

Reg No.: _____

Name: _____

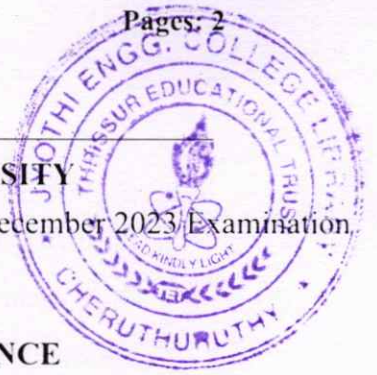
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE)/S5 (PT)(S) June 2024 (2019 Scheme)/S3 (WP)(R) December 2023 Examination

Course Code: MET205**Course Name: METALLURGY & MATERIAL SCIENCE**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer all questions. Each question carries 3 marks*

- | | Marks |
|---|-------|
| 1 Define atomic packing factor. Explain its significance. | (3) |
| 2 Draw a HCP crystal structure. Find the effective number of atoms. | (3) |
| 3 Explain Frenkel defect and Schottky defect. | (3) |
| 4 State and explain Fick's first law for steady state diffusion. | (3) |
| 5 What are the conditions that govern substitutional solid solubility? | (3) |
| 6 Explain spheroidising heat treatment process. | (3) |
| 7 Explain the functions of Nickel, Chromium and Vanadium as alloying elements on steel. | (3) |
| 8 Explain Bauschinger Effect. | (3) |
| 9 Differentiate between transgranular and intergranular fracture. | (3) |
| 10 What is superplasticity? | (3) |

PART B*Answer any one full question from each module. Each question carries 14 marks***Module 1**

- | | |
|---|------|
| 11 a) Find atomic packing factor for BCC structure? [6 Marks] | (14) |
| b) What is coordination number? [2 Marks] | |
| c) Explain effect of grain size and grain shape on material properties. [6 Marks] | |
| 12 a) Explain plastic deformation by slipping and twinning. [10 Marks] | (14) |
| b) Explain the procedure for obtaining miller indices for any crystallographic directions [4 Marks] | |

Module 2

- | | |
|---|------|
| 13 a) With the help of a schematic diagram explain the principle of TEM. [7 Marks] | (14) |
| b) Discuss vacancy diffusion and interstitial diffusion. [7 Marks] | |
| 14 With the help of neat sketches explain edge dislocation and screw dislocation. Explain the significance of Burger's vector and Burger's circuit. | (14) |

Module 3

- 15 a) Draw Fe- C equilibrium diagram and explain different invariant reactions. (14)
[10 Marks]
b) Explain the Jominey end quench test. [4 Marks]
- 16 a) Give a detailed description about the hardening and tempering process. (14)
[8 Marks]
b) Explain flame hardening and induction hardening.[6 Marks]

Module 4

- 17 a) Explain solid solution strengthening and precipitation strengthening.[10 (14)
Marks]
b) What is white cast iron? [4 Marks]
- 18 a) Explain the transformations that take place during the annealing of cold worked (14)
metallic materials. [10 Marks]
b) Differentiate between cold working and hot working. [4 Marks]

Module 5

- 19 a) Explain different stages of ductile fracture. [7 Marks] (14)
b) Differentiate between ductile and brittle fracture. [5 Marks]
c) Define fracture toughness [2 Marks]
- 20 a) Explain sub grain formation and grain boundary sliding [6 Marks] (14)
b) Explain the need and characteristics of polymer metal composites and metal
matrix composites. [8 Marks]