2018

CBCS

3rd Semester

PHYSICS

PAPER—GE3T

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary

Solid State Physics.

Answer Q. N. 1 and Group A & Group B

1. Answer any *five* quesitons : 5×2

(a) Find the miller indices for planes in each of the following sets which intercept $\vec{a}, \vec{b}$ and $\vec{c}$ axes at (i) 3a, 3b, 2c; (ii) a, 25, ∞. 2

(b) Distinguish between metals, insulators and semi conductors on the basis of band theory of solids. 2

(c) What is the susceptibility of a perfectly diamagnetic materials ? 2

(d) What is meant by doping ? What are the different types of doping ? 2

(e) Show that for a simple cubic lattice :

$d_{100} : d_{110} : d_{111} = \sqrt{6} : \sqrt{3} : \sqrt{2}$ 2

(f) What is Meissner effect ? 2

(g) Draw the 1st and 2nd Brillouin zone of a 2-dimensional square lattice. 2

(h) What are the drawbacks of Einstein's theory of specific heat ? 2

Group—A

2. Answer any *four* questions : 4×5

(a) What is Hall effect in metal ? Find an expression for Hall co-efficient to a solid metal with only electrons as carriers. 1+4

(b) Define the polarizability of a dielectric material. Derive the Clausius-Mossolti relation between polarizability and dielectric constant of a solid. 1+4

(c) Describe Langevin's theory of paramagnetism and obtain curie law at normal field strength and ordinary temperature. 5

(d) What is Bragg's condition in X-ray diffraction ? Find out its expression from Lave's equation. State the Bloch theorem. 1+3+1

(e) What are intrinsic and extrinsic semiconductors ?

Write down the Dulong and Petit's law. Interpret it. 2+2+1

(f) (i) What are type-I and type-II superconductor ?

(ii) Pb in superconducting state has $T_c = 6.2$ K at zero field and a critical field of 0.064 A/m at 0 K. Determine the critical field at 4 K. 3+2

Group—B

3. Answer any *one* question : 1×10

(a) (i) What is reciprocal lattice? Show that reciprocal lattice of FCC lattice is BCC and vice-versa. 1+5

(ii) NaCl has cubic structure with molecular weight 58.46. The density is 2.17g.cm^{-3}. Find the distance between two adjacent atoms in NaCl crystal. 4

(b) (i) Deduce the dispersion relation of one dimensional monoatomic chain of lattice. 6

(ii) Explain why inert gases do not show paramagnetism. 2

(iii) What is the effect of isotope on the critical temperature of a superconductor. 2

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