

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2008-09 & thereafter)

SUBJECT CODE : PH/MC/SS64

B.Sc. DEGREE EXAMINATION APRIL 2013
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. Metallic bond is
 - a) an unsaturated covalent bond
 - b) a saturated covalent bond
 - c) a modified version of ionic bond
 - d) weaker than secondary bonds
2. Diamond belongs to
 - a) covalent bonded solid
 - b) ionic bonded solid
 - c) dipole bonded solid
 - d) metallic bonded solid
3. Bond energy is the amount of energy required to
 - a) break two mole of bonds
 - b) break one mole of bonds
 - c) make one mole of bonds
 - d) make two mole of bonds
4. A substitutional impurity refers to a
 - a) small atom
 - b) big atom
 - c) foreign atom
 - d) molecule
5. Colour centers are present in
 - a) conduction band
 - b) band gap
 - c) valence band
 - d) induction band
6. Defect due to displacement of atom into an interstitial site or void space is called
 - a) Schottky defect
 - b) Frenkel defect
 - c) vacancies
 - d) interstitialcies
7. According to classical theory, metal is an aggregate of
 - a) atoms and molecules
 - b) nuclei and electrons
 - c) positive ions and electron gas
 - d) negative ions and positive ions
8. Classical theory could not explain
 - a) photoelectric effect
 - b) Compton effect
 - c) black body radiation
 - d) all the above

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9. In N- type semiconductors Hall coefficient is
 a) zero b) positive c) negative d) infinity
10. Susceptibility of a paramagnetic material is
 a) positive and very small b) negative and small
 c) positive and large d) negative and large
11. In the case of ferromagnetic materials the spin moments associated with two sets of atoms are aligned
 a) parallel to each other b) antiparallel to each other
 c) antiparallel but unequal d) randomly
12. Ferrites are modified structure of
 a) copper with no carbon b) copper with carbon
 c) iron with carbon d) iron with no carbon
13. Two electrons of a Cooper pair have
 (a) equal and opposite spins and momentum values
 (b) same energy but different momentum values
 (c) different energy but same momentum values
 (d) same energy and equal momentum values
14. Residual resistivity is due to scattering by
 a) impurities b) phonons c) photons d) protons
15. In electron- phonon – electron interaction, the force between two electrons is
 a) repulsive b) attractive c) zero d) magnetic

II FILL IN THE BLANKS:

16. When the bond length is decreased, the bond energy -----
17. Errors in charge distribution in solids are called -----
18. Electrical conductivity of metals -----with increase in temperature.
19. The permeability of ferromagnetic material is very -----
20. The quanta of energy emitted during the lattice vibrations are called -----

III STATE WHETHER TRUE OR FALSE:

21. Hydrogen bond is formed by a hydrogen ion located between two anions.
22. Point imperfections are also called as one dimensional imperfections.

23. Mobility of electron is defined as the magnitude of the drift velocity per unit magnetic field.
24. When the temperature is less than Curie temperature, paramagnetic material behaves like a diamagnetic material.
25. Flow of ac current through the junction by tunneling even in the absence of any electric or magnetic field is called dc Josephson effect.

IV ANSWER IN ONE OR TWO SENTENCES:

26. What is covalent bond?

27. Define line defect.

28. State Wiedemann – Franz law.

29. What is superconductivity?

30. What is Meissner effect in superconductors?

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SECTION - B

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

1. Explain Van der Waal's bond formation in helium.
2. Briefly explain various colour centers in alkali halides.
3. Prove Ohm's law based on classical free electron theory of metals.
4. Calculate the drift velocity of the electrons and current density in a copper wire of diameter 0.16 cm which carries a steady current of 10 A. Given the electron density $n = 8.46 \times 10^{28} / \text{m}^3$
5. a) Give the results and drawbacks of Langevin's theory of diamagnetism.
b) Mention any two applications of ferrites.
6. a) Distinguish between Type I and Type II superconductors.
b) What is BCS theory?
7. a) Superconducting tin has a critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 tesla at 0 K. Find the critical magnetic field at 2 K.
b) Mention any two applications of superconductors

SECTION – C

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

8. What is cohesive energy? Assuming a suitable model for interatomic forces derive an expression for the cohesive energy of ionic solids
9. Explain Schottky defect. Obtain an expression for the number of Schottky defects for an ionic crystal.

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10. a) Define Hall effect?
b) Derive an expression for the Hall coefficient.
c) Describe an experimental setup for the measurement of Hall voltage.
11. a) What is ferromagnetism?
b) Explain the reasons for the formation of domain structure in a ferromagnetic material.
c) How the hysteresis curve is explained on the basis of the domain theory?
12. a) What are normal conducting and superconducting electrons?
b) Derive first and second London equations and hence explain the phenomenon of superconductivity using them.
