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Pages: 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S2 (R,S) Examinations April 2026 (2024 Scheme)

Course Code: PCMET205

Course Name: MATERIAL SCIENCE AND ENGINEERING

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

			CO	Marks
1		Why are materials with metallic bonds conducting in nature?	CO1	(3)
2		Distinguish between the two modes of plastic deformation.	CO1	(3)
3		Why do Frenkel and Schottky defects occur in pairs?	CO2	(3)
4		Define the terms diffusion flux and diffusion coefficient.	CO2	(3)
5		What is Ductile-to-Brittle Transition Temperature (DBTT)? Explain its significance in engineering application	CO3	(3)
6		Why is a brittle fracture more dangerous than a ductile fracture in engineering applications?	CO3	(3)
7		State Gibbs phase rule. Where is it applicable?	CO4	(3)
8		What is annealing? Why is it done?	CO4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

9	a)	With the help of neat diagrams, describe the BCC, FCC, and HCP crystal structures. For each structure, state: (a) number of atoms per unit cell, (b) coordination number, (c) atomic packing factor, and (d) one example.	CO1	(6)
	b)	Compare slip and twinning	CO1	(3)
10	a)	Calculate the atomic radius of tantalum (Ta), given that it has a BCC crystal structure, a density of 16.6 g/cm³, and an atomic weight of 180.9 g/mol. Avogadro's number is 6.022×10^{23}atoms/mol	CO1	(4)

	b)	Explain how crystallographic planes and directions are specified. Sketch (110), (111), and (020) planes in a cubic unit cell.	CO1	(5)

Module -2

11	a)	Differentiate between edge and screw dislocations with sketches.	CO2	(5)
	b)	Discuss the steps in any one method for determining the grain size	CO2	(4)
12	a)	Explain the working of a Scanning Electron Microscope with the help of a neat sketch.	CO2	(5)
	b)	List and explain the factors affecting diffusion.	CO2	(4)

Module -3

13	a)	How to distinguish a ductile metal and a brittle metal from a tensile test?	CO3	(4)
	b)	List common alloying elements in steel and explain their effects on properties.	CO3	(5)
14	a)	Discuss the mechanism of fatigue failure with neat sketches.	CO3	(5)
	b)	What are plain carbon steels? How are they classified? Mention the properties and applications of different plain carbon steels.	CO3	(4)

Module -4

15	a)	Draw an iron-carbon phase diagram and discuss the different invariant reactions in it.	CO4	(6)
	b)	Discuss any one diffusionless surface hardening method with the help of a diagram.	CO4	(3)
16	a)	Explain the TTT diagram and its significance.	CO4	(5)
	b)	What is hardenability? Discuss the technique used to determine hardenability with a suitable sketch.	CO4	(4)

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