# Department- Physics

## Question Bank

Class: T.Y.B.Sc.          Subject: Physics –II          Semester- III – solid state Physics

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### Chapter- 1  The Crystalline State

Question for 1 Marks

1. Define the term 'Symmetry operations'.
2. What are Miller indices?
3. Define the term 'Co-ordination number' of an atom.
4. Define the term 'Unit cell' .
5. Sketch (101) plane in S C unit sell.
6. The minimum angle of rotation for a certain crystal structure which leaves it invariant is $120^0$. Find fold number (n).
7. Define the term 'Packing fraction'.
8. Define reciprocal lattice.
9. Find the number of atoms per unit cell in SC structure.
10. Find the number of atoms per unit cell in BCC structure.
11. Find the number of atoms per unit cell in FCC structure.

Questions for 5 Marks.

1. Obtain an expression for interplaner spacing for simple cubic system.
2. Describe the crystal structure i) NaCl and ii) CsCl with the help of neat diagrams.
3. What is reciprocal lattice? Obtain expression for reciprocal lattice vectors A, B, C.
4. What is reciprocal lattice? Show that the reciprocal vectors of the reciprocal lattice are direct lattice vectors themselves.
5. Find packing fraction for BCC crystal structure. Give your comment about the structure.
6. Show that the volume of unit cell of the reciprocal lattice is inversely proportional to the volume of unit cell of direct lattice.
7. Describe the sodium chloride (NaCl) and Dimond cubic structure with the help of neat diagram.

8. Show that every reciprocal lattice vector is perpendicular to a direct lattice plane.

## Chapter- 2 X-Ray Diffraction and Other Characterization Techniuques

Question for 1 Marks

1. Why continuous wavelength X-ray radiation is used in Laue Method?
2. What is photoelectric effect?
3. Give any two application of STEM.
4. What are advantages of powder method?
5. State Bragg's diffraction condition in direct lattice.
6. Explain crystal as a grating.
7. Give the Principle of photoelectron spectroscopy.
8. Give two applications of scanning electron microscopy.
9. State any two uses of thermal gravimetric analysis techniques.
10. State any two spectroscopic techniques for the analysis of crystal structure.
11. Why ordinary optical grating cannot diffract X-Rays?
12. Give the names of characterization techniques.
13. Give any two applications of UV-Vis spectrophotometer.
14. Draw the schematic labelled diagram of UV-Vis spectrophotometer.

Questions for 5 Marks

1. Write a short note on ultraviolet and visible absorption spectroscopy.
2. Using Ewald's construction show that Bragg's diffraction condition in reciprocal lattice is exactly equivalent to the condition in direct lattice.
3. Write a short note on scanning tunneling electron microscopy.

Questions for 8 Marks

1. Describe X-Ray powder diffraction method with the help of neat diagrams . explain how it is used to study crystal structure.
2. Obtain an expression for Braggs diffraction condition in direct lattice and in reciprocal lattice.

## Chapter 3 Free Electron and Band Theory of Metals

Question for 1 Marks

1. What is the main assumption in classical free electron theory?
2. What is Fermi level and Fermi energy?
3. What is the Main drawback of Summerfield's theory?

4. Define Hall Coefficient.
5. Define the term 'density of States'.
6. Define the term 'Band gap energy (Eg)'.
7. State Bloch theorem.
8. State Fermi-Dirac distribution function.
9. State the parameter on which Hall coefficient depends.
10. State any two uses of Hall Effect.
11. What is 'mobility'?
12. State Hall Effect.
13. Give the formula for Fermi function.
14. What is mean free path?
15. What is Fermi energy level?

Questions for 5 Marks

1. Describe Hall Effect. Obtain an expression for hall angle.
2. Obtain an expression for energy levels in three dimension, for an electron of mass 'm' confined in a box of length 'L'.
3. Explain classical free electron model.
4. Explain Wiedemann- Franz law.
5. Write note on nearly free electron model.

Questions for 8 Marks

1. Obtain an expression for energy levels and density of states in one dimension.
2. On the basis of band theory of solids distinguish between insulators, semiconductors and metals.
3. Obtain an expression for density of states in three dimensions and average energy of an electron at absolute zero temperature.

**Chapter 4 Magnetism**

Questions for 1 Marks

1. What is Curie temperature?
2. What is Superconductor?
3. What do you mean by 'domains' in ferromagnetic materials?
4. Give two examples of ferromagnetic materials.
5. Define the term 'Magnetization (M). give its SI unit.
6. What is Neel temperature?
7. Why conductivity of semiconductor increases with temperature?

8. What is Mobility?
9. What are ferrites? Give two applications.

Questions for 5 Marks

1. State and explain Meisner effect.
2. Write short note domain and hysteresis of ferromagnetic materials.
3. What are ferrites? Give any two examples and six applications of ferrites.

Questions for 8 Marks

1. What is diamagnetism? Obtain classical Langevin's formula for the susceptibility of the diamagnetic material.
2. What do you mean by ferrimagnetisms? Describe lattice structure of ferromagnetic materials. What are soft and hard ferrites? And state any four applications of ferrites.
3. What is Meisner effect? Describe Type-I and Type-II superconductors.
4. Define the term 'Magnetic Susceptibility ($^{x}M$). Obtain Langevin's formula for the paramagnetic susceptibility
5. Discuss the characteristics feature of diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism. Give an example of each type of material.