5. (a) Discuss the graphical construction of a reciprocal lattice. **4**

(b) Prove that the face centered cubic (fcc) lattice is the reciprocal lattice of the body centered cubic (bcc) lattice. **4**

Unit III

6. (a) What is the need of London equations in superconductivity ? Derive these equations and discuss how they explain the Meissner effect. **6**

(b) The critical temperature of mercury with isotopic mass 203.4 is 4.145 K. Calculate its critical temperature when its isotopic mass becomes 199.5. **2**

7. (a) Explain the isotope effect in superconductivity. How this effect leads to the BCS theory of superconductivity ? **4**

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B.Sc. EXAMINATION, 2026

(Sixth Semester)

(Re-appear Only)

PHYSICS

Paper-XI

Solid State and Nano Physics

Time : 3 *Hours*] [*Maximum Marks :* 40

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) What are the main differences between Crystalline Solids and Glassy Solids ? **2**

(b) Define the coordination number in a crystal lattice. What is the coordination number of the diamond lattice ? **1**

(c) Why visible light cannot be used to study the crystal diffraction ? **1**

(d) What do you understand by the superconductivity ? What are the factors which destroy the superconductivity state ? **2**

(e) Explain the importance of length scale in nanotechnology. **2**

Unit I

2. (a) Explain the different types of symmetry operations in a crystal. Prove that a crystal cannot have a fivefold rotational symmetry. **6**

(b) Define the primitive unit cell. Discuss the Wigner-Seitz method to construct the primitive cell. **2**

3. (a) What do you understand by the Crystal planes and Miller indices ? Define the rules to find the Miller indices by using an example. 4

(b) Explain the diamond crystal structure. Calculate its atomic packing fraction and give comment on it. **4**

Unit II

4. (a) Discuss the X-ray diffraction by the crystal lattice and derive an expression for Bragg's law. **4**

(b) What conclusion can you draw from the Laue's diffraction pattern ? **2**

(c) X-ray of wavelength 2 Å is incident at an angle of 30 degree on a cubic crystal. Calculate the lattice constant of the crystal. **2**

(b) Give some applications and potential uses of superconductors. **4**

Unit IV

8. (a) Discuss the size dependence properties of nanomaterial. **4**

(b) Discuss the molecular assembler concept in nanotechnology. **4**

9. (a) What is a Scanning Tunneling Microscope (STM) ? Explain its use and working principle. What are the limitations of this technique ? **4**

(b) Give some applications of nanotechnology in different fields. **4**

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