Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – SUMMER 2025

Subject Code:3142109 Date:23-05-2025

Subject Name:Physical Metallurgy

Time:10:30 AM TO 01:00 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)**	Define: system, component, and phase.	**03**
	(b)	Describe the concept of degree of freedom in phase equilibria and provide an example.	**04**
	(c)	Draw Fe-Fe_3C phase diagram and label the phases present at various compositions and temperatures.	**07**
Q.2	**(a)**	As a metallurgist, what information one can extract from a phase diagram?	**03**
	(b)	Explain the meaning of the terms "eutectic," "peritectic," and "eutectoid" reactions in alloy systems, providing examples of each.	**04**
	(c)	Compare and contrast solid solution strengthening and precipitation hardening as strengthening mechanisms in alloys.	**07**
		OR	
	(c)	Describe the phase fractions in a binary alloy system using the lever rule and its application.	**07**
Q.3	**(a)**	List the possibility of formation of phases upon solidification of binary alloy.	**03**
	(b)	Define an alloy. Give two examples of it.	**04**
	(c)	How cooling curves of a binary alloy system are related to the formation of phases during solidification? Explain for an isomorphous system.	**07**
		OR	
Q.3	**(a)**	Draw an allotropy of iron.	**03**
	(b)	Illustrate the micrographs at 0.4 wt. %C on the Fe-Fe_3C diagram.	**04**
	(c)	What is the reasons that FCC is more ductile than the BCC structure?	**07**
Q.4	**(a)**	How spherical aberration can be minimized for microscopic objective lense?	**03**
	(b)	What is the minimum separable distance between features that can be resolved by a microscope using the flight of 500 nm wavelength, having a refractive index of the lens is 1.9 and an aperture angle of 150°?	**04**
	(c)	Write a short note on the Gibbs phase rule.	**07**
		OR	
Q.4	**(a)**	Draw the Miller indices planes: (1 1 1); (1 2 3); ($\bar{2}\ \bar{1}$ 0)	**03**
	(b)	What is the purpose of heat treatment?	**04**
	(c)	Explain the annealing and normalizing. What type of phases could be formed?	**07**
Q.5	**(a)**	What do you mean by hardenability of steel?	**03**
	(b)	For binary systems, A & B, a solid of 60% A (40% B) co-exists with a liquid of 18% A (82% B). The overall composition is 38%, find the fraction of solid.	**04**
	(c)	Write a short note on super alloys and shape memory alloys.	**07**
		OR	
Q.5	**(a)**	Write two alloys of aluminium and copper.	**03**

(b) Classify the ferrous alloys. **04**

(c) Give the mechanisms that strengthen the alloys. Discuss briefly about any one mechanism. **07**

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