

B.Sc. Semester - 6 (CBCS) Examination

March/April-2025 (NEW COURSE)

Statistical Mechanics & Solid State Physics (Core (New))

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

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- Que-1(A) **Answer the following questions (any two out of three)** (10)
1. Derive the distribution law of Bose - Einstein statistics.
 2. Derive the general equation of volume in Phase Space.
 3. Explain: Maxwell – Boltzmann distribution law.
- Que-1(B) **Answer the following questions (any one out of two)** (04)
1. Explain: Thermodynamic Probability.
 2. Give the comparison (any four) of MB, BE and FD statistics.
- Que-2(A) **Answer the following questions (any two out of three)** (10)
1. Describe the crystal structure of diamond and calculate the packing factor of Diamond. (No need to draw unit cell).
 2. What are Miller indices? How they are calculated?
 3. What is single crystal and polycrystalline crystal? Explain symmetry consideration.
- Que-2(B) **Answer the following questions (any one out of two)** (04)
1. Calculate the Packing Factor of Body Centered Cubic crystal structure.
 2. Draw the below-given plane in a cubic crystal having Miller indices as
[a] (0 1 0) [b] (1 1 1) [c] (0 1 1) [d] (1 0 0)
- Que-3(A) **Answer the following questions (any two out of three)** (10)
1. Derive London Equations.
 2. Derive Gibbs free energy and Entropy of superconducting transition.
 3. Write a note on influence of external agents on superconductivity.
- Que-3(B) **Answer the following questions (any one out of two)** (04)
1. Write any four applications of superconductivity.
 2. Discuss any four properties that change in the Superconducting transition.
- Que-4(A) **Answer the following questions (any two out of three)** (10)
1. Write a note on the Metallic Bond.
 2. Write a note on Ionic Bond.
 3. Discuss thermotropic liquid crystal.
- Que-4(B) **Answer the following questions (any one out of two)** (04)
1. Write any four Characteristics of Covalent Bond.
 2. Discuss in brief stability consideration and characteristics of Molecular Bonds.
- Que-5(A) **Answer the following questions (any two out of three)** (10)
1. Write a note on Discovery and Structure of C₆₀.
 2. Discuss bottom up and top down method for preparation of quantum nanostructures.
 3. Discuss electrical properties of carbon nanotubes.
- Que-5(B) **Answer the following questions (any one out of two)** (04)
1. Discuss inert gas clusters, superfluid clusters, and, molecular clusters.
 2. Write any four applications of carbon nanotubes.
