

Reg. No.....

Name.....

**B. Sc. DEGREE END SEMESTER EXAMINATION - APRIL 2021****SEMESTER –6: PHYSICS (CORE COURSE)****COURSE: 15U6CRPHY11: CONDENSED MATTER PHYSICS***(Common for Regular 2018 admission & Improvement 2017/Supplementary 2017 /2016 /2015 admissions)*

Time: Three Hours

Max Marks: 60

**PART A*****Answer all questions; each question carries 1 mark***

1. A unit cell equivalent to one lattice point is also known as.....
2. What do you mean by coordination number in a crystal structure?
3. The packing fraction for fcc structure is.....
4. What is the momentum of a free electron?
5. Explain polar and nonpolar molecules.
6. What does Bohr magneton represent?
7. Define orbital gyromagnetic ratio.
8. What do you mean by remanence in magnetic hysteresis?
9. What is meant by critical field of a superconductor?
10. Define coherence length. (1 × 10 = 10)

**PART B*****Answer any seven questions; each question carries 2 marks***

11. Explain Bravais space lattices.
12. Describe hexagonal close packed structure.
13. What are known as van der Waals bonds?
14. Explain Hall Effect.
15. Describe the different types of polarization.
16. Explain ferrimagnetism.
17. Explain Meissner effect.
18. What are the classifications of superconductors?
19. What are Carbon Nanotubes? (2 × 7 = 14)

**PART C*****Answer any four questions; each question carries 4 marks***

20. What is meant by the packing fraction of a crystal structure? Calculate the packing fraction for a simple cubic, body centered cubic and face centered cubic structure.
21. Find the Miller indices of a plane that makes intercepts on a, b and c axes equal to 3 Å, 4 Å and 3 Å in a tetragonal crystal with c/a ratio as 1.5.
22. Find the lowest energy of an electron confined to motion in a three dimensional potential box of length 0.5 Å.

23. The applied magnetic field in copper is  $10^6$  A/m. If the magnetic susceptibility of copper is  $-0.8 \times 10^{-5}$ , calculate the flux density and the magnetization in copper.
24. A paramagnetic salt contains  $10^{28}$  ions/m<sup>3</sup> with magnetic moment of one Bohr magneton. Calculate the paramagnetic susceptibility and magnetization produced in a uniform magnetic field of  $10^6$  A/m, at room temperature.
25. A superconducting tin has a critical temperature of 3.7K at zero magnetic field and a critical field of 0.0306T at 0K. Find the critical field at 2K. (4 × 4 = 16)

#### PART D

***Answer any two question; each question carries 10 marks***

26. Explain the classical theory of paramagnetism. Discuss its drawbacks and hence the advantages of Weiss theory of paramagnetism.
27. Explain the classical free electron theory of metals and discuss its drawbacks. Discuss the band theory of solids.
28. Explain the concept of reciprocal lattice and derive the relation between reciprocal lattice vector and direct lattice parameters. Discuss the properties of reciprocal lattice.
29. Derive the London equations of superconductivity and arrive at the expression for London penetration depth. Discuss the main features of BCS theory. (10 × 2 = 20)

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