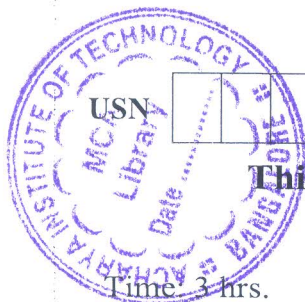


# CBCS SCHEME

18MT32



## Third Semester B.E. Degree Examination, June/July 2024 Material Science and Technology

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- Draw stress – strain diagram and detail all the salient features of ductile (mild steel) material behavior under tensile force. (08 Marks)
  - A 10mm diameter aluminum rod is subjected to a 6 kN tensile load. If the diameter of the rod is 9mm at this load, determine true stress and true strain. (Take  $E = 70 \text{ GPa}$ ). (04 Marks)
  - Define and derive Flick's laws of diffusion. (08 Marks)

OR

- What is Creep? Describe the stages of creep failure with the help of creep curve. Enumerate two examples of creep failure. (10 Marks)
  - How the fatigue testing is carried out? Describe fatigue behavior of a metal using appropriate S – N curve, with endurance limit. (10 Marks)

### Module-2

- Draw TTT diagram for eutectoid steel and explain all the phase mappings. State how CCT – curve is different from TTT - Curve. (08 Marks)
  - Explain Normalizing heat treatment with neat sketch. (05 Marks)
  - Define Hardenability. With neat sketch, describe the Jominy end – Quench test. (07 Marks)

OR

- Sketch the microstructure, enumerate properties and applications of Grey cast iron and Spheroidal graphite cast iron. (09 Marks)
  - Enumerate Composition, properties and applications of brasses and bronzes. (06 Marks)
  - Explain age hardening in Al - 4% Cu in an aluminum alloy. (05 Marks)

### Module-3

- Define Homogenous and Heterogeneous nucleation. Derive an expression for critical radius of nucleus in homogeneous condition. (10 Marks)
  - Describe Solidification of pure – metal and alloy with the help of cooling curves. (05 Marks)
  - Enumerate Hume – Rothary rules for the formation of substitutional solid solution. (05 Marks)

OR

- State : i) Gibb's phase rule ii) Lever rule. (04 Marks)
  - Two metals A and B have their melting points at  $610^\circ\text{C}$  and  $410^\circ\text{C}$  respectively. When alloyed together these metals do not form any compound or intermediate phases, but forms eutectic at 40% A and 60% B at  $260^\circ\text{C}$ . Maximum solubility of each other at eutectic temperature is 4%, which remains the same until  $0^\circ\text{C}$ .
    - Draw the phase diagram and label all the important points and fields.
    - Find the temperature at which alloy containing 70% A and 30% B will begin to crystallize from the melt and at which the melt will be completely solid.
    - Percentage of solid in the above alloy at  $300^\circ\text{C}$ . (16 Marks)

**Module-4**

- 7 a. Classify the composites based on : i) Matrix ii) Reinforcement with neat sketch. (08 Marks)  
b. Describe : i) Hand – Lay up ii) Filament winding processes for FRP composites with neat sketch. (12 Marks)

**OR**

- 8 a. Enumerate the need, characteristics and applications of metal matrix composites. (08 Marks)  
b. Describe : i) Pultrusion ii) Injection moulding processes with neat sketch. (12 Marks)

**Module-5**

- 9 Describe with neat sketch :  
i) Piezo electric materials ii) Shape memory materials. (20 Marks)  
iii) Electrostrictive materials iv) Magnetorheological fluids.

**OR**

- 10 a. Differentiate Sensors and Actuators. (05 Marks)  
b. Describe with neat sketch :  
i) Accelerometer ii) Load cells iii) Pressure sensors. (15 Marks)

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