Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3150508 Date:04-01-2023

Subject Name:Material Science and Engineering

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.**

Q.1	**(a)**	Explain secondary bonding and its types.	**03**
	(b)	Differentiate between crystalline and non-crystalline states.	**04**
	(c)	Briefly discuss about the various methods of protection against corrosion.	**07**
Q.2	**(a)**	Define ionization potential. What is its importance?	**03**
	(b)	State and explain the classification of engineering materials.	**04**
	(c)	What do you understand by levels of structure? Explain their types briefly.	**07**
		OR	
	(c)	With suitable illustrations, discuss about the relationship between the variation in bonding character and properties of materials.	**07**
Q.3	**(a)**	Differentiate between Frenkel and Schottky defects.	**03**
	(b)	Discuss about the factors which promote the non-crystallinity of long chain polymers.	**04**
	(c)	Describe in detail about the progressive transformation of a liquid to solid crystals by nucleation and growth.	**07**
		OR	
Q.3	**(a)**	Differentiate between edge and screw dislocations.	**03**
	(b)	Briefly explain the slip mode of plastic deformation in crystalline materials.	**04**
	(c)	Explain the mechanism of creep. Also discuss about the importance of creep resistant materials.	**07**
Q.4	**(a)**	Mention the conditions for unlimited solid solubility for an alloy system.	**03**
	(b)	Explain the lever rule used for calculating the fractions of two coexisting phases with an illustration.	**04**
	(c)	Draw the Iron – Iron carbide (Fe – Fe_3C) phase diagram and briefly discuss about the phase transformations in steel.	**07**
		OR	
Q.4	**(a)**	Briefly discuss about the applications of phase diagrams.	**03**
	(b)	Explain Gibb's phase rule. Find the degree of freedom when FCC and BCC iron coexist in equilibrium.	**04**
	(c)	With suitable illustrations, discuss about the structure-property relationship in materials.	**07**
Q.5	**(a)**	Differentiate between plastic deformation and creep in crystalline materials.	**03**
	(b)	Define the glass transition temperature (T_g) and state its significance.	**04**
	(c)	Draw and explain the various stages of an ideal creep curve.	**07**
		OR	
Q.5	**(a)**	Cite the differences between n-type and p-type extrinsic semiconductors.	**03**

(b) In terms of electron energy band structure, discuss the reasons for the difference in the electrical conductivity of metals, semiconductors and insulators. **04**

(c) Explain the mechanism of oxidation briefly. Also discuss about the oxidation resistant materials. **07**

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