GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2023

Subject Code:3150508   **Date:05-12-2023**
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 how melting and boiling points of materials vary with bond strength.	**03**
	(b)	Categorize engineering materials based on nature and major areas of applications. Cite examples for each of them.	**04**
	(c)	'The internal structure of a material, simply called the structure, can be studied at various levels of observation'- Discuss with illustrations.	**07**
Q.2	(a)	Name the constituents of the following alloys and state their uses (one each): Nichrome, Inconel, Alumel	**03**
	(b)	Explain ligancy of an ionic solid and various conditions for stable configuration.	**04**
	(c)	Define Pilling-Bedworth ratio. State its importance in evaluating the oxidative corrosion propensity of various metals/metal oxides.	**07**
		OR	
	(c)	Discuss the structure-property relationship in engineering materials with suitable examples.	**07**
Q.3	(a)	Explain the mechanism of nucleation during crystal growth.	**03**
	(b)	Draw the differences between edge and screw dislocation. What is grain boundary?	**04**
	(c)	Identify 3 types of crystal defects in solids (one point, one linear, and one planar) and suggest for each of these one material property that is adversely affected by its presence and one that is improved. Also state what to look for in a crystal that possesses each of these defects	**07**
		OR	
Q.3	(a)	What are the degrees of freedom of a system of two components when the number of phases is one, two, three, and so on?	**03**
	(b)	Define/explain the following: (i) Tie line (ii) Lever rule (iii) degree of freedom (iv) 1-2-1 rule	**04**
	(c)	State and explain Gibb's phase rule. Briefly explain the important phase transformation in steels.	**07**
Q.4	(a)	Explain glass transition temperature and its importance.	**03**
	(b)	Give four examples of ethylene based long chain polymers and state	**04**

one industrial application for each of them.

	(c)	State the differences between thermoplastic and thermosetting polymers. Name the factors influencing the crystallinity of long chain polymers.	**07**

OR

Q.4.	(a)	Explain plastic deformation and creep in crystalline materials.	**03**
	(b)	State the important applications of creep resistant materials.	**04**
	(c)	Draw the tensile load-elongation curve and the true stress-true strain curve for a ductile material and explain the salient features.	**07**
Q.5	(a)	Explain superconducting phenomena in brief.	**03**
	(b)	Write a note on Ferromagnetism phenomena.	**04**
	(c)	Discuss potential applications of superconducting materials.	**07**

OR

Q.5	(a)	Name important types of stainless steel. Which metal in stainless steel is responsible for imparting anticorrosion properties?	**03**
	(b)	Define Fermi energy level. How does the electron distribution change at Fermi level when temperature is 0 K and above 0 K.	**04**
	(c)	Discuss with examples general types of corrosion and their preventive measures.	**07**

****