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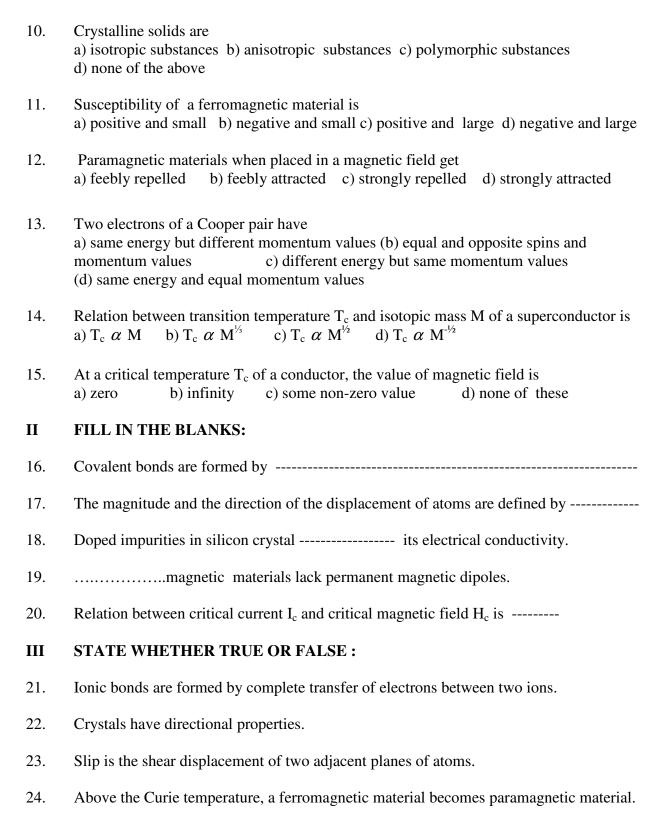
(For candidates admitted during the academic year 2004-05 & thereafter)

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

B.Sc. DEGREE EXAMINATION APRIL 2010
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.   Among the following bonds which is stronger bond?
      a) metallic bond   b) ionic bond c) hydrogen bond   d) covalent bond

2.   When the bond length is decreased, the bond energy
      a) remains constant   b) increases   c) also decreases   d) none of the above

3.   During the formation of a bond
      a) some energy is lost   b) energy remains constant
      c) some energy is gained   d) none of the above

4.   Van der Waals' bonds are
      a) non-directional   b) directional c) unidirectional d) none of the above

5.   Tetrahedral bonding is characteristic of
      a) covalent bonds   b) metallic bonds   c) ionic bonds d) molecular bonds

6.   Primary bonds are formed by
      a) intermolecular forces   b) Van der Waals' type forces
       c) interatomic forces   d) dipole interaction between two atoms

7.   Madelung constant of NaCl is
      a) 17.475   b) 0.17475   c) 1.7475   d) 25.0312

8.   Dislocations are
      a) line defects   b) plane defects   c) chemical defects   d) point defects

9.   Errors in charge distribution in solids result in
      a) vacancies   b) interstitialcies   c) volume defects   d) electronic defects

10.   Crystalline solids are
        a) isotropic substances b) anisotropic substances c) polymorphic substances
        d) none of the above

11.   Susceptibility of a ferromagnetic material is
        a) positive and small   b) negative and small c) positive and large d) negative and large

12.   Paramagnetic materials when placed in a magnetic field get
        a) feebly repelled   b) feebly attracted   c) strongly repelled   d) strongly attracted

13.   Two electrons of a Cooper pair have
        a) same energy but different momentum values (b) equal and opposite spins and
        momentum values   c) different energy but same momentum values
        (d) same energy and equal momentum values

14.   Relation between transition temperature T_c and isotopic mass M of a superconductor is
        a) $T_c \alpha M$ b) $T_c \alpha M^{1/3}$ c) $T_c \alpha M^{1/2}$ d) $T_c \alpha M^{-1/2}$

15.   At a critical temperature T_c of a conductor, the value of magnetic field is
        a) zero   b) infinity   c) some non-zero value   d) none of these

II   FILL IN THE BLANKS:

16.   Covalent bonds are formed by --

17.   The magnitude and the direction of the displacement of atoms are defined by -------------

18.   Doped impurities in silicon crystal ------------------ its electrical conductivity.

19.   ….…………..magnetic materials lack permanent magnetic dipoles.

20.   Relation between critical current I_c and critical magnetic field H_c is ---------

III   STATE WHETHER TRUE OR FALSE :

21.   Ionic bonds are formed by complete transfer of electrons between two ions.

22.   Crystals have directional properties.

23.   Slip is the shear displacement of two adjacent planes of atoms.

24.   Above the Curie temperature, a ferromagnetic material becomes paramagnetic material.

25   Type I superconductors have two critical fields.

IV   **ANSWER IN ONE OR TWO SENTENSES:**

26.   Define bond energy.

27.   What is Frenkel defect?

28.   State Wiedemann – Franz law.

29.   What is Meissner effect in superconductors?

30.   What is Josephson's effect in superconductivity?

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SECTION – B

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

1.   Explain the potential energy diagram of ionic molecule with a neat sketch.

2.   Explain what is Schottky defect with a neat sketch and example.

3. a)   What are colour centers?
   b)   Briefly explain any two types of colour centers present in crystals.

4.   Calculate the mobility, relaxation time and drift velocity of the electrons in silver if the field intensity in the material is 1 volt / cm. Given: the resistivity = 1.54 x 10^{-8} Ω m at room temperature and the electron density = 5.8 x 10^{28} / m^3.

5. a)   What are ferrites?
   b)   Mention any six applications of ferrites.

6. a)   Prove that superconductors are perfect diamagnetic in nature
   b)   Mention any four applications of superconductors.

7. a). What is BCS theory?
   b). Enumerate the important results of BCS theory.

SECTION – C

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

8.   Explain with suitable example and diagram the ionic, covalent and metallic bonds in solids.

9.   Write short notes on
 a).   Edge dislocation   b). Grain boundaries   c). Crystal growth (any one method)

10. a) What is Hall effect?
    b) Obtain an expression for the Hall coefficient.
    b) Describe an experimental setup for the measurement of Hall voltage.

11.   Discuss Langevin's theory of paramagnetism and obtain an expression for the
       paramagnetic susceptibility.

12. a). Derive first and second London equations and hence explain the phenomenon of
         superconductivity using them.
    b). The superconducting transition temperature of lead is 7.26 K.The magnetic field at 0 K
         is 64×10^3 A / m. Calculate the critical magnetic field at 5 K.

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