

(3 Hours)

[Total Marks: 80]

- N.B:** (1) Question No. 1 is compulsory.
 (2) Attempt any three questions from remaining five questions.
 (3) Figures to the right indicate full marks
 (4) Illustrate the answer with neat sketches wherever required.
 (5) Answers to questions should be grouped & written together.

1. Write short note on **any four** of the following: (20)
 - a) Dislocation pile up
 - b) Creep Resistant Materials
 - c) Solid Solution
 - d) Martempering heat treatment process
 - e) Classification of alloying elements
 - f) Composite materials
2. (a) Explain the mechanisms of creep failure. (8)
 (b) Explain the process of dislocation generation by Frank Read source. (6)
 (c) Draw and explain Isomorphous and Eutectic Phase diagrams. (6)
3. (a) What is Surface hardening? Name its different methods. Discuss any one method in detail. (8)
 (b) Draw a neat and labelled microstructure of White Cast Iron, Grey Cast Iron and Nodular Cast Iron. (6)
 (c) What is Critical Resolved Shear Stress? Derive the expression for Critical Resolved Shear Stress for deformation by slip. (6)
4. (a) Explain the stages of recrystallization annealing and factors affecting it. (8)
 (b) Discuss the Tempering heat treatment of Steel. (6)
 (c) What are the limitations of Plain Carbon Steel? Explain the effect of alloying elements on phase transformation. (6)
5. (a) State Griffith's theory of brittle fracture and derive Griffith's equation. (8)
 (b) Discuss the Spheroidise Annealing heat treatment of Steel. (6)
 (c) Give classification on stainless steel. (6)
6. (a) Draw neat Iron- Iron Carbide Equilibrium diagram indicating all important temperature, phases and composition. (8)
 (b) Explain how are materials tested for fatigue analysis. Draw and explain the S-N Curve. (6)
 (c) What are Nano Materials? Write a note on Nano Composites. (6)