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**5 SEM TDC PHYH (CBCS) C 12**

**2023**

( November )

**PHYSICS**

( Core )

Paper : C-12

( **Solid-State Physics** )

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct option from the following  
(any five) : 1×5=5

(a) If 0.28 nm is the interatomic distance in NaCl crystal, the lattice parameter is

(i) 0.14 nm

(ii) 0.56 nm

(iii) 0.08 nm

(iv) None of the above

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- (b) The Miller indices of the plane parallel to  $y$  and  $z$  axes are
- (i) (1 0 0)
  - (ii) (0 1 0)
  - (iii) (0 0 1)
  - (iv) (1 1 1)
- (c) At lower temperature, the lattice specific heat varies as
- (i)  $T^3$
  - (ii)  $1/T^3$
  - (iii)  $T$
  - (iv)  $1/T$
- (d) For a given dielectric, as the temperature increases, the ionic polarizability
- (i) increases
  - (ii) decreases
  - (iii) remains unchanged
  - (iv) None of the above
- (e) Ferromagnetic materials or ferrites are obtained from
- (i) copper
  - (ii) zinc
  - (iii) aluminium
  - (iv) None of the above

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( Continued )

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- (f) A superconducting material on being subjected to the critical field changes to
- (i) critical conductivity
  - (ii) superconductivity which is independent of temperature
  - (iii) normal state
  - (iv) Remains uninfluenced

2. Answer any five from the following questions : 2×5=10

- (a) Define unit cell and atomic packing factor.
- (b) Define atomic radius in crystal. Calculate the atomic radius in case of b.c.c. lattices.
- (c) What is meant by hysteresis in magnetic material?
- (d) Draw the (111) plane for a simple cubic structure.
- (e) What are Curie law and Curie temperature?
- (f) What is penetration depth? Explain briefly.

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( Turn Over )

3. (a) What is diffraction of X-rays? Explain Bragg's law for X-ray diffraction. 2+3=5
- (b) What is a reciprocal lattice? Find the reciprocal lattice vectors for b.c.c. lattice. 2+4=6

Or

What are atomic and geometrical factors? Explain. 6

4. Derive the expression for the dispersion relation for a linear monoatomic chain of atoms. 6
5. (a) Distinguish dia- and para-magnetism. Explain classical Langevin theory of diamagnetic domain. 2+4=6
- (b) Explain classical theory of electric polarizability. 5

Or

Deduce Clausius-Mossotti equation.

- (c) Distinguish conductor, semi-conductor and insulator on the basis of band theory of solids. 5

Or

What is mobility? Discuss Hall effect.

6. What is critical magnetic field? Explain type-I and type-II superconductors. 2+3=5

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