

Roll No. ....

(07/20-I)

**5257**

**B. Sc. EXAMINATION**

(Sixth Semester)

**PHYSICS**

Paper-XI (PH-601)

Solid State and Nano-Physics

*Time : Three Hours*

*Maximum Marks : 40*

**Note :** Attempt *Five* questions in all, selecting at least *one* question from each Unit. Q. No. 1 is compulsory. Use of Scientific non-programmable calculator is allowed.

1. (a) Define Wigner seitz primitive cell. 1
- (b) What do you mean by K-space ? 1
- (c) Give the practical applications of superconductivity. 2

- (d) What was there a need for modification in London's theory ? 1
- (e) Differentiate between nanobiotech and bionanotech. 2
- (f) How is nanoscience different from nanotechnology ? 1

### Unit I

2. (a) Discuss the crystal structure of diamond and show the tetrahedral bond between the atoms of a unit cell of diamond. 4
- (b) What are Miller indices ? Draw sketches illustrating (101),  $(\bar{1}11)$  and  $(\bar{2}00)$  planes in cubic unit cell. 4
3. (a) What do you mean by Bravais lattice ? Explain different types of Bravais lattices in three dimensions. 4
- (b) Why can the crystal lattice not have five fold rotational symmetry ? 4

### Unit II

4. (a) Show that the reciprocal lattice of a f.c.c. lattice is b.c.c. lattice. 4
- (b) X-ray beam is incident on a crystal face having interplanar spacing  $3.82\text{\AA}$ . The first order Bragg's reflection is observed at a glancing angle of  $8^\circ 35'$ . Calculate the wavelength of the X-ray. ( $\sin 8^\circ 35' = 0.1492$ ). 4
5. (a) Derive Bragg's law of diffraction crystal and give its important features. 5
- (b) Define reciprocal lattice. Give its physical significance and properties also. 3

### Unit III

6. (a) Discuss flux quantization and show that the magnetic flux within the superconducting ring is quantized in unit of  $h/2e$ . 5

- (b) Define Meissner effect and show that it is in contradiction of Maxwell's equation. 3
7. (a) Derive London's equation and explain London's penetration depth also. 5
- (b) Calculate the penetration depth for tin at 3.5K if transition temperature is 3.72 K and penetration depth at 0K is  $3.4 \times 10^{-8}$  m. 3

#### Unit IV

8. (a) Discuss the scope of nanotechnology in development of modern technology. 4
- (b) Explain the role of nanotechnology in electronics and medicine. 4
9. (a) What is nano physics ? Discuss its historical background in detail. 4
- (b) Describe Molecular assembler concept. 4