

(3 Hours)

[Total Marks : 100

- N. B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from remaining **six** 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 and written **together**.

1. (a) Discuss the Full Annealing heat treatment of Steel. 6
 (b) Draw neat iron-iron carbide equilibrium diagram indicating all important temperature, phases and composition. Explain the slow cooling of an alloy containing 0.3% C steel, when cooled from 1600°C to room temperature. Draw microstructure at each phase and calculate phases in the alloy at various points by lever rule from liquid state to room temperature. 14
2. (a) What are Line defects in crystals? Explain the various Line defects in detail. 10
 (b) Define the term "Hardenability". Discuss the factor affecting hardenability and explain any one of the hardenability tests. 10
3. (a) State and explain Slip mechanism of plastic deformation. What is Slip system? Explain Slip system in various lattice structures such as FCC, HCP and BCC. 10
 (b) What is Diffusion Coating? Name its different methods. Discuss any one process of diffusion coating in details on basis of principle, process, advantages and applications. 10
4. (a) Define Fracture and give a brief classification of fracture. State Griffith's theory of brittle fracture and derive Griffith's equation. 10
 (b) What is Carburizing? Explain the heat treatment after Carburizing. 10
5. (a) Define Fatigue failure. Give examples of components prone to fatigue failure. Discuss fatigue testing and explain SN curve for ferrous and non ferrous metals. 10
 (b) Explain the various transformations in Iron – Iron Carbide Equilibrium diagram. 10
6. (a) Define Creep. Explain the mechanism of Creep Failure. 10
 (b) Explain in detail the Heat Treatment for 18-4-1 Tool Steel. 10
7. Write short notes on (**Any four**) 20
 - (a) Recrystallization and Effect of recrystallization temperature
 - (b) Maraging Heat Treatment Process
 - (c) Precipitation Hardening
 - (d) Differentiate between Annealing and Normalizing
 - (e) Effect of alloying elements on ferrite
 - (f) Hume Rothery's rules of solid solubility
