SUBJECT CODE : **PH/MC/SS64**

### B.Sc. DEGREE EXAMINATION APRIL 2008
BRANCH III - PHYSICS
SIXTH SEMESTER

REG. No._____

COURSE     :     **MAJOR – CORE**
PAPER       :     **SOLID STATE PHYSICS**
TIME         :     **30 MINS.**                              MAX. MARKS : 30

## SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS:                                        (30 x 1 = 30)

I     CHOOSE THE CORRECT ANSWER:

1.   The nature of binding for a crystal with alternative and evenly spaced positive and negative ions is
     a) Ionic          b) Dipole          c) Covalent          d) Metallic

2.   Which of the following element is currently bonded crystal?
     a) Aluminium      b) Lead          c) sodium chloride   d) silicon

3.   The important characteristic of a metal is they have
     a) high electrical resistivity       b) low electrical resistivity
     c) low electrical conductivity        d) bad conductivity

4.   The color center which are produced by excess alkali metal atoms is called
     a) F center                           b) V center
     c) Frenkel defect                     d) Schettky  defect

5.   An extra atom in the interstice of the lattice is
     a) schettky defect                    b) frenkel defect
     c) impurity atom                      d) interstial atom

6.   The motion of dislocation is possible by
     a) climb          b) glide          c) slip          d) all of these

7.   The temperature dependence of the classical expression for electrical resistivity of a metal

     a) $S \alpha T^2$          b) $S \alpha T^{1/2}$          c) $S \alpha \dfrac{1}{T^2}$          d) $S \alpha \dfrac{1}{T}$

8. The unit of Hall coefficient is
   a) $Vm^3 A^{-1} Wb^{-1}$   b) $Vm^2 A Wb^{-1}$   c) $Vm^3 A Wb^{-1}$   d) $Vm^2 A^{-2} Wb$

9. Diamagnetic materials possess
   a) Permanent magnetic dipoles   b) No permanent magnetic dipoles
   c) Induced Dipole moment   d) None of these

10. Magnetic susceptibility $(\chi)$
    a) Dipole moment per unit volume   b) Torque per unit Area
    c) Induced Dipole moment   d) none of these

11. The transition temperature of mercury is
    a) 4.12K   b) 1.14K   c) 2.12K   d) 6.42K

12. In the superconducting state resistivity is
    a) zero   b) one   c) Higher   d) Infinite

13. The width of the energy gap of a superconductor at $O^oK$ is about
    a) O joule   b) $3.5K_BT_C$   c) $K_BT_C$   d) $300 K_BT_C$

14. On cooling below the critical temperature in all superconductors the entropy
    a) Increases   b) Goes to infinity
    c) Decreases   d) Becomes constant

15. If 0.28nm is the spacing between the nearest neighbouring ions in NaCl lattice, the unit cell parameter is
    a) $1.4 A^o$   b) $5.6 A^o$   c) 1nm   d) $0.7 A^o$

II   FILL IN THE BLANKS:

16. Ionic bonds have _____ electrical conductivity.

17. An extra atom in the interstice of the lattice is _____.

18. The ratio between thermal and electrical conductivities is given by _____.

19. At Neel temperature, susceptibility is _____.

20. A _____ may be considered as a new particle having twice the mass and charge of an electron.

III   STATE WHETHER TRUE OR FALSE:

21. Argon is an example of Vanderwaals bonding.

22. Plastic Deformation results in the decrease of the crystal length.

23. Alnico V material is used for making permanent magnet.

24. The temperature below which certain materials and antiferromagnetic and above which they are paramagnetic is called transition temperature.

25. Superconducting state is more ordered than the normal state for type I superconductors.

IV ANSWER IN ONE OR TWO SENTENCES:

26. What are molecular crystals?

27. What is a plane defect?

28. What are domains?

29. What is Neel temperature?

30. Give any two application of ferrites.

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STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2004-05 & thereafter)

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### SECTION – B

ANSWER ANY FIVE QUESTIONS:                          (5 x 5 = 25)

1.  What is Modeling constant?  Show that the modeling constant for one dimensional array of ions of alternating sign with a distance between two successive ions is equal to 2 log2.

2.  Explain the difference between edge and screw dislocations.  What is Burgers vector.

3.  Obtain the maximum sheet stress $(T_c)$ max for a cubic crystal.

4.  Obtain the relation between electrical conductivity and thermal conductivity.

5.  Explain weiss theory of paramagnetism.

6.  Explain Meissner effect.  Show that a superconductor is a perfect diamagnet.

7.  Explain BCS theory of superconductivity.

### SECTION – C

ANSWER ANY THREE QUESTIONS:                          (3 x 15 = 45)

8.  a)  Distinguish between ionic and covalent bonds.

    b)  Explain Metallic bonds.  Give any 2 properties.

    c)  What is the nature of bonds in Nacl & Diamonad.

9.  Obtain the expressions for the number of schettky and frenkel defects with reference to ionic crystal.

10. What is Hall effect?  Explain how Hall voltage and Hall coefficients can be determined experimentally?

11. Distinguish between Ferromagnetic, Ferrimagnetic and antiferromagnetic materials. Give an example for each class of material. Discuss the various uses of ferrites.

12. What is superconductivity? Discuss the following properties of superconductors.
a) entropy          b) Energy Gap          c) Specific heat.

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