Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(NEW) EXAMINATION – WINTER 2022

Subject Code:3142109 Date:20-12-2022

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 crystal system by lattice parameters.	**03**
	(b)	Illustrate the atomic arrangement of BCC, FCC, and HCP. How many atoms are in a unit cell of the same?	**04**
	(c)	Find the atomic radii of BCC. Find the APF of BCC by using atomic radii.	**07**
Q.2	**(a)**	Draw the miller indices of: (1 2 1), ($\bar{1}$ 1 $\bar{1}$), (3 2 1).	**03**
	(b)	If the metal A and metal B are completely soluble in liquid-state as well as solid-state. For the said condition, draw the phase diagram.	**04**
	(c)	Draw the Fe-Fe_3C diagram and its invariant reactions. Label the phase diagram appropriately and show phases for 0.8 wt. % C at various temperatures in the Fe-Fe_3C diagram.	**07**
		OR	
	(c)	What are the phases present in 0.4 wt. %C? To reveal the phases under the microscope, what procedural steps are required?	**07**
Q.3	**(a)**	What is the crystal structure of cementite and martensite?	**03**
	(b)	Determine the ASTM grain size number if 25 grains per square inch are measured at a magnification of 75.	**04**
	(c)	What do you mean by nucleation and growth? Explain the thermodynamic concept of homogeneous nucleation. Determine critical radius and free energy for homogeneous nucleation.	**07**
		OR	
Q.3	**(a)**	Determine the term: degree of freedom; phase; and thermodynamic equilibrium.	**03**
	(b)	What informations collect from the phase diagram?	**04**
	(c)	Explain the Gibbs' phase rule.	**07**
Q.4	**(a)**	Draw a cooling curve for pure metal.	**03**
	(b)	Classify the cast iron. Explain any one cast iron by microstructure.	**04**
	(c)	Explain the Hume-Rothery rules for a substitutional solid solution.	**07**
		OR	
Q.4	**(a)**	What is polymorphism? Draw the allotropy of iron.	**03**
	(b)	Explain any one strengthening mechanism.	**04**
	(c)	What is the purpose of heat treatment? Explain briefly annealing, normalizing, and hardening.	**07**
Q.5	**(a)**	How hardenability of steel is to be carried out?	**03**
	(b)	Classify the super alloys.	**04**

	(c)	Draw the ray diagram of metallurgical microscope for bright field illumination.	**07**

OR

Q.5	**(a)**	Describe any grain size measurement method.	**03**
	(b)	How is the lever rule applied on the phase diagram for finding the amount of phase?	**04**
	(c)	Describe the peritectic system by example.	**07**

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