

**STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI- 86**

**END SEMESTER EXAMINATION (ONLINE) - NOVEMBER 2021**

**SOLID STATE PHYSICS**

**CLASS: III B.SC. PHYSICS**

**TIME: 3 HRS**

**SUBJECT CODE: 19PH/MC/SS54**

**MAX. MARKS: 100**

**SECTION-A**

**ANSWER ALL THE QUESTIONS**

**CHOOSE THE CORRECT ANSWER**

**(8x1=8)**

1. The length of H – H bond is (in nm) \_\_\_\_\_.  
a) 0.074                      b) 0.01                      c) 0.037                      d) 2 eV
2. A diamagnetic material has susceptibility  
a)  $\chi=0$                       b)  $\chi \geq 0$                       c)  $\chi < 0$                       d)  $\chi > 1$
3. Which of the following are the properties of superconductors?  
a) They are diamagnetic in nature  
b) They have zero resistivity  
c) They have infinite conductivity  
d) All the above
4. A Copper strip 2.0 cm wide and 1.0 mm thick is placed in a magnetic field with  $B=1.5\text{W/m}^2$  perpendicular to the strip. Suppose a current of 200 A is set up in the strip, what Hall potential difference would appear across the strip? ( $N=8.4 \times 10^{28}$  electrons/ $\text{m}^3$ )  
a)  $1.1 \times 10^{-6}$  V                      b)  $2.2 \times 10^{-5}$  V  
c)  $1.1 \times 10^{-5}$  V                      d)  $2.2 \times 10^{-6}$  V

- FILL IN THE BLANKS:** (5x1=5)

- ANSWER BRIEFLY: (7x3=21)**

14. Distinguish between metallic bonds and covalent bonds?
15. Write the significance of Burger's vector.
16. What was the drawback of classical theory in explaining the specific heat capacity of solids?

17. Why anisotropy energy changes with domain wall thickness?
18. Differentiate Curie temperature and Neel temperature.
19. How does the critical magnetic field vary with temperature in type II superconductors?
20. Mention the unique properties of a superconductor.

### SECTION B

**ANSWER ANY FOUR QUESTIONS**

**(4x9=36)**

21. A metallic wire has a resistivity of  $1.42 \times 10^{-8} \Omega \text{m}$ . For an electric field of 0.14 V/m. Find (i) average drift velocity and (ii) mean collision time, assuming that there are  $6 \times 10^{28}$  electrons/ $\text{m}^3$ .
22. Calculate the cohesive energy and bond energy of KCl from the following data  $r_0$  (the equilibrium separation between the ion pair) = 0.314 nm,  $A=1.75$ ,  $n=5.77$ , ionization energy of K= 4.1 eV, electron affinity of Cl=3.61 eV.
23. Explain the Schottky and Frenkel defects with neat diagram?
24. (i) A magnetic field strength of  $2 \times 10^5$  amperes/metre is applied to a paramagnetic material with a relative permeability of 1.01. Calculate the values of B and M.  
  
(ii) A magnetic field of 1800 ampere/metre produces a magnetic flux of  $3 \times 10^{-5}$  weber in an iron bar of cross sectional area  $0.2 \text{ cm}^2$ . Calculate magnetic permeability.
25. Enumerate the properties of type I and type II superconductors.

### SECTION C

**ANSWER ANY ONE QUESTION**

**(1x30=30)**

26. A. What is Hall effect? Give the theory of Hall effect. Describe the Hall effect experiment to determine the Hall coefficient of semiconductor. (15)  
  
B. Explain the BCS theory of superconductivity. (15)
27. A. Explain metallic bond and properties of metallic solids. (15)  
  
B. Derive the Langevin's theory of paramagnetism and obtain an expression for paramagnetic susceptibility. (15)

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