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

Duration : Three Hours   Max. Weights: 30

PART A
Answer any 8 questions   Weight: 1

1.	Draw a neat diagram illustrating the lattice parameters of a unit cell?	(U)
2.	Calculate the packing fraction of Simple cubic structure?	(A)
3.	Write down the co-ordination number of simple cubic, body centered cubic and face centered cubic lattices?	(A)
4.	What do you meant by periodic zone scheme of Brillouin zone?	(R)
5.	List any two drawbacks of Drude-Lorentz model?	(A)
6.	Define mean life time of carriers?	(U)
7.	What is meant by Optical mode of wave propagation in linear diatomic crystal	(U)
8.	What are the different branches of the phonon dispersion curves of a linear diatomic lattice? Why are they called so?	(An)
9.	Write down the expression for Curie-Weiss law in ferromagnetism and explain its temperature dependance?	(R)
10.	Obtain the relation between magnetic induction, magnetization and magnetizing field?	(R)

(1 x 8 = 8)

PART B
Answer any 6 questions   Weights: 2

11.	In a crystal, lattice planes cut intercepts of length 2a, 3b and 4c along X, Y and Z axes. Find the Miller indices of the plane?	(A)
12.	Lattice constant of a cubic lattice is a. Calculate the spacing for (211) and (001) planes?	(E)
13.	The lattice constant of a cubic crystal is 6.23 A^O. What is the interplanar spacing between the (111) planes?	(A)
14.	Find the lowest energy of an electron confined to move in a three dimensional potential box of length 0.8 A^O	(A)
15.	Explain the construction of Brillouin zones by applying it to a 2-dimensional square lattice?	(E)
16.	In a p-type semiconductor, the Fermi level lies 0.4 eV above the valence band. If the concentration of the acceptor atom is tripled, find the new position of the Fermi level?	(E)

17. The intrinsic carrier density at room temperature in germanium is $2.37 \times 10^{19}/m^{-3}$. If the electron and hole mobilities are 0.38 and 0.18 $m^2V^{-1}s^{-1}$, respectively. Calculate the resistivity of the intrinsic germanium. **(E)**

18. An iron rod 0.2 m long, 10 mm diameter and of relative permeability 1000 is placed inside a long solenoid wound with 300 turns/m. If a current of 0.5 A is passed through the coil, find the magnetic moment of the rod? **(A)**

(2 x 6 = 12)

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

19. Obtain expression for wave function and energy eigen values for electrons confined to a line of length L. Derive expression for Fermi energy and density of states **(R)**

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

21. Discuss Debye model of lattice heat capacity. Derive an expression for it. **(An)**

22. Give an account of Wiess theory of ferromagnetism and show from the plot of Langevin function spontaneous magnetization exists below the Curie temperature and vanishes above it? **(U)**

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.

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