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SEAT No. :

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T.Y.B.Sc.

PHYSICS

PH-332 : Solid State Physics

(2013 Pattern) (Semester - III) (Paper - II)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Use of log tables and calculator is allowed.*

Q1) Attempt all of the following: (One mark each)

[10]

- a) Define packing fraction.
- b) Define the term symmetry operation.
- c) State Bragg's diffraction condition in reciprocal lattice.
- d) What is nearly free electron model.
- e) What do you mean by quantitative analysis?
- f) Define Fermi energy.
- g) What are domains?
- h) What is Neel temperature?
- i) Define super conductors.
- j) Define primitive unit cell.

Q2) Attempt any two of the following: (5 Marks each)

[10]

- a) Discuss crystal structure of NaCl in details.
- b) With the help of Ewald's construction show that the diffraction condition in reciprocal lattice is exactly equivalent to $2d \sin \theta = n\lambda$ in the direct lattice.
- c) Write a note on type-I and type - II superconductors.

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Q3) Attempt any two of the following: (5 Marks each) **[10]**

- a) Find out the number of atoms per square millimeter on a plane (100) of lead whose interatomic distance is 3.499 \AA . Lead has Face-centred cubic structure.
- b) In a Hall effect experiment on Zinc, a potential of $4.5 \mu\text{V}$ is developed across a foil of thickness 0.02 mm . When a current of 1.5 A is passed in a direction perpendicular to a magnetic field of 2.0 T . Calculate
- The Hall coefficient for Zinc.
 - The electron density.
- (Given: Charge on electron = $1.6 \times 10^{-19} \text{ C}$).
- c) A paramagnetic substance has 10^{28} atoms/ m^3 . The magnetic moment of each atom is $1.79 \times 10^{-23} \text{ A-m}^2$. Calculate the paramagnetic susceptibility of the material at temperature 320°K . What would be the dipole moment of the rod of this material 0.1 m long and 1 cm^2 cross-section placed in a field of $7 \times 10^4 \text{ A/m}$? ($K = 1.38 \times 10^{23} \text{ J/}^\circ\text{K}$, $\mu_0 = 4\pi \times 10^{-7} \text{ Wb/A-m}$).

Q4) a) Attempt any one of the following: (Eight marks) **[8]**

- State three assumptions of Sommerfeld's free electron model and obtain an expression for energy levels and density of states in one dimension.
 - Write detailed note on TGA and Ultraviolet visible spectrophotometer.
- b) Attempt any one of the following: (two marks) **[2]**
- What are ferrites? Give two examples.
 - Sketch (112) and (2,0,0) planes in simple cubic cell.

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