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Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, July 2023

Physics with Specialization in Nano Science/Physics with Specialization in Space Physics

PHSP 533/PHNS 533 – CONDENSED MATTER PHYSICS

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

SECTION – A

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

1. Explain the concept of reciprocal lattice.
2. Write a short note on thermal conductivity of solids.
3. Explain Hall effect.
4. Discuss the temperature dependence on the mobility of charge in semiconductors.
5. Write a short note on Lorentz field.
6. Explain atomic theory of magnetism.
7. Explain Meissner effect.
8. Briefly explain CVD and what are the basic chemical reactions involved in CVD process.

(5 × 3 = 15 Marks)

P.T.O.

SECTION – B

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

9. Define specific heat and discuss the classical and debye model of specific heat.

OR

10. Discuss Kroning Penny model of band theory and its inferences.

11. Explain the term polarizability and discuss classical theory of electronic polarazability.

OR

12. Discuss the carrier concentration in intrinsic and extrinsic p type and n type semiconductors

13. Explain BCS theory of superconductivity and flux quantization.

OR

14. Discuss two non-lithographic preparation techniques for the nanomaterial.

(3 × 15 = 45 Marks)

SECTION – C

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

15. The Debye temperature for diamond 2230 K. Calculate the highest possible vibrational frequency and the molar heat capacity of diamond at 10K.

16. Show that five-fold rotation axis is not compatible with a lattice.

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

    (a) intrinsic silicon and

    (b) silicon containing 1 donor impurity atom per 10^8 silicon atom.

18. A paramagnetic salt contains 10^{28} ions/m^3 with magnetic moment of one Bohr magneton. Calculate the paramagnetic susceptibility and the magnetization produced in a uniform magnetic field of 10^6 A/m at room temperature of 300K.

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

20. Discuss the working principle of SEM.

(3 × 5 = 15 Marks)