CBCS SCHEME

USN | | | | | | | | | | 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

1 a. Draw stress – strain diagram and detail all the salient features of ductile (mild steel) material behavior under tensile force. **(08 Marks)**

b. 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 GPa). **(04 Marks)**

c. Define and derive Flick's laws of diffusion. **(08 Marks)**

OR

2 a. What is Creep? Describe the stages of creep failure with the help of creep curve. Enumerate two examples of creep failure. **(10 Marks)**

b. 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

3 a. Draw TTT diagram for eutectoid steel and explain all the phase mappings. State how CCT – curve is different from TTT - Curve. **(08 Marks)**

b. Explain Normalizing heat treatment with neat sketch. **(05 Marks)**

c. Define Hardenability. With neat sketch, describe the Joming end – Quench test. **(07 Marks)**

OR

4 a. Sketch the microstructure , enumerate properties and applications of Grey cast iron and Spheroidal graphite cast iron. **(09 Marks)**

b. Enumerate Composition, properties and applications of brasses and bronzes. **(06 Marks)**

c. Explain age hardening in Aℓ - 4% Cu in an aluminum alloy. **(05 Marks)**

Module-3

5 a. Define Homogenous and Heterogeneous nucleation. Derive an expression for critical radius of nucleus in homogeneous condition. **(10 Marks)**

b. Describe Solidification of pure – metal and alloy with the help of cooling curves. **(05 Marks)**

c. Enumerate Hume – Rothary rules for the formation of substitutional solid solution. **(05 Marks)**

OR

6 a. State : i) Gibb's phase rule ii) Lever rule. **(04 Marks)**

b. Two metals A and B have their melting points at 610°C and 410°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°C. Maximum solubility of each other at eutectic temperature is 4%, which remains the same until 0°C.

i) Draw the phase diagram and label all the important points and fields.

ii) 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.

iii) Percentage of solid in the above alloy at 300°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.

iii) Electrostrictive materials iv) Magnetorheological fluids. **(20 Marks)**

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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