Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – SUMMER 2025

Subject Code:3132004 Date:06-06-2025

Subject Name:Principles of Materials Science and Metallurgy

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1*	**(a)**	Explain the requirement of engineering materials.	**03**
	(b)	Draw miller indices for planes (011), (100) and (111) and directions [011], [100] and [111] in a simple cubic crystal.	**04**
	(c)	Draw iron-iron carbide equilibrium diagram. Explain important phases in it. Discuss the phase transformation takes place for the eutectoid steel from liquid to room temperature.	**07**
Q.2	**(a)**	Differentiate between deformation by slip and twinning.	**03**
	(b)	What is sintering? Why is sintering carried out in controlled atmosphere furnace?	**04**
	(c)	Explain working principle of eddy current test. Mention various applications of eddy current test.	**07**
		OR	
	(c)	Explain jominy hardenability test with a neat sketch.	**07**
Q.3	**(a)**	Write limitations of RT and UT.	**03**
	(b)	Why normalizing produces structure having superior strength and hardness compared to annealing?	**04**
	(c)	Justify the need of heat treatment processes for metals. Explain with neat sketch TTT diagram for heat treatment of steel.	**07**
		OR	
Q.3	**(a)**	Explain various methods of magnetization used in MPT.	**03**
	(b)	Write purpose of the case hardening heat treatment and explain any one in details.	**04**
	(c)	What is atomic packing factor? Derive APF for hexagonal closed pack structure with neat sketch.	**07**
Q.4	**(a)**	What information may be obtained from an equilibrium diagram?	**03**
	(b)	Explain the procedure of specimen preparation for microstructure examination.	**04**
	(c)	List down merits and limitations of powder metallurgy.	**07**
		OR	
Q.4	**(a)**	Define the following material properties (i) Ductility (ii) creep and (iii) Hardness.	**03**
	(b)	Explain any two mechanical process utilized for metal powder production.	**04**
	(c)	What is NDT? Explain in details radiography testing method with advantages, disadvantages and applications of radiographic testing method.	**07**

Q.5	**(a)**	What are the advantages of Austempering and Martempering?	**03**
	(b)	Differentiate between polymers and composite materials.	**04**
	(c)	Explain point defect, line defect and plane defect.	**07**

OR

Q.5	**(a)**	Explain optical metallurgical microscope with neat sketch.	**03**
	(b)	Differentiate between interstitial defects and substitutional defects.	**04**
	(c)	Explain the "hume-rothery rules" for solid solution, with suitable case study.	**07**

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