Register Number:
Date:

ST.JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27.

M.Sc. PHYSICS - IV SEMESTER
SEMESTER EXAMINATION: APRIL 2019.
PH-DE0517: MATERIAL SCIENCE

Time: 2.5 hours **Max Marks: 70**

This paper contains three printed pages

PART – A

Answer any 5 questions. Each question carries 10 marks. (5x10=50)

1. Discuss in detail the characteristics of shape Memory Alloys (SMA) and applications of SMA. (5+5)
2. (a) Explain stoichiometry study by Energy Dispersive X-ray analysis.

   (b) Draw the schematic diagram of X-ray Photoelectron Spectroscopy (XPS) and explain the basic principle, X-ray source and applications of XPS. (4+6)
3. (a) Define Composite materials and how are composites classified?
   (b) What are advantages and limitations of phase rule? (5+5)
4. What are the four possible equilibria of water system and discuss its significance of phase diagram.
5. (a). Define specific heat. Describe the characteristics and applications of specific heat materials with suitable diagram?. (5)

   (b).Describe the Basic concept and applications of piezoelectric materials?. (5)
6. (a). With neat sketch, explain the Seebeck effect. Why the Seebeck effect is applicable only for dissimilar metals?. (5)

   (b). Explain the Seebeck coefficient of metals and semiconductors using differential method with suitable example?. (5)
7. Derive the expression for the Wiess molecular field theory of ferromagnetism with reference to Curie point. (10)

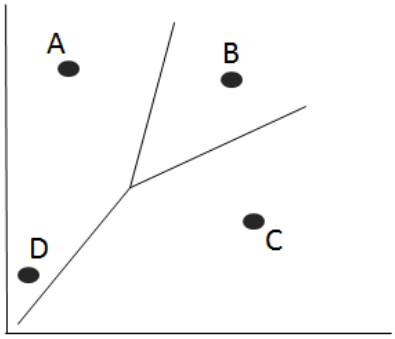
PART – B

Answer any 4 questions. Each question carries 5 marks. (4x5=20)

8. Metal A and metal B have the same length and the same cross-sectional. Both metals heated at its end and the change in temperature of both metals are the same. If the thermal conductivity of metal A = ¼ times the thermal conductivity of metal B. Find the ratio of the rate of the heat conduction of metal A to metal B.
9. At 30 °C the volume of an aluminum sphere is 30 cm^3. The coefficient of linear expansion is 24 x 10^{-6} $°C^{-1}$. If the final volume is 30.5 cm^3, what is the final temperature of the aluminum sphere?.
10. A transformer core wound with a coil carrying an alternating current at a frequency of 50 Hz. assuming the magnetization to be uniform throughout the core volume of 0.01 m^3, calculate the hysteresis loss. The Hysteresis loop has an area of 60,000 units, when the axes are drawn in units of 10^{-4} Wbm^{-2} and 10^2 Am^{-1}.
11. A binary (Cu) and remaining Silver (Ag) which is solidifies at 779 °C. The solid consists of two phases α and β. The phase α has 9% of Cu whereas β has 8% of Ag at 779 °C. At room temperature these are pure Ag and Cu respectively.

    (a). Label all fields and lines. Melting points of Cu & Ag are 1083 °C & 960 °C respectively.

    (b). Estimate the amount of α and β in the above alloy at 779 °C and at room temperature.

12. 

From the figure what phase change corresponds to each of these below

A ⟶ B, B ⟶ C, C ⟶ D, D ⟶ C, C ⟶ B, B ⟶ A

13. For the binary system Copper (Cu) – Nickle (Ni) the following data are available from cooling experiments:

T (^{o}C)	Melt composition (atomic % Ni)	Composition of solid first formed on cooling (atomic % Ni)
1100	3	10
1180	20	37
1260	40	57
1340	60	73
1410	80	87

From these data and information provided in the table above, construct the phase diagram (Temperature (T) vs Composition (c) and label all points.