



Third Semester B.E. Degree Examination, June/July 2025  
**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. Sketch the stress – strain diagram for mild steel material and explain the salient points. (05 Marks)
- b. State Fick's laws of diffusion. Explain the factors affecting diffusion. (10 Marks)
- c. Differentiate between Slip and Twinning. (05 Marks)

**OR**

- 2 a. With the help of a creep curve, explain the stages of it. List out the factors affecting creep. (10 Marks)
- b. Define Endurance limit. With S-N diagram explain fatigue behavior of a metal. (05 Marks)
- c. With neat sketches, explain cup and cone fracture. (05 Marks)

**Module-2**

- 3 a. With the help of neat diagrams, explain the procedure for the construction of TTT diagrams. (07 Marks)
- b. With the help of a neat sketch, explain hardening process and the essence of tempering. (07 Marks)
- c. With a neat sketch, explain flame hardening process and the advantages of it. (06 Marks)

**OR**

- 4 a. Enumerate the properties, composition and uses of grey cast iron and malleable iron. (12 Marks)
- b. Enumerate the properties and applications of  $\alpha$  – Brasses and Aluminium alloys. (08 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. Define Composites. Give its classification based on reinforcement and matrix. (06 Marks)  
b. With a neat sketch explain Pultrusion process. (08 Marks)  
c. Explain the filament winding process with a neat sketch. (06 Marks)

**OR**

- 8 a. What are the roles of reinforcement and matrix? (06 Marks)  
b. Differentiate between Thermoset and Thermoplastics. (06 Marks)  
c. With a neat sketch, explain Injection moulding process. (08 Marks)

**Module-5**

- 9 a. What is a Piezoelectric Material? Explain working principle and characteristics of it. (08 Marks)  
b. Explain in detail Force and Torque sensors. (08 Marks)  
c. Write a note on Magnetostrictive materials. (04 Marks)

**OR**

- 10 a. Write a note on shape memory materials. (08 Marks)  
b. With a neat sketch, explain load cells, state its usage. (08 Marks)  
c. Write a short note on Magnetorheological fluids. (04 Marks)

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