CBCS SCHEME

USN | | | | | | | | | | |

18MR32

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Material Science

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain with a neat sketch the following crystal structure:
(i) Body Centered Cubic (BCC)
(ii) Face Centered Cubic (FCC)
(iii) Hexagonal Closed Packed (HCP) **(12 Marks)**

b. State and explain Fick's laws of Diffusion **(08 Marks)**

OR

2 a. Draw stress strain curve for a ductile material and explain its properties. **(08 Marks)**

b. Define (i) Elastic strength (ii) Stiffness (iii) Resilience
(iv) Toughness (v) Ductility (vi) Hook's law. **(06 Marks)**

c. A steel rod of 10mm diameter and 1.5m length is subjected to an axial tensile load of 1 kN Determine (i) Stress (ii) Strain (iii) Elongation. Take $E = 205 \times 10^6$ kN/m^2. **(06 Marks)**

Module-2

3 a. Differentiate the slip and twinning in plastic deformation. **(06 Marks)**

b. What is fracture? Briefly explain the different types of fracture. **(07 Marks)**

c. Derive Griffith's criterion for brittle fracture. **(07 Marks)**

OR

4 a. What is fatigue failure? Briefly explain the stages of fatigue failure. **(07 Marks)**

b. What is creep? Explain creep curve characteristics for the material. **(09 Marks)**

c. Write a note on Creep resistant materials. **(04 Marks)**

Module-3

5 a. What is a Solid Solution? Explain the Hume – Rothary rules for the formation of substitutional solid solution with examples. **(09 Marks)**

b. With neat sketch explain the grain structure of cast metal. **(06 Marks)**

c. Compare homogeneous and heterogeneous nucleation. **(05 Marks)**

OR

6 a. Write the equations for the following invariant reaction :
(i) Eutectic (ii) Eutectoid (iii) Peritectoid **(06 Marks)**

b. State Gibbs phase rule and explain each term. **(06 Marks)**

c. Briefly explain the construction of phase diagram. **(08 Marks)**

Module-4

7 a. Draw Iron-Carbon equilibrium diagram and explain the invariant reaction in the system. **(12 Marks)**

b. What is TTT diagram? Draw TTT diagram for eutectoid steel and explain its construction. **(08 Marks)**

OR

8 a. Explain the following with suitable sketch :
(i) Annealing
(ii) Normalizing
(iii) Austempering **(12 Marks)**

b. With neat sketch explain induction hardening process. **(08 Marks)**

Module-5

9 a. Explain the properties, composition and microstructure of following :
(i) Grey cast iron (ii) SG Iron. **(12 Marks)**

b. What are the characteristics of Alluminium alloys? List the major alloys used in engineering application. **(08 Marks)**

OR

10 a. Differentiate the thermosets and thermoplastics. **(08 Marks)**

b. Write a note on:
(i) Laminated Composites
(ii) Pultrusion process
(iii) Powder metallurgy Technique. **(12 Marks)**

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