U – 6231

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Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, March 2025

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

PART – A

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

1. Explain Bravais lattices.
2. Differentiate Phonons and Photons.
3. What is Hall effect ? Explain.
4. What is Wiedmann Franz law?
5. Explain the mobility of charge carriers in semiconductors.
6. What is meant by ferroelectricity?
7. Explain London penetration depth.
8. What are Carbon nano tubes?

(5 × 3 = 15 Marks)

P.T.O.

PART– B

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

9. (a) Discuss the vibrations of monoatomic linear lattice

   (b) Explain the dispersion curve.

OR

10. (a) Explain Einstein's model of specific heat capacity

    (b) Explain how Debye modified it.

11. (a) Explain the free carrier concentration in semiconductors.

    (b) Derive the expressions for charge densities in n type and p type semi conductors.

OR

12. (a) What are paramagnetic substances?

    (b) Explain the quantum theory of paramagnetism.

13. (a) What is superconductivity?

    (b) Discuss BCS theory of Superconductivity.

OR

14. (a) Explain Transmission electron microscopy

    (b) Compare it with scanning electron microscopy.

(3 × 15 = 45 Marks)

PART – C

Answer any **three** questions. Each question carries **5** marks.

15. The distance between consecutive (111) planes in a cubic crystal is 2Å. Determine the lattice parameter.

16. The Debye temperature for copper is 340 K. Calculate the molar heat capacity of diamond at 30 K.

A uniform silver wire has a resistivity of 1.54×10^{-8} Ωm at room temperature. For an electric field along the wire of 1 Volt/cm, compute the average drift velocity of the electrons, assuming that there are 5.8×10^{28} conduction electrons/m^3. Also calculate the mobility of electrons.

18. A uniform copper wire of length 0.5 m and diameter 0.3 mm has a resistance of 0.12 Ω at 293 K. If the thermal conductivity of the specimen at the same temperature is 390 $Wm^{-1}K^{-1}$. Calculate the Lorentz number.

19. The penetration depth of mercury at 3.5 K is about 750 Å. Estimate the penetration depth at 0 K.

20. Find the conductivity of an intrinsic germanium rod which is 1 cm long. The intrinsic carrier density at 300K is 2.5×10^{19} m^{-3} and the mobilities of electron and hole are 0.39 and 0.19 $m^2V^{-1}s^{-1}$ respectively.

(3 × 5 = 15 Marks)