



"ज्ञान, विज्ञान आणि सुसंस्कार यासाठी शिक्षण प्रसार"

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DEPARTMENT OF PHYSICS

QUESTION BANK

B. Sc. – III, PHYSICS (Paper-XIV), DSE-F2 Solid State Physics

Q. 1 Long answer type questions.

(08 Marks each)

1. Derive an expression for interplanar spacing for planes having Miller indices (hkl) in case of cubic crystal structure.
2. Explain BCC crystal structure. Determine packing fraction of BCC crystal structure.
3. Show that packing fraction of FCC and HCP crystal structures are same.
4. Explain the concept of reciprocal lattice and Properties of it.
5. Give construction of 2-D reciprocal lattice.
6. Show that reciprocal lattice to bcc lattice is fcc lattice.
7. Derive Bragg's law for X-ray Diffraction.
8. What are Brillouin zones? Discuss the construction of first two Brillouin zones for a square lattice.
9. Describe Laue's method of X-ray diffraction.
10. Describe Rotating crystal method of X-ray diffraction.
11. Describe powder method of X-ray diffraction.
12. What is reciprocal lattice? Derive relations for primitive translation vectors of the reciprocal lattice in terms of those of the direct lattice.
13. Explain classical Langevin's theory of diamagnetism and obtain an expression for diamagnetic susceptibility.
14. Explain classical Langevin's theory of paramagnetism and obtain an expression for paramagnetic susceptibility.

15. State and explain Curie law in paramagnetism.
16. Give an account of quantum theory of paramagnetism and discuss low and high temperature cases.
17. Give an account of Weiss theory of ferromagnetism. Discuss the temperature variation of saturation magnetization.
18. Draw a typical B-H curve and describe the different magnetization processes.
19. Why Diamagnetic materials have negative susceptibility?
20. Explain the following terms briefly.
 - a) Hysteresis
 - b) coercivity
 - c) remanence
21. Distinguish between diamagnetic, paramagnetic and ferromagnetic materials.
22. Distinguish between metal, semiconductor and insulator on the basis of their energy band structure.
23. Discuss the formation of allowed and forbidden energy bands on Kronig- penny model.
24. Write a note on effective mass of an electron.
25. State Bloch function and explain the concept of density of state.
26. Obtain an expression for velocity of an electron as predicted by band theory. Hence explain variation of velocity of electrons with wave vector.
27. Show that the effective mass of an electron is inversely proportional to $\frac{d^2E}{dk^2}$. Explain its significance.
28. Obtain an expression for Hall voltage and Hall coefficient.
29. Explain variation of effective mass of an electron with a wave vector.
30. Explain how energy gap is formed between allowed energy bands.
31. Define Valence band, conduction band and forbidden energy gap.

Q. 2 Short answer type questions.

(4 Marks each)

1. Explain properties of crystalline, polycrystalline and amorphous materials.
2. Distinguish between crystalline solids and amorphous solids.
3. Define lattice, basis, and crystal structure. Unit cell, primitive unit cell and non primitive unit cells.
4. Discuss the various types of symmetry elements and symmetry operations presents in a cubic crystal.

5. Describe seven crystal systems in three dimensions with suitable diagrams.
6. Explain Bravais lattices in two dimensions.
7. Explain Bravais lattices in three dimensions.
8. Write a note on Miller indices.
9. What are Miller Indices? How they determined?