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Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, March 2021

First Degree Programme under CBCSS

Physics

Core Course IX

PY 1641 – SOLID STATE PHYSICS

(2015-2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in one or two sentences. Each carries **1** mark.

1. The coordination number in BCC structure is ————

2. The number of Bravais lattice in three dimension is ————

3. Give an example for primary and secondary bond.

4. An electron is accelerated to a potential V=150 V. The corresponding wavelength λ is ————

5. What is Wiedemann-Franz law?

6. What is Matthiessen's rule?

7. State Bloch theorem.

8. State Curie Weiss Law.

P.T.O.

9. The magnetic susceptibility of a super conductor is ————

10. What is photoconductivity?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions, not exceeding a paragraph. Each question carries **2** marks.

11. Write a short note on amorphous solids.

12. Distinguish between unit cell and primitive cell.

13. Sketch the variation of potential energy with distance for two interacting atoms?

14. What are the advantages of neutron diffraction compared to x-ray diffraction?

15. Explain Hall effect.

16. Draw Brillouin zones for a two dimensional square lattice of side *a*.

17. Write a short note on piezoelectricity. Give an example for piezoelectric material.

18. Write a short note on BCS theory.

19. Show that five fold rotation is not possible in crystal.

20. Based on band theory, explain conductors, semiconductors and insulators.

21. Explain Meissner effect.

22. Briefly explain ferroelectricity.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Write a short note on various symmetry elements.

24. Aluminum (Al) and Iron (Fe) crystallize in FCC and BCC structure respectively. The lattice parameter of Al and Fe were 4.04 Å and 2.86 Å and atomic weight 26.98 and 55.85 gm respectively. Determine its density.

25. The edge of unit cell in the cubic crystal is a = 2.62 Å . Find the Bragg angle corresponding to reflection from the planes (100), (110) and (111). Given that the monochromatic X-ray line wavelength $\lambda = 1.54$ Å.

26. Silver (FCC) has an atomic radius of 1.44 Å. Assuming silver to be monovalent metal, calculate the value of the Fermi energy at 0K and Fermi velocity.

27. Explain Type I and Type II superconductors.

28. The critical fields at 6 K and 8 K for NbTi alloy are 7.616×10^4 and 4.284×10^4 A/m. Calculate the transition temperature and the critical field at 0K.

29. In a photocell, a copper surface was irradiated by light of wavelength 1849Å, the stopping potential was found to be 2.72 V. Calculate threshold frequency, the work function and maximum energy of the photoelectron.

30. NaCl is a cube with lattice parameter 0.564 nm and four formula units per unit cell. The polarizabilities of Na and Cl are 0.16×10^{-40} and 3.30×10^{-40} F/m^2 . Calculate the refractive index of NaCl.

31. Write a short note on Ferromagnetic domains.

(6 × 4 = 24 Marks)

SECTION – D

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

32. Explain the way in which crystallographic directions and planes are defined in crystals. Explain how do we obtain Miller indices. Draw (100), (110) and (111) planes.

33. Obtain Bragg's Law. Briefly Describe any two experimental techniques to determine crystal structure by X-ray diffraction.

34. What is meant by free electron Fermi gas? Based on the concept of free electron gas, show that the electrical conductivity of a metal is $Ne^2 \tau /m$.

35. Write a short note on classification of magnetic materials ? Explain the origin of diamagnetism in materials. Obtain the expression for diamagnetic susceptibility using the Langevin's theory.

(2 × 15 = 30 Marks)
