DEPARTMENT OF PHYSICS
QUESTION BANK
SUBJECT – SOLID STATE/ CONDENSED MATTER PHYSICS
(V th SEMESTER , CC-XII)

By M. Das Pattanayak
Asst. Prof. of Physics

SECTION-A

(Short questions)

1. Explain primitive cell and how many atoms are there in a primitive unit cell?
2. What is meant by unit cell?What are the lattice parameters for a unit cell?
3. A unit cell has the dimensions a = b = c = 4.74 Å and $\alpha = \beta = \gamma = 60°$. What is its crystal structure?
4. What are Miller Indices? Draw the planes for Miller Indices (100), (110) and (111).
5. A crystal has FCC structure and its lattice parameter is 3.6 Å Find the atomic radius.
6. The interplaner distance of (110) planes in a BCC crystal is 2.03Å. What is the lattice parameter of the crystal?
7. Calculate the number of atoms per unit cell of a face centered cubic crystal.
8. Distinguish between acoustic and optical phonons.
9. Derive an expression for the density of available electron states.
10. Draw the figure for hcp structure.
11. What do you mean by SC, BCC and FCC structures? Give suitable examples.
12. What is the significance of Fermi function?
13. Draw a (1 1 0) plane in a cubic unit cell.
14. What is the relationship between the real and reciprocal space lattices?
15. What types of radiation other than X-rays are commonly used to obtain diffraction patterns?
16. Explain what is a Bravais lattice
17. Draw the Wigner-Seitz primitive unit cell.
18. Define coordination number
19. An element has HCP structure. If the radius of the atom is 1.6 Å. Find the volume of the unit cell
20. Explain Bragg's Law
21. Define phase and group velocity?
22. Give dispersion relation for one dimensional monoatomic lattice?
23. What is phonon? Give evidence of its existence.
24. State Dulong and Petit's law?
25. Define Debye temperature?
26. What are drawbacks of Debye theory?
27. What is the value of heat capacity of most of solid at room temperature?

28. What is Einstein's temperature?
29. Plot phonon dispersion curve for diatomic molecule .
30. Plot phonon dispersion curve for monotomic molecule.
31. What is Debye T^3 law?
32. Define magnetic susceptibility?
33. Define permeability?
34. Distinguish between diamagnetism and paramagnetism .
35. Define Curie's law of paramagnetism?
36. What are the basic causes of paramagnetism?
37. What is spontaneous magnetization?
38. What are ferro magnetism domains?
39. Distinguish between ferromagnetism and ferrimagnetisms .
40. Explainthe terms hysteresis and coercivity in short.
42. What is Neel temperature?
43. Briefly Discuss Hysterisis curve .
44. Explain importance of negative susceptibility?
45. Define electric susceptibility?
46. Define dielectric constant. What is significance of its value.
47. Explain polarisabillity? Enlist different contributions to total polarisability
48. Differentiate between ionic and electronic polarisation?
49. What is orientational polarisability?
50. Explain Clausius Mosotti Equation?
51. What do you mean by local field?
52. Define Bloch function?
53. What is forbidden energy gap? Give the order of band gap for a metal, semiconductor and insulator
54. Define critical temperature?
55. What is critical magnetic field?
56. What is Meisner effect?
57. Differentiate between type I and type II superconductor?
58. What is Hall effect?
59. How the conductivity of metal and semiconductor change with temperature and why?
60. What is penetration depth?

Section-B
(Long questions)

1. What is Bragg's law? Define reciprocal lattice. Derive relationship for the primitive translation vector of the reciprocal lattice in terms of those of the direct lattice?
2. Derive the dispersion relationship for a one dimensional atomic crystal and discuss the nature of acoustic and optical modes?
3. Discuss the Einstein's model of lattice heat capacity. Discuss the success and failure of this model?

4. Discuss the Debye's model of lattice heat capacity. Discuss the success and failure of this model? What is Debye T^3 law?

5. Explain diamagnetism? Obtain expression for diamagnetic susceptibility using Langevin's theory?

6. Describe the Langevin's theory of paramagnetism and obtain expression for paramagnetic susceptibility?

7. Give an account of Weiss theory of ferromagnetism? Explain hysteresis and Curie point on basis of this theory?

8. Derive Clausius Mosotti equation expressing the relationship between dielectric constant and atomic polarisability?

9. Discuss the formation of allowed and forbidden energy band gap on the basis of Kronig-Penney model?

10. What are superconductors? Give an account of Superconducting state on the basis of BCS theory.

11. Explain Meisner effect. Explain the difference between type I and type II superconductor on the basis of Meisner effect?

12. Distinguish between spontaneous and stimulated emission. What are Einstein's A and B coefficients?. Obtain relation among them.

13. Write short notes on i) He Ne Laser

ii) Ruby Laser.

14. Mention the important characteristics of Semi conductors.Explain the type of bonding in semi conductors with the help of band structure.Explain the effect of temperature and impurity on the Fermi level in a semi conductor.