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

Module 2

13	a) With the help of a schematic diagram explain the principle of TEM.[7 Marks] b) Discuss vacancy diffusion and interstitial diffusion. [7 Marks]	(14)
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. [10 Marks] (14)

b) Explain the Jominey end quench test. [4 Marks]

16 a) Give a detailed description about the hardening and tempering process. [8 Marks] (14)

b) Explain flame hardening and induction hardening.[6 Marks]

Module 4

17 a) Explain solid solution strengthening and precipitation strengthening.[10 Marks] (14)

b) What is white cast iron? [4 Marks]

18 a) Explain the transformations that take place during the annealing of cold worked metallic materials. [10 Marks] (14)

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]