Date:

Registration number:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
M.Sc. PHYSICS - IV SEMESTER
SEMESTER EXAMINATION: APRIL 2022
(Examination conducted in July 2022)

PHDE-0518– Material Science (Elective)

(For Supplementary Candidates)

Time- 2 ½ hrs Max Marks-70

This question paper contains Two printed pages and Two parts

Part A
Answer any FIVE questions. Each question carries 10 marks

[5 x 10 = 50]

1. (a). With a neat sketch, explain the Successive Ionic Layer adsorption and reaction method (SILAR) mechanism.
   (b). Compare the top-down and bottom-up approaches for nanostructure with a suitable diagram. [5+5]
2. Describe the thermal expansion of solids? Obtain the expression for the linear coefficient of solids. [3+7]
3. (a). Explain the phase diagram for the iron-carbon alloy with suitable illustration.
   (b). Using a phase diagram, explain the given terms, (i). Tie-Line rule, (ii). Lever rule and (iii). 1-2-1 rule. [5+5]
4. Define the shape memory effect. Explain the principle and phase transformation of shape memory alloys with a suitable sketch. [2+8]
5. (a). Describe the concepts of the Seebeck effect with a suitable diagram.
   (b). Using the Van der Pauw method, obtain the vertical and horizontal resistance with a suitable diagram. [5+5]
6. Derive an expression for the susceptibility of a paramagnetic material using quantum theory.
7. What is a domain? Explain, with suitable sketches, the hysteresis property of ferromagnetic material. [2+8]

Part B

Answer any Four questions. Each question carries 5 marks

[4 x 5 = 20]

8. Calculate the heat flux through a sheet of brass 7.5 mm thick if the temperatures at the two faces are 423 and 323 K. If the area of the sheet is 0.5 m^2, calculate the total energy transmitted per hour. (Thermal conductivity of brass is 120 W m^{-1} K^{-1}).
9. A magnetic field of 1800 ampere/meter produces a magnetic flux of 3 $x10^{-5}$ Weber in an iron bar of a cross-sectional area of 0.2 cm^2. Calculate the permeability.
10. With a neat sketch, explain the nanoparticle synthesis using the sol-gel method.
11. Using the Gibbs phase rule, Calculate the degrees of freedom (F) for the given systems. (i). One-component, (ii). Two components and (iii). Three components system
12. What are ferroelectric materials? Describe the spontaneous polarization of Barium titanate.
13. Describe the following mechanism (i). thermal conductivity, (ii). Thermal diffusivity and (iii). Melting point. [2+2+1]