E 7520

Reg. No............................

Name............................

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2014

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

Answer all questions.
Objective type question.
Weight 1 for each bunch.

Bunch I

1. An X-ray tube works in 60 KV. What will be minimum wave length of X-rays emitted from it.

    (a) 0.2×10^{-10} m.   (b) $2A^\circ$.

    (c) $20A^\circ$.   (d) $200A^\circ$.

2. Five fold rotation axis ———— is lattice.

    (a) Exist.   (b) Dose not exist.

    (c) May possible.   (d) All the above are correct.

3. A crystal possess maximum ———— point groups.

    (a) 23.   (b) 32.

    (c) 532.   (d) 1.

4. The minimum symmetry elements presents in :

    (a) Ortho rhombic crystal.   (b) Cubic Crystal.

    (c) Trigonal crystal.   (d) Hexagonal crystal.

Bunch II

5. At low temperature above absolute zero for $E \ll E_p$ the Fermi Dirac function approaches.

    (a) $\dfrac{-E}{e^{KT}}$.   (b) Zero.

    (c) Unity.   (d) Infinity.

Turn over

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

    (a) T.

    (b) T^2.

    (c) T^3.

    (d) T^5.

7. Phonon is ————.

    (a) Electromagnetic wave.

    (b) Polarization wave.

    (c) Magnetisation wave.

    (d) Quantised lattice vibration.

8. Which of the following shows tendency to polymarise ?

    (a) Ionic.

    (b) Covalent.

    (c) Metallic.

    (d) Vander-Walls.

BUNCH III

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

    (a) $\dfrac{1}{v}$.

    (b) v.

    (c) $2\pi^3 v$.

    (d) $\dfrac{2\pi^3}{v}$.

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

    (a) a^3.

    (b) $\dfrac{a^3}{2}$.

    (c) $\dfrac{a^3}{4}$.

    (d) $\dfrac{a^3}{8}$.

11. Two dimensional lattice with highest rotational symmetry is :

    (a) Triangular lattice.

    (b) Hexagonal lattice.

    (c) Squire lattice.

    (d) All of the above.

12. 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.

BUNCH IV

13. At absolute zero temperature all the allowed energy states up to Fermilevel will be :

    (a) Empty.

    (b) Occupied.

    (c) Half occupied and half empty.

    (d) Partially occupied and partially empty.

14. Which of the following has hydrogen bonding :

    (a) CH_4.   (b) C.

    (c) HF.   (d) Cscl.

15. A crystallographic 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).

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

    (a) 1.   (b) $\dfrac{\sqrt{8}}{\pi}$.

    (c) $\sqrt{3}$.   (d) $\sqrt{\dfrac{8}{3}}$.

$(4 \times 1 = 4)$

Part B

Answer any **five** *questions.*
Short answer question.
Weight 1 for each.

17. What are Miller indices ?

18. What is Bohr Magneton ?

19. Explain what is A.C and D.C Josephson's effect.

20. Shows that five fold rotation is not exist in crystals.

21. Distinguish between Lattice and Reciprocal Lattice.

22. State and prove Bloch theorem.

23. Distinguish between type I and type II Super conductors.

24. Explain graphically the variation :

    (a) Inter atomic force and potential energy with the spacing between the two atom ?

$(5 \times 1 = 5)$

Part C

Answer any **four** *questions.*
Short Essay / Problem.
Weight 2 for each.

25. Show that $\left(-\dfrac{\partial f}{\partial E}\right)$ is a Fermi Dirac distribution is symmetrical and its integral is unity ?

Turn over

26. What are nanomaterials? Bring out the applications ?

27. Calculate the packing fraction for a face centered cubic structure ?

28. Explain briefly the Debey - Scherror (Powder Method) for crystal structure analysis.

29. Copper has F.C.C structure and its atomic radius is 0. 1278 nm. Calculate its density. Atomic weight of copper is 63.5 a.m.u- Number of atoms/ unit volume 4.

30. Calculate the compressibility of an ionic solid. Madu lung constant 1.76. Lattice constant 0.41 mm. Repulsive exponent 0.5 ? $\Sigma_0 = 8.85 \times 10^{-12}$ $e = 1.6 \times 10^{-19}$ coulomb.

$$(4 \times 2 = 8)$$

Part D

*Answer any **two** questions.*
Essay. Weight 4 for each.

31. Describe the two dimensional and three dimensional crystal lattices.

32. What are Super conductors ? Explain Meisner effect. Briefly explain the B.C.S theory and energy gap of Super conductors.

33. What is Hall effect ? Derive an expression for Hall Coefficient. Mention some applications.

$$(2 \times 4 = 8)$$