

E 1694

(Pages : 4)

Reg. No.....

Name.....

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2015**

**Sixth Semester**

**Core Course—CONDENSED MATTER PHYSICS**

[Common for B.Sc. Physics Model I, B.Sc. Physics Model II, B.Sc. Physics E.E.M. and  
B.Sc. Physics - Instrumentation]

Time : Three Hours

Maximum Weight : 25

**Part A (Objective Type Questions)**

*Answer all questions.*

*Each bunch of four questions carries a weight of 1.*

**Bunch I**

1. The ideal  $c/a$  ratio for hexagonal close packed structure is :

(a) 1.

(b)  $\frac{\sqrt{8}}{\pi}$ .

(c)  $\sqrt{3}$ .

(d)  $\frac{\sqrt{8}}{3}$ .

2. A crystallographic plane has intercept 1 along 'a' 2 along 'b' and 3 along 'c'. The Miller indices are :

(a) (1, 2, 3).

(b) (2, 4, 6).

(c) (3, 2, 1).

(d) (6, 3, 2).

3. Which of the following has hydrogen bonding ?

(a)  $\text{CH}_4$ .

(b) C.

(c) HF.

(d)  $\text{C}_2\text{Cl}_2$ .

4. At absolute zero temperature all the allowed energy states upto Fermi level will be :

(a) Empty.

(b) Occupied.

(c) Half occupied and half empty.

(d) Partially occupied and partially empty.

**Bunch II**

5. The density of allowed states between energy states of  $E$  and  $E + dE$  is proportional to :

(a)  $E^{1/2}$ .

(b)  $E$ .

(c)  $E^{3/2}$ .

(d)  $E^2$ .

**Turn over**

6. Two dimensional lattice with highest rotational symmetry is :

- (a) Triangular lattice. (b) Hexagonal lattice.  
(c) Square lattice. (d) All of the above.

7. The volume of a primitive unit cell of a F.C.C. structure with lattice constant 'a' is :

- (a)  $a^3$ . (b)  $\frac{a^3}{2}$ .  
(c)  $\frac{a^3}{4}$ . (d)  $\frac{a^3}{8}$ .

8. The volume of a crystal primitive cell is 'V'. The volume of the first Brillouin zone :

- (a)  $\frac{1}{V}$ . (b)  $v$ .  
(c)  $2\pi^3v$ . (d)  $\frac{2\pi^3}{V}$ .

#### Bunch III

9. Which of the following shows tendency to polymerize ?

- (a) Ionic. (b) Covalent.  
(c) Metallic. (d) Van der Waals.

10. Phonon is ———.

- (a) Electromagnetic wave. (b) Polarization wave.  
(c) Magnetisation wave. (d) Quantised lattice vibration.

11. At low temperature, the electrical resistivity varies as :

- (a)  $T$ . (b)  $T^2$ .  
(c)  $T^3$ . (d)  $T^5$ .

12. At low temperature above absolute zero for  $E \ll E_F$  the Fermi Dirac function approaches :

- (a)  $\frac{-E}{e^{KT}}$ . (b) Zero.  
(c) Unity. (d) Infinity.

#### Bunch IV

13. The maximum symmetry elements presents in :

- (a) Ortho rhombic crystal. (b) Cubic crystal.  
(c) Trigonal crystal. (d) Hexagonal crystal.



14. A crystal possess maximum ——— point groups.  
(a) 23. (b) 32.  
(c) 532. (d) 1.
15. Five fold rotation axis ——— is lattice.  
(a) Exist. (b) Does not exist.  
(c) May possible. (d) All the above are correct.
16. An X-ray tube works in 60 kV. What will be minimum wave length of X-rays emitted from it ?  
(a)  $0.2 \times 10^{-10}$  m. (b)  $2\text{\AA}$ .  
(c)  $20\text{\AA}$ . (d)  $200\text{\AA}$ .

(4 × 1 = 4)

**Part B (Short Answer Questions)**

*Answer any five questions.*

*Each question carries a weight of 1.*

17. What is Bragg's Law ? Explain.  
18. Distinguish between Point group and Space group.  
19. State Bloch Theorem.  
20. What is reciprocal lattice and why it is called so ?  
21. What are Brillouin Zones ?  
22. What is Meissner effect ?  
23. Distinguish between Type 1 and Type 2 super conductors.  
24. Bring out the application of Nanomaterials.

(5 × 1 = 5)

**Part C (Short Essay/Problems)**

*Answer any four questions.*

*Each question carries a weight of 2.*

25. Explain Curie Weiss's Law in magnetism.  
26. What is London equation in superconductivity ? Explain.  
27. Give the free electron theory in one dimension.  
28. What are amorphous superconductors ?  
29. Show that in a simple cubic lattice the separation between successive lattice planes (100), (110) and (111) are in the ratio of 1 : 0.71 : 0.58.

Turn over

30. The potential energy of a diatomic molecule is given in the terms of inter atomic distance 'x' by  $U(r) = \frac{a}{r^m} + \frac{b}{r^n}$  given the expression for the equilibrium spacing of the atoms and hence obtain dissociation energy.

(4 × 2 = 8)

**Part D (Essays)**

*Answer any two questions.*

*Each question carries a weight of 4.*

31. Describe the Langevin's theory for paramagnetism.
32. What is superconductivity ? Mention the properties. Explain the BCG theory of superconductivity and discuss the energy gap based on this theory.
33. What is Hall effect ? Obtain an expression for Hall voltage. What are the application of Hall effect ?

Explain the formation of ionic bonding-covalent bonding, metallic bonding and van der Waal bonding. What is Madelung constant ?

(2 × 4 = 8)