



Roll no.

End Semester Examination, December 2024

B.Sc. (Hons.) Physics– III Semester

SOLID STATE PHYSICS -SCPH203

Time: 2.5 hrs.

Max Marks: 50

Note: **All Questions are compulsory.** Marks are indicated against each question.

PART-A

Q.1 First question will consist of 7 small questions covering entire syllabus out of which the student has to attempt 5 questions and understanding level will be assessed.

- (a) Explain HCP crystal structure. [CO-1] [L-5] 2
- (b) What are grain boundaries. [CO-1] [L-1] 2
- (c) If the average energy required to produce a Frenkel defect in an ionic crystal is 1.41eV , find out the ratio of the number of Frenkel defects at 20°C and 300°C in one gram of the crystal. [CO-1] [L-3] 2
- (d) Write notes on stacking faults. [CO-1] [L-1] 2
- (e) Give the properties of ionic bonds. [CO-1] [L-2] 2
- (f) Draw (211) and (021) planes inside a cubic unit cell. [CO-1] [L-6]

2

- (g) Find the planar density of BCC planes of (111) [CO-1] [L-3] 2
- 2x5**

PART-B

There will be five questions each covering one specific Course Outcome from the complete syllabus. There shall be an internal choice in each of the questions covering the same (set) of COs and BL. Questions carrying 10 marks can be further subdivided as per the paper setter choice.

Q.2 (a) How can you explain the hysteresis loop of ferromagnetic materials based on domains? What is the cause of hysteresis?

(b) Distinguish hard and soft magnetic materials.

[CO-2] [L-2, 4] 7+3=10

OR

Explain Langevin's theory of diamagnetism. How does it account for the weak negative susceptibility observed in diamagnetic materials? [CO-2] [L-5] 10

- Q.3** What is piezo-electric effect? Explain the origin of the effect. Discuss applications of piezoelectric crystals. [CO-3] [L-5] 10

OR

What do you mean by polarization of a solid?
Explain the meaning of internal field in solids. Incorporating an internal field in the expression for polarization, Derive Clausius-Mosotti relation for elemental solid dielectrics. [CO-3] [L- 1,2] 10

- Q.4** (a) Derive and explain the London equations and calculate the expression for penetration depth.
(b) Calculate the critical current density for 1 mm diameter wire of lead at 4.2K. Given T_c for lead = 7.18 K and H_c for lead = 6.5×10^4 A/m. [CO-4] [L- 2, 3] 7+3=10

OR

(a) For a specimen of Ga, the critical fields are respectively 1.4×10^5 and 4.2×10^5 A/m for 14 K and 13 K. Calculate the transition temperature and critical fields at 0 K and 4.2 K.

(b) Explain why superconductors have zero resistivity. [CO- 4] [L-3,1] 5+5=10

- Q.5** Illustrate and describe the Burger's circuit for both edge and screw dislocations. Explain the significance of the Burger's vector in these dislocations. [CO-1] [L-4] 10

OR

Consider a body centered cubic FCC lattice of identical atoms having radius R. Compute

- (I) the number of atoms per unit cell
- (II) the coordination number
- (III) atomic Radius
- (IV) the packing fraction
- (V) percentage Void Space

[CO- 1] [L-4] 10