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R – 6581

Reg. No. :

Name :

Fourth Semester M.Sc. Degree Examination, July 2023

Physics

PH 241 : CONDENSED MATTER PHYSICS

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

PART – A

Answer any **five** questions. Each question carries **3** marks.

1. Define phonon and phonon momentum.
2. Write a short note on thermal resistance of solid.
3. Explain Wiedemann Franz Lorentz law.
4. Write a short note on Lorentz field.
5. Write Clausius Mosotti equation and explain the term polarizability.
6. What do you mean by critical current.
7. Explain Meissner effect.
8. Briefly explain how AFM can be used for biological samples.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **all** questions. Each question carries **15** marks.

9. Discuss Debye theory of specific heat.

OR

10. Discuss nearly free electron model of solids.

11. Discuss different polarization mechanisms and derive Clausius–Mosotti relation.

OR

12. Explain Langevin theory of paramagnetism.

13. Discuss BCS theory of superconductor and explain the term penetration depth.

OR

14. What do you mean by electron microscopy and explain the working of SEM.

(3 × 15 = 45 Marks)

PART – C

Answer any **three** of the following questions. Each question carries **5** marks.

15. Estimate the Debye temperature of gold if its atomic weight is 197, the density is $1.9 \times 10^4 \text{ Kg/m}^3$ and the velocity of sound is 2100 m/s .

16. Show that the reciprocal lattice of BCC is face centered.

17. The intrinsic carrier density at 300 K in silicon is $1.5 \times 10^{16} / \text{m}^3$. If the electron and hole mobilities are 0.13 and $0.05 \text{ m}^2 \text{V}^{-1} \text{s}^{-1}$, respectively. Calculate the conductivity of intrinsic silicon and silicon containing 1 donor impurity atom per 10^8 silicon atom.

18. The magnetic intensity in a piece of ferric oxide is 10^6 A/m . If the susceptibility of the material at room temperature is 1.5×10^{-3} , Calculate the flux density and magnetization of the material.

19. Calculate the critical current for a wire of lead having a diameter of 1 mm at 4.2 K. critical temperature for lead is 7.18 K and $H_c(0) = 6.5 \times 10^4 \text{ A/m}$.

20. Discuss Sol gel technique for the nanomaterial preparation.

(3 × 5 = 15 Marks)