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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

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

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		Compare the important aspects related to Miller indices for directions and Miller indices for planes.	(3)
2		What are the lattice parameters that define a unit cell? List them.	(3)
3		Explain the mechanism of dislocation generation by the Frank-Read source.	(3)
4		Mention the effects of any three factors affecting diffusion in crystals.	(3)
5		Draw a labelled schematic phase diagram of an isomorphous binary alloy showing the liquidus and solidus lines and mark the single phase and two phase regions.	(3)
6		Name the three allotropic forms of pure iron with their crystal structures and temperature stability ranges.	(3)
7		Distinguish between hot working and cold working.	(3)
8		Give the composition and uses of bronze.	(3)
9		Define fatigue and explain the characteristics of fatigue failure.	(3)
10		What is superplasticity? What promotes superplasticity in certain alloys?	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11	a)	What is the significance of atomic packing factor? Obtain the APF of BCC and FCC structures.	(7)
	b)	With the help of neat sketches explain two modes of plastic deformation in metals and alloys.	(7)
12	a)	An atom having FCC crystal structure has a density of 22.4 gm/cc and atomic weight of 192.2 gm/mol. Calculate its atomic radius. Also find the lattice parameter.	(7)

	b)	Explain the procedure for obtaining miller indices for any crystallographic plane with a suitable example.	(7)

Module 2

13	a)	Give the comparison between an edge dislocation and a screw dislocation with neat sketch.	(8)
	b)	With the help of neat sketch explain the mechanism of vacancy diffusion and interstitial diffusion.	(6)
14	a)	Explain with appropriate sketches zero dimensional defects in crystals.	(7)
	b)	Describe the working of SEM with a neat sketch.	(7)

Module 3

15	a)	Draw the labelled iron-iron carbide phase diagram showing all phase boundaries and invariant reactions. Write the reactions at the invariant points and mention the phases present.	(10)
	b)	What is the purpose of normalizing heat treatment? What are the stages involved in the process?	(4)
16	a)	With the help of a neat diagram, explain the development of an isothermal transformation diagram for eutectoid steel. Comment on its significance.	(7)
	b)	How does surface hardening differ from hardening? Explain how surface hardening is attained by carburizing and flame hardening.	(7)

Module 4

17	a)	Describe about grey cast iron and nodular cast iron.	(4)
	b)	Name any five alloying elements used in steels and explain their effects.	(10)
18	a)	Give an account of composition and uses of any two aluminium alloys.	(6)
	b)	Compare solid solution hardening with age hardening.	(8)

Module 5

19	a)	Draw a typical creep curve and explain the various stages involved in creep.	(7)
	b)	What are composites? Give the classification and applications of composites.	(7)
20	a)	With the help of neat sketches, explain the various stages of ductile fracture.	(7)
	b)	Define ceramics? Enumerate the types of ceramics? Mention any two advantages of ceramics.	(7)