B.TECH
(SEM IV) THEORY EXAMINATION 2022-23
MATERIAL SCIENCE

Time: 3 Hours   *Total Marks: 100*

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt** *all* **questions in brief.**   **2 x 10 = 20**

(a)   Define the terms: (i) Phase, (ii) Phase diagrams.
(b)   State Gibb's phase rule.
(c)   What are alloy steels?
(d)   Write the alloying elements in HSLA steel.
(e)   Define true stress and true stain.
(f)   Define deformation of engineering materials.
(g)   Explain the ferromagnetic materials with suitable examples.
(h)   What is superconductor materials?
(i)   Distinguish between matrix and reinforcement in composites materials.
(j)   What do you mean by shape memory alloy?

SECTION B

2.   **Attempt any** *three* **of the following:**   **10x3=30**

(a)   Derive the lever rule for the amount in wt% of each phase in two-phase regions of a binary phase diagram.
(b)   Explain the working of Time-Temperature Transformation diagram and what information is supplied by them?
(c)   Define slip system. Explain why zinc is brittle material and copper and aluminium are ductile.
(d)   Define hysteresis in ferromagnetic materials. Draw a hysteresis loop for a ferromagnetic material.
(e)   What are the basic steps in the processing of ceramic products? How the raw materials are selected for the preparation of ceramic products?

SECTION C

3.   **Attempt any** *one* **part of the following:**   **10x1=10**

(a)   Define the following in a binary eutectic phase diagram:
      (i)   Eutectic composition,
      (ii)   Eutectic temperature,
      (iii) Eutectic reaction,
      (iv)   Eutectic point.
(b)   Derive Gibb's phase rule.

4. **Attempt any _one_ part of the following:**   **10x1=10**

  (a) Explain in detail hypo and hypereutectoid steels.

  (b) State fick's laws of diffusion in detail.

5. **Attempt any _one_ part of the following:**   **10x1=10**

  (a) What is meant by creep? Draw a typical creep curve for a metal under constant load and at a relatively high temperature, and indicate on it all three stages of creep.

  (b) Describe the salient features of Brinell, Rockwell B, and Vicker's hardness test.

6. **Attempt any _one_ part of the following:**   **10x1=10**

  (a) What is superconductivity? Draw the curve of resistivity versus temperature for normal metal and pure superconductors.

  (b) What is meant by polarization of a material? Explain different types of polarization.

7. **Attempt any _one_ part of the following:**   **10x1=10**

  (a) What are fibrous composites? How are they classified? Explain their properties.

  (b) What are carbon nanotubes? Explain various properties and applications of carbon nanotubes.