Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2024

Subject Code:3131904 Date:26-11-2024

Subject Name:Material Science and 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)**	What are engineering materials, and how are they classified?	**03**
	(b)	Calculate the atomic packing factor for a BCC and FCC crystal structure. How does the APF affect the density of the material?	**04**
	(c)	Consider a situation where you need to select a material for a high-temperature furnace lining. Based on the properties of metals, ceramics, and composites, which material would you choose and why?	**07**
Q.2	**(a)**	Define Macro examination & micro Examination and, State its uses in the field of Material Science.	**03**
	(b)	Using the concept of solute strengthening, explain how the addition of elements like carbon in steel or aluminum in copper improves the strength and mechanical properties of the base metal.	**04**
	(c)	Discuss the mechanism of crystallization, focusing on the nucleation and growth processes. What factors influence nucleation and growth in materials?	**07**
		OR	
	(c)	Define the Dislocation and Differentiate Edge Dislocation and Screw Dislocation.	**07**
Q.3	**(a)**	What are Hume-Rothery rules.	**03**
	(b)	In Iron carbon diagram, which phases are presents at 0.4% carbon contain steel at 600^0C. and find out the % of Phases presents using lever rule.	**04**
	(c)	Explain the eutectic and eutectoid reactions in detail. Discuss their differences and give examples of alloy systems where each reaction occurs.	**07**
		OR	
Q.3	**(a)**	What is Gibbs' phase rule?	**03**
	(b)	Differentiate between homogeneous nucleation and heterogeneous nucleation.	**04**
	(c)	Draw Iron Carbon Diagram with all notations like Phases and Reactions Nomenclature.	**07**
Q.4	**(a)**	Define Heat Treatments. States its purpose.	**03**
	(b)	Explain the Grey cast iron.	**04**
	(c)	Classify the Heat Treatments Process and Explain the Normalizing Heat Treatments.	**07**

OR

Q.4	**(a)**	Classify the Plain carbon Steel.	**03**
	(b)	Explain the characteristics of Powder material used in Powder metallurgy.	**04**
	(c)	Write full name of TTT Diagram. Draw TTT diagram for eutectoid steel with necessary notations. and Describe How Rate of Cooling is affect the Microstructure of Steel.	**07**
Q.5	**(a)**	Define Powder metallurgy. State its Advantages and Limitation.	**03**
	(b)	States the various Non Destructive methods. State the Advantages of RT over UT techniques.	**04**
	(c)	Explain the various methods used to prevents the Corrosion.	**07**

OR

Q.5	**(a)**	Define Corrosion. Classify the corrosion.	**03**
	(b)	State the various metal powder production methods. Explain any one method among them.	**04**
	(c)	Define Non Destructive Testing. Explain the Dye Penetrant Testing with principle, procedure, advantages and Limitations.	**07**

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