Reg. No ....   Name **24P2032**

M. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2024
SEMESTER 2 - PHYSICS
COURSE : **21P2PHYT07 - CONDENSED MATTER PHYSICS**
(For Regular 2023 Admission and Improvement/Supplementary 2022/2021 Admissions)

Duration : Three Hours   Max. Weights: 30

PART A
Answer any 8 questions   Weight: 1

1. What is meant by doping?   (A)
2. Write down the co-ordination number of simple cubic, body centered cubic and face centered cubic lattices?   (A)
3. Explain the concept of negative mass on the basis of band theory?   (R)
4. How is the paramagnetic susceptibility of conducting electrons calculated?   (R)
5. What is meant by acoustical mode of wave propagation in diatomic crystal?   (U)
6. Enumerate some properties of semiconductors?   (U, CO 2)
7. Draw the B-H curve for a ferromagnetic material and identify the retentivity and coercive field on the curve. What is the energy loss per cycle?   (An, CO 2, CO 4)
8. Draw (110) plane?   (U)
9. Explain the term 'donors' ?   (A)
10. Schematically show, how Fermi energy varies for a metal at 0 K and room temperature?   (A, CO 3)

                                                                            (1 x 8 = 8)

PART B
Answer any 6 questions   Weights: 2

11. Calculate the energy of an electron in the energy state immediately above the lowest energy level in a cubic box of side 1 A^0.   (E)

12. The first order spectrum of a beam of X-rays diffracted by a silicon crystal corresponds to an angle of 30. The distance between the corresponding parallel planes is 3 A^0. Calculate the wavelength of X-rays used?   (U)

13. The applied magnetic field in copper is 10^7A/m. If the magnetic susceptibility of the copper is -0.6x10-4, calculate the magnetic flux density and magnetization in copper.   (An)

14. A beam of X-rays incident on a sodium chloride crystal (lattice spacing 0.282 nm), the first order Bragg reflection is observed at a glancing angle of 8°35'. What is the wavelength of X-rays? At what angles would be the second order and third order Bragg's reflections occur?   (E)

15. State and prove Bloch theorem?   (A)

16. The density of sodium chloride is 2.18 g/cc. Determine the lattice constant. Given structure is fcc and molecular weight is 58.5g. Give the unit of molecular weight.   (A)

17. In a p-type semiconductor, the Fermi level lies 0.8 eV above the valence band. If the concentration of the acceptor atom is tripled, find the new position of the Fermi level? (A)

18. Give an account on the quantization of lattice vibrations. (An)

(2 x 6 = 12)

PART C
Answer any 2 questions   **Weights: 5**

19. Briefly explain (i) Domain theory of ferromagnetism (ii) Explain magnetic hysteresis in the case of ferromagnets? (An)

20. Write a note on quantization of lattice vibrations. Discuss the energy and momentum conservation law for neutron inelastically scattered by phonons. (A)

21. Discuss Bragg's law and Laue equations for diffraction of X-rays by a crystalline solid. Show that Bragg's law is a special case of Laue equations. (A)

22. Obtain the vibrational spectrum of a linear diatomic lattice and show that the spectrum consists of two branches. (An)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 2	Effectively communicate the knowledge of their study and research in their respective disciplines to their stakeholders and to the society at large.	E	6, 7	2
CO 3	Make choices based on the values upheld by the institution, and have the readiness and know-how to preserve the environment and work towards sustainable growth and development.	An	10	1
CO 4	Develop an ethical view of life and have a broader (global) perspective transcending the provincial outlook.	Cr	7	1

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;