STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.

(For candidates admitted during the academic year 2008-09)

SUBJECT CODE : PH/MC/SS64

B.Sc. DEGREE EXAMINATION APRIL 2011

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 strongest bond is
   (a) covalent bond (b) Ionic bond (c) Van der Waals bond (d) Metallic bond

2. The value of Madelung constant for one dimensional lattice of oppositely charged ion is
   (a) 2 log 2 (b) log 2 (c) ½ log 2 (d) 6 log 2

3. The lengh of H –H bond is (in nm)
   (a) 0.074 (b) 0.01 (c) 0.037 (d) 2

4. A lattice vacancy is often indicated in illustrations in chemical equations by
   (a) Square (b) Circle (c) Point (d) Rectangle

5. When an atomleaves its site and dissoloves interstitially into the structure it is called
   (a) Schottky defect (b) Frenkel defect (c) Vaccancy pair (d) Grain defect

6. Boundary between two parts of a closest packing alternate stacking sequence is called
   (a) Grain defect (b) Staking fault (c) Screw dislocation (d) Lineage boundary

7. The temperature dependence of the classical expression for electrical resistivity of metal is
   (a) $\rho \alpha T^2$ (b) $\rho \alpha 1/T^2$ (c) $\rho \alpha 1/T$ (d) $\rho \alpha 1/\sqrt{T}$

8. Ohms law relates to the electric field E, conductivity σ and current density J as
   (a) $J = \sigma E$ (b) $J = \sigma E^2$ (c) $J = \sigma / E$ (d) $J = E/.\sigma$

9. If e, μ and n respectively represent charge, mobility and concentration of electrons then the electrical conductivity of the material is given by
   (a) $\mu e /n$ (b) $n /\mu e$ (c) $ne\mu$ (d) ne

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10. The relation between flux density (B) and magnetic field strength (H) is given by
    (a) B =H (b) B =$\mu_0 \mu_r$ H (c) B = μ_0/μ (d) B = H / μ

11. The magnetic susceptibility (χ)per unit volume is
    (a) μ_0 M / B (b) B / μ_0M (c) B / μ_0 (d) B/μ_0 +M

12. The most important characteristics of ferromagnetic materials is
    (a) Spontaneous magnetization (b) Neel temperature
    (c) Faraday's temperature (d) Demagnetization temperature.

13. If the external field is increased beyond a critical value, called critical field H_c a superconducting material changes to
    (a) normal state (b) remains –unaffected
    (c) ferromagnetic state (d) anti ferromagnetic state

14. Type II superconductor observe
    (a) partial Meissner- Ochsenfield effect (b) Breakdown of Silsbee effect
    (c) High critical field (H_c) and high temperature (d) All the above

15. For a material to be considered as a superconductor, it has to exhibit
    (a) only zero resistivity (b) only Meissner effect
    (c) zero resistivity and Meissner effect both (d) only Josephson effect.

II. STATE IF TRUE OR FALSE:

16. The nature of bonding in $CH_4$is metallic.
17. An atom displaced to interstitial site creating nearby vacancy is called Schottky effect.
18. The relation between average drift- velocity (v_d) of electrons in a metal is related to the applied electric field E and collision time τ as eEτ/m.
19. The characteristic lengths of a superconductor are only coherence length.
20. Substances with negative susceptibility are called as diamagnetic materials.

III. FILL IN THE BLANKS:

21. The nature of binding for a crystal with alternate and evenly spaced positive and negative ions is ----------.
22. Electronic defects are the results of errors in ---------- in solids
23. The value of Lorentz number is ----------.
24. Magnetism is essentially a ---------- effect.
25. In a BCS theory superconductivity, electron pair responsible for superconducting state is called ----------.

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IV. ANSWER IN ONE OR TWO SENTENCES:

26. Define bond energy.

27. Name any two types of defects in crystals.

28. State Wiedmann Franz law.

29. State Curie-Weiss law.

30. What is type I superconductor?

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SECTION - B

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

1. The force of attraction between Na and Cl is 3.02×10^{-9} N when the two ions touch each other. Find the radius of Cl^-.ion.Given ionic radius of Na^+ ion is 10.95Å, e= 1.6×10^{-19}C,$\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$.

2. Calculate the change in negative moment of a circulating electron in an applied field of 2 tesla acting perpendicular to the plane of the orbit. Given r = 5.29×10^{-11} m.

3. Calculate the temperature of a proton whose energy $E_g = 1.8 \times 10^{-22}$ J is just sufficient to break up Cooper pairs in mercury at T = 0 K .In what region of electromagnetic spectrum are such photon found?

4. Explain vacancy, impurity, interstitial impurity and electronic defect.

5. State and prove Wiedmann Franz law.

6. What is antiferromagnetism? List out the properties of it.

7. Differentiate type I and type II superconductor.

SECTION - C

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

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

9. Write an essay on crystal defects by explaining point defects, line defects, surface defects and volume defects.

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10. Derive an expression for the Hall coefficient. Describe an experiment for the determination of Hall coefficient.

11. Describe Weiss theory of Para magnetism.

12. Derive first and second London equations and hence obtain an expression for penetration depth.

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