

**63/1 (SEM-5) CC12/PHYHC5126**

**2 0 2 2**

( Held in 2023 )

**PHYSICS**

Paper : PHYHC5126

( **Solid State Physics** )

Full Marks : 60

Pass Marks : 24

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

1. Choose the correct answer from the following : 1×5=5

(a) Lattice plus basis is called

(i) unit cell

(ii) primitive cell

(iii) molecular structure

(iv) crystal structure

( 2 )

- (b) The quantity of heat required to raise the temperature of the whole of the substance through  $1^\circ\text{C}$  is defined by
- (i) specific heat
  - (ii) thermal capacity
  - (iii) water equivalent
  - (iv) thermal equilibrium
- (c) The magnetic properties of a material are due to the existence of
- (i) electrons in atoms
  - (ii) electric dipole moment
  - (iii) magnetic dipole moment
  - (iv) protons in atoms
- (d) The unit of mobility of a semi-conductor is
- (i)  $\text{mV}^{-1} \text{sec}$
  - (ii)  $\text{cm V}^{-1} \text{sec}^{-1}$
  - (iii)  $\text{V cm}^{-1} \text{sec}$
  - (iv)  $\text{m}^2 \text{V}^{-1} \text{sec}^{-1}$

( 3 )

- (e) The magnetic susceptibility of a super-conductor
- (i) has positive value
  - (ii) has negative value
  - (iii) is infinity
  - (iv) None of the above

2. Answer the following questions : 2×5=10

- (a) Define crystalline and amorphous solids.
- (b) What is phonon? Which statistics does it obey?
- (c) What do you mean by piezoelectric effect?
- (d) Distinguish between hard and soft magnetic materials.
- (e) What is superconductivity? Define the term 'transition temperature'.

3. Answer any five of the following questions :

5×5=25

- (a) What are Miller indices? How are they determined? Explain with an example.

2+3=5

KB23/238

( Turn Over )

( 4 )

(b) Define the term 'specific heat'. Describe the classical theory of lattice heat capacity and obtain the value of molar heat capacity for metals.  $1+4=5$

(c) What do you mean by electrical conductivity? Obtain an expression for conductivity of intrinsic semiconductor in terms of mobility.  $1+4=5$

(d) Write a short note on measurement of conductivity by four-probe method. 5

(e) Derive an expression for orientational (or dipolar) polarizability. 5

(f) What is Meissner effect? Explain the difference between type-I and type-II superconductors.  $1+4=5$

(g) Discuss the theory of ferroelectricity and mention its applications.  $3+2=5$

4. Answer any *two* of the following questions :  $10 \times 2 = 20$

(a) Deduce Langevin's formula for the molar diamagnetic susceptibility. 10

( 5 )

(b) Derive Laue's equations of diffraction of X-rays and obtain Bragg's diffraction condition from them.  $5+5=10$

(c) Write short notes on the following :  $5 \times 2 = 10$

(i) BCS theory of superconductivity

(ii) Clausius-Mossotti relation

\*\*\*