

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER– III EXAMINATION – SUMMER 2026****Subject Code:3131904****Date:17-06-2026****Subject Name:Material Science and Metallurgy****Time:02:30 PM TO 05:00 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) Defend the statement with example: “India has been exceptional in the field of materials science and metallurgy.”	03
	(b) List at least eight different properties in materials that make them useful for engineering applications.	04
	(c) Explain the criteria for selection of materials for engineering applications.	07
Q.2	(a) Define: Unit cell, Crystal structure and Polymorphism.	03
	(b) List major mechanical property requirement for, i) Base of heavy machinery, and ii) Gears in Car	04
	(c) Draw the following: (1 0 0), [1 1 0], (2 1 1), [1 2 2], (0 2 1) and (0 0 0 1)	07
	OR	
	(c) Draw the following: (0 0 1), [0 1 1], (1 2 1), [2 1 2], (1 0 2) and (0 0 0 2)	07
Q.3	(a) Explain the need for use of etchants during microstructure observation.	03
	(b) Differentiate between macroscopic and microscopic examination.	04
	(c) Draw a neatly labeled Fe – Fe ₃ C phase diagram and write all of the invariant reactions taking place in the same.	07
	OR	
Q.3	(a) Define: System, Phase and Component.	03
	(b) What is Degree of Freedom? Write Gibb’s Phase Rule for unary and binary systems.	04
	(c) Explain the mechanism of solidification of metals. Derive the expression to calculate critical radius of nuclei for homogeneous nucleation.	07
Q.4	(a) Differentiate between equilibrium cooling and non-equilibrium cooling.	03
	(b) Write the characteristics of grey cast iron and white cast iron.	04
	(c) Draw TTT diagram for eutectoid steels and explain the significance of cooling rate with example.	07
	OR	
Q.4	(a) State advantages and disadvantages of powder metallurgy.	03
	(b) Draw the microstructure of hypoeutectoid steel and hypereutectoid steels.	04
	(c) Write short notes on Carburizing and Flame hardening.	07

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| Q.5 | (a) | List the types of corrosion. | 03 |
| | (b) | Explain the principles of eddy current testing along with its advantages and disadvantages. | 04 |
| | (c) | State various methods used for metal powder production and explain the atomization method. | 07 |

OR

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|------------|------------|---|-----------|
| Q.5 | (a) | Explain the techniques to prevent corrosion. | 03 |
| | (b) | Write a short note on diffusion processes. | 04 |
| | (c) | Explain the principles of ultrasonic testing along with its advantages, disadvantages and applications. | 07 |
