

OR

11. (P) What is magnetic permeability ? State Curie-Weiss law. 2
- (Q) State the Properties of paramagnetic material. 4
- (R) What is Curie temperature ? Explain variation of spontaneous magnetization with temperature in ferromagnetic materials. 4
- (S) Explain the domain theory of ferromagnetism. 2

EITHER

12. (A) What is Meissner Effect ? 1
- (B) Explain type I and type II superconductors. 5
- (C) Explain BCS theory of super conductors. 6

OR

13. (P) Explain importance of surface to volume ratio and quantum size effect in nanomaterials. 6
- (Q) What are quantum dots ? 2
- (R) State any four applications of nanomaterials. 4

AP-515

B.Sc. Part – III (Semester – VI) Examination
6S : PHYSICS

(Statistical, Mechanics and Solid State Physics)

Time—Three Hours]

[Maximum Marks—80

N.B. :— (1) All questions are compulsory.

(2) Draw neat and well labelled diagrams wherever necessary.

1. (A) Fill in the blanks :

- (i) As the temperature of metal increases, the value of its electrical conductivity _____.
- (ii) Iron, Nickel and Cobalt are _____ magnetic material.
- (iii) Miller indices are denoted by _____.
- (iv) In an insulator the conduction band is completely _____ and valence band is completely filled.

2

(B) Choose correct alternative of the following :

- (i) The co-ordination number of bcc structure is :
 (a) 6
 (b) 10
 (c) 8
 (d) 16

(ii) The thermodynamic probability of the system in equilibrium is :

- (a) Maximum
- (b) Minimum but not 1
- (c) One
- (d) Zero

(iii) Diamagnetic Susceptibilities are :

- (a) Negative and small
- (b) Positive and small
- (c) Positive and very large
- (d) None of these

(iv) According to band theory of solids, the potential of an electron in crystal is :

- (a) Constant
- (b) Zero
- (c) Periodic
- (d) None of these

2

(C) Answer the following questions in **one** sentence :

- (i) Define atomic packing fraction.
- (ii) What is nano particle ?
- (iii) State Brag's equation.
- (iv) What is curie temperature ?

4

(B) Show that Fermi energy at absolute zero is

$$E_{F(0)} = \left(\frac{3n}{8\pi} \right)^{2/3} \frac{h^2}{2m}$$

where n – is number of electrons per unit volume

m – mass of electron. 6

(C) Define forbidden energy gap. 2

(D) Explain insulator on the basis of band theory of solid. 3

OR

9. (P) Define density of energy state and show that density of energy state is given by :

$$n(E) = \frac{4\pi}{h^3} (2m)^{3/2} \sqrt{E} . \quad 6$$

(Q) What is Fermi energy ? 2

(R) Distinguish between Semiconductor and Conductor the basis of Band Theory of Solids. 4

EITHER

10. (A) Define magnetization and magnetic susceptibility. 2

(B) State the properties of diamagnetic material. 4

(C) Explain Ferromagnetism on the basis of Weiss Molecular Field theory. 4

(D) What is soft and hard ferromagnetic material ? 2

EITHER

2. (A) Define unit cell and most probable distribution. 4
- (B) Explain microstate and macrostate with example. 4
- (C) Show that root mean square speed is :

$$V_{rms} = \sqrt{\frac{3KT}{M}} \quad 4$$

OR

3. (P) State equal a Priori Probability Principle. 2
- (Q) Write the expression for thermodynamic probability in MB distribution and find the expression for MB distribution law. 6
- (R) Show that average speed is :

$$\bar{V} = \sqrt{\frac{8KT}{\pi m}} \quad 4$$

EITHER

4. (A) What are Bosons ? State the properties of Bosons. 4
- (B) Derive Planck's law of black body radiation on the basis of BE distribution law. 6
- (C) What is Fermi Energy ? 2

OR

5. (P) Give difference between distinguishable and indistinguishable particle. 4

- (Q) Show that the energy level above fermi level are empty and below fermi level are occupied at absolute zero. 4
- (R) Explain Fermi function. What is its importance on account of energy level ? 4

EITHER

6. (A) Distinguish between crystalline and amorphous material. 4
- (B) Explain Edge dislocation and screw dislocation in the crystal. 5
- (C) The interplaner spacing for a given (h, k, l) planes of a crystal is 2.82 Å. It is found that the first order reflection occurs at an angle of 10° . What will be the wavelength of X-ray if $\sin 10^\circ = 0.1736$. 3

OR

7. (P) What are plane defects ? Explain grain boundaries and stacking faults. 5
- (Q) Give names of seven crystal systems. 2
- (R) In X-ray diffraction of wavelength 0.7Å , the first order reflection occurs at an angle of $6^\circ 30'$, find the distance between the crystal planes. (Given : $\sin 6^\circ 30' = 0.1132$) 3
- (S) Explain simple orthorhombic crystal with diagram. 2

EITHER

8. (A) State SI unit of electrical conductivity. 1