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Subject Title: Solid State Physics | Prepared by: E Gayathri
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Unit - I: Crystal Structure

1. Define Unit cell.
2. Differentiate crystalline and amorphous materials.
3. What are Miller Indices and how to find them?
4. What are translational vectors?
5. What are Reciprocal lattice vectors?
6. Write the relation between translational and reciprocal lattice vectors?
7. Write Bragg's law.
8. Why only x-rays are used for diffraction?
9. What is phonon? Explain optical and acoustical Phonons.
10. What are the conditions for x-ray diffraction and Derive Bragg's law.
11. Define atomic and geometrical factors and derive the expressions for the same.
12. Explain about Brillouin zones.
13. Explain vibrations on a 1D monatomic chain.
14. Explain about qualitative description of phonon spectrum in solids.
15. Explain vibrations modes of 1D diatomic linear lattice.
16. Derive an expression for specific heat a solid following classical theory theory.
17. Obtain an expression for heat capacity from Einstein theory of specific heat capacity.
18. Using Debye approximation, obtain an expression for specific heat capacity of a solid.
19. Derive an expression for specific heat of a solid following classical theory .
20. Explain about the types of lattices.

Unit - II: Magnetic properties of Matter

21. Give the classification of magnetic materials and also list their corresponding properties.

22. What is Susceptibility?
23. Write the Expression for Curie's law
24. What are ferromagnetic domains?
25. Draw Hysteresis loop and explain different points on the loop
26. What is an energy loss and how it varies with the size of the loop.
27. Write the expression for depolarization field.
28. Write the relation between Polarizability and dielectric constant.
29. Discuss classical Langevin theory of dia, Para magnetism.
30. Derive curie's law from Langevin theory of Para magnetism
31. Explain the Weiss's theory of ferromagnetism.
32. Derive an expression for local electric field of an atom.
33. Derive Clausius- Mosotti equation.
34. What is Polarizability and discuss the classical theory of the same.
35. Derive the expressions for Electronic polarizability.
36. Obtain the expressions for ionic polarizability.
37. Draw and explain about B-H curve.

Unit - III: Elementary Band Theory

38. Write the conclusions of Kroning –penny model
39. Define band gap.
40. What are Brillouin zones?
41. What is effective mass of an electron?
42. Define conductor
43. Give the classification of extrinsic semiconductor.
44. Define Mobility.
45. Define Hall effect.
46. Define conductivity.
47. Discuss the kronig-penny model for the motion of an electron in a periodic

potential.

48. Explain the formation of bands

49. Define and derive an expression for effective mass of an electron

50. What are Brillouin Zones? Construct zones for a square lattice

51. Classify the solids into conductors, insulators, and semiconductors on the basis of band theory of solids.

52. Based on energy bands, distinguish between conductors, semiconductors, and insulators.

53. Distinguish between intrinsic and extrinsic semiconductors.

54. Explain about N type and P type semiconductors.

55. Explain about electrical conductivity by four probe method.

56. Derive an expression for hall coefficient for p type semiconductor.

57. Explain the applications of hall effect.

Unit - IV: Lasers

58. What is laser?

59. Write the characteristics of laser

60. Define absorption.

61. Define spontaneous emission.

62. Define stimulated emission.

63. Define Einstein coefficients.

64. Define population inversion, pumping, superconductivity.

65. Define Meissner effect and give its applications.

66. Define type I and type II super conductors

67. Define metastable state. Give its importance

68. Define BCS theory.

69. What is laser? Explain the characteristics of lasers.

70. Explain about Einstein coefficients.

71. Derive the relation between Einstein coefficients.

72. Write the differences between spontaneous and stimulated emissions.

73. Describe the various methods of pumping in lasers.

74. Explain about three level pumping scheme.

75. Explain the working of ruby laser with the help of neat diagram

76. With the help of a suitable diagram explain the principle, construction and working of a helium–neon laser.

77. Define Superconductivity. Give the properties of semiconductors

78. State and explain Meissner effect

79. Explain type I and type II superconductors

80. Derive London's equations

81. Explain BCS theory of superconductors.

82. Write short notes on A.C and D.C Josephson effect.