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Sixth Semester B.Sc. Degree Examination, April 2022

First Degree Programme under CBCSS

Physics

Core Course IX

PY 1641 – SOLID STATE PHYSICS

(2014 & 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What is a primitive cell of a crystal?
2. What are the different space lattices in the cubic crystal system?
3. Draw the position of Fermi level in an n type semiconductor
4. What is Meissner effect?
5. How does the resistivity of a metal vary with temperature?
6. What is the reciprocal lattice of bcc structure.
7. What is ferro-electricity
8. Define magneto-resistance.

P.T.O.

9. What do you understand by magnetic susceptibility?

10. What is a phonon.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Write the formula for the magnetic dipole moment of current carrying loop of N turn and with a cross sectional area A.

12. Explain Miller indices of a crystal plane?

13. What is photoelectric effect? Write the equation for photo electric effect.

14. Explain Braggs law and the X ray diffraction condition.

15. How do you describe semiconductors and insulators on the basis of band theory of solids.

16. What is meant by Hall Effect? Give an application?

17. State Dulong-Petit law.

18. Distinguish between type I and type II superconductors.

19. How do you distinguish ferromagnetic and antiferromagnetic material.

20. What is Josephson effect.

21. Distinguish between ionic polarization and dipolar polarization.

22. Define magnetic susceptibility. Distinguish between the properties of Diamagnetic, Paramagnetic materials with regard to its susceptibility.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. A metallic foil has 0.005cm thickness is in the form a square of side 25 cm. Calculate the number of atoms in the foil, if unit cell has an fcc structure of edge length 0.4049 nm.

24. Calculate the inter-planar distance for a (321) plane in a simple cubic lattice, for which the lattice constant is 4.2×10^{-8} cm.

25. Find the average drift velocity of electron in Al conductor with a cross sectional area 10^{-4} m^2 carrying a current of 1 A. The atomic weight of Al is 27 and density is 2.7 g/cm^3

26. Super conducting lead has a critical temperature of 7.26 K at zero magnetic field and a critical field of a $8X10^5$ A/m at 0K. Find the critical field at 5K.

27. The Debye temperature of carbon is 2000K. calculate specific heat per K mol. for diamond at 20K.

28. Magnetic susceptibility of a ferromagnetic material is 560 K become half that at room temperature. Find the curie temperature of the material.

29. A beam of X ray incident on NaCl crystal of lattice spacing $0.3X10^{-9}$m. Bragg's reflection is found to be at 8 degree for first order. What is the wave length of Xray used.

30. Calculate the frequency of Josephson current when 0.8 Volt dc is applied across Josephson junction.

31. Fermi energy of silver is 5.0 eV. Find the probability that electrons have energy 0.8% above Fermi energy at 300 K.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Discuss wave equation in a periodic potential and Bloch theorem.

33. Discuss langevin classical theory diamagnetism.

34. Explain classical free electron theory of metals. Obtain expression for drift velocity, mobility and electron current density and resistively of the metal. What are draw backs of classical theory?

35. Explain BCS theory of super conductivity. Describe the Meissner effect of superconductors.

($2 \times 15 = 30$ Marks)
