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 2016
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. Molecular solids exist in gaseous state at
   a) absolute temperature b) 0°C c) room temperature d) 100°C

2. Ionic bond formed between two atoms is
   a) unidirectional b) bidirectional c) non-directional d) multidirectional

3. Van der Waal's bond has _____ mechanical strength.
   a) very low b) moderate c) high d) very high

4. Point imperfections are _____ dimensional defects.
   a) zero b) one c) two d) three

5. A V centre is formed when _____ gets trapped at a vacant lattice site.
   a) electrons b) holes c) atoms d) molecules

6. M centres consist of _____ adjacent F centres.
   a) one b) two c) three d) four

7. The concentration of electron gas is _____ ordinary gas.
   a) independent of b) less than c) equal to d) greater than

8. The potential energy of an electron at rest inside the metal _____ that of an electron outside the metal.
   a) independent of b) less than c) equal to d) greater than

9. The relation between mean free path (λ), collision time (τ) and velocity(υ)
   a) $\lambda=\tau/\upsilon$ b) $\upsilon = \lambda\tau$ c) $\tau = \upsilon\lambda$ d) $\tau = \lambda/\upsilon$

10. The material for which the magnetic susceptibility is negative is
    a) ferrimagnet b) ferromagnet c) paramagnet d) diamagnet

11. The magnetic field required to reduce the induction of a magnetized material to zero is
    a) permeability b) coercivity c) susceptibility d) retentivity

12. The magnetic moment per unit volume of a material is called
    a) Magnetostriction b) magnetization c) permeability d) susceptibility

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13. A dc current flow across superconductor-insulator-superconductor junction even when no voltage is applied is called
    a) ac Josephson effect b) dc Josephson effect c) London effect d) Meissner effect

14. The entropy difference between normal and superconducting state is
    a) $S_N-S_S=-H_C\, dH_C/dT$ b) $S_N-S_S=H_C\, dH_C/dT$
    c) $S_N-S_S=-H_C\, dT/dH_C$ d) $S_N-S_S=H_C\, dT/dH_C$

15. In ac Josephson effect, a static voltage V_0 across the junction produces an ac current with frequency given by
    a) $\omega = eV_0 / h$ b) $\omega = eV_0 / \hbar$ c) $\omega = 2eV_0 / h$ d) $\omega = 2eV_0 / \hbar$

Fill in the blanks:

16. The value of the Madelung constant depends upon the _____ .
17. A colour centre is a _____ which absorbs visible light.
18. According to _____ principle, electrons having parallel spins tend to stay away.
19. _____ materials possess opposite moments of different magnitudes resulting in large magnetization.
20. The penetration depth and coherence length are functions of _____.

State whether the following statements are true or false:

21. Covalent bond is a directional bond.
22. Frenkel defect consists of a vacancy and an interstitial atom.
23. The free electron theory explains the heat capacity of a metal.
24. Hysteresis curve is reversible.
25. In superconducting materials, the electrical resistance disappears below critical temperature.

Answer briefly:

26. What is Madelung energy?

27. What is Schottky defect?

28. What is free electron gas?

29. Differentiate Curie temperature and Neil temperature.

30. Expand SQUID.

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SECTION – B

Answer any Five Questions: 5x5=25

1. Describe the hydrogen bond formation in water molecules with a suitable diagram.
2. Write the origin and the properties of a metallic bond.
3. Explain the formation of F centre in alkali halides with suitable diagram.
4. On the basis of free electron theory, briefly explain electrical conductivity & thermal conductivity of a metal. Hence deduce Wiedemann-Franz Law.
5. Explain the Langevin's theory of paramagnetism and discuss the shortcomings.
6. Explain the variation of susceptibility with temperature for antiferromagnetic materials.
7. Explain the formation of cooper pair electrons.

SECTION – C

Answer any Three Questions: 3x15=45

8. Describe the forces existing between the atoms of crystal. Explain the formation of a stable bond using the potential energy versus interatomic distance of the atoms.
9. What is Frenkel defect? Calculate the number of Frenkel defects in equilibrium at temperature T.
10. What is Hall effect? Explain how the mobility of ions in metals can be determined using Hall coefficient. Mention the applications of Hall effect.
11. Discuss in detail the domain theory of ferromagnetism.
12. What is Meissner effect? Using Meissner effect, differentiate the behavior of type I and type II superconductors in detail.

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