**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.**
**(For candidates admitted during the academic year 2011-2012 and thereafter)**

**SUBJECT CODE : 11PH/MC/SS54**

**B.Sc. DEGREE EXAMINATION NOVEMBER 2015**
**BRANCH III - PHYSICS**
**FIFTH SEMESTER**

**REG. No._____**

**COURSE : MAJOR - CORE**
**PAPER : SOLID STATE PHYSICS**
**TIME : 30 MINUTES** **MAX. MARKS : 30**

**SECTION – A**
**TO BE ANSWERED IN THE QUESTION PAPER ITSELF**

**ANSWER ALL QUESTIONS:** **(30x1=30)**
**Choose the correct answer:**

1. Crystalline Argon has
   a) Van der Waals bond b) ionic bond c) metallic bond d) covalent bond

2. Hydrogen bond has bond energy of the order
   a) 1 KeV b) 10 eV c) 1 eV d) 0.1 eV

3. Sodium has
   a) ionic bond b) Van der Waals bond c) metallic bond d) covalent bond

4. Diamond is an example of
   a) metallic bond b) covalent bond c) Van der Waals bond d) ionic bond

5. With usual notations, thermal conductivity can be expressed as
   a) $k = cvl$ b) $k = \frac{cv}{3}$ c) $k = cv$ d) $k = \frac{cvl}{3}$

6. Hall voltage will be developed in a direction
   a) mutually perpendicular to magnetic field B and current I
   b) perpendicular to B and parallel to I
   c) parallel to B and I
   d) perpendicular to I and parallel to B

7. With usual notations, the Hall coefficient can be expressed as
   a) $R = ne$ b) $R = \frac{n}{e}$ c) $R = \frac{e}{n}$ d) $R = \frac{1}{ne}$

8. The expression for electrical conductivity can be conventionally written as
   a) $\sigma = \frac{ne^2\tau}{m}$ b) $\sigma = \frac{ne\tau}{m}$ c) $\sigma = nem$ d) $\sigma = ne\tau$

9. Curie's law can be written as
   a) $\psi = cT^2$ b) $\psi = \frac{c}{T}$ c) $\psi = \frac{1}{T}$ d) $\psi = cT$

10. A diamagnetic material has susceptibility
    a) $\psi = 0$ b) $\psi \geq 0$ c) $\psi < 0$ d) d) $\psi > 1$

11. At Neel temperature, an antiferromagnet has
    a) maximum positive susceptibility b) maximum negative susceptibility
    c) minimum positive susceptibility d) minimum negative susceptibility

12. The first London equation can be written as
    a) $j = \frac{A}{\mu_0}$ b) $j = \frac{-A}{\mu_0}$ c) $j = \frac{-A}{\lambda_L^2}$ d) $j = \frac{-A}{\mu_0 \lambda_L^2}$

13. The vector potential $A$ and the magnetic field $B$ are related as
    a) $B = -A$ b) $B = curl\ A$ c) $B = A^2$ d) $B = A^{-1}$

14. When a superconducting material is cooled below the transition temperature, the magnetic lines are effected from the material. This is
    a) Josephson effect b) Isotopic effect c) Meissner effect d) Hall effect

15. Tunneling of superconducting electron pairs corresponds to
    a) Isotopic effect b) Josephson effect c) Meissner effect d) Hall effect

**Fill in the blanks;**

16. Cohesive energy is defined as _____.
17. Madelung constant $\alpha =$ _____.
18. An antiferromagnet attains maximum susceptibility at _____ temperature.
19. As the atomic mass of a superconducting element increases, the critical temperature _____.
20. The entropy of a substance in the superconducting state is _____ (lower/higher) then in the normal state.

**State whether the following statements are true or false:**

21. A missing atom or ion in a crystal is called Frenkel defect.
22. Transfer of an atom from the lattice site to an interstitial position is called Schottky defect.
23. $F$ centre is a positive ion vacancy in Alkali halides.
24. In alkali halides, two adjacent $F$ centres form a $M$ centre.
25. Three adjacent $F$ centres form a $R$ centre.

**Answer briefly:**

26. What is Schottky defect?

27. What is Wiedemann-Franz ratio?

28. State Hall effect.

29. Explain magnetic domain.

30. Give an example of ferrite.

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|---|---|---|---|
| **COURSE** | **:** | **MAJOR - CORE** | |
| **PAPER** | **:** | **SOLID STATE PHYSICS** | |
| **TIME** | **:** | **2½ HOURS** | **MAX. MARKS : 70** |

## SECTION – B

**Answer any Five Questions:** **5x5=25**

1. Explain the types of bonding in crystals with example.
2. Evaluate Madelung constant for NaCl crystal.
3. Explain colour centres in Alkali halides.
4. Derive an expression for electrical conductivity of solids.
5. Outline Langevin theory of diamagnetism.
6. Draw the hysteresis loop of a ferromagnetic material and explain.
7. Explain what are Type I and Type II superconductors.

## SECTION – C

**Answer any Three Questions:** **3x15=45**

8. a) Explain the properties of covalent crystals. (7)
   b) Explain metallic bond and properties of metallic solids. (8)

9. a) Outline the calculation of Schottky defect in a crystal. (7)
   b) Outline the calculation of Frenkel defect in a crystal. (8)

10. Discuss Drude Lorentz free electron theory.

11. Explain Langevin's theory of paramagnetism.

12. Outline BCS theory of superconductivity and explain the applications of superconductors.

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