive an expressions for London equation and penetration depth.

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