

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: 3132004

Date: 02/07/2026

Subject Name: Principles of Materials 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.

- Q.1** (a) Define (i) Specific heat (ii) Absorptivity (iii) Creep 03
(b) Write a material selection process for a crankshaft of Engine. 04
(c) Explain selection criteria for engineering materials. 07
- Q.2** (a) Draw the three most commonly observed space lattices in metals. 03
(b) Draw a unit cell and show the following planes (i) (113) (ii) (102) (iii) (111) (iv) (001) 04
(c) Differentiate between screw dislocation and edge dislocation with sketch. 07
- OR
- Q.2** (c) Explain Point defect, Line defect and Plane defect. 07
- Q.3** (a) Differentiate : Macro structure and Micro structure Examination. 03
(b) Mention any one etchant used for mild steel along with its chemical composition. 04
(c) Draw neat sketch of inverted metallurgical microscope and explain in detail steps for specimen preparation for metallurgical examination under metallurgical microscope. 07
- OR
- Q.3** (a) Define (i) phase (ii) Degree of freedom (iii) Free energy 03
(b) What is Gibb's phase rule? Explain its importance. 04
(c) Draw Iron-carbon Diagram and explain eutectic reaction in it. 07
- Q.4** (a) Explain Allotropic transformation of iron. 03
(b) Discuss application of Steels in engineering field. 04
(c) Describe how a T.T.T diagram is obtained experimentally. 07
- OR
- Q.4** (a) What is heat treatment of steel? what is its purpose? 03
(b) Write note on : (i) Nitriding (ii) Cyaniding 04
(c) Describe briefly the Austempering and Martempering processes. what are the special advantages of these heat treatment operations? 07
- Q.5** (a) State the applications of powder metallurgy. 03
(b) Explain Hot Isostatic Pressing (HIP). 04
(c) Explain the requirements of metal powders used in powder metallurgy. Also explain various methods of powder production. 07
- OR
- Q.5** (a) Write limitations of RT and UT. 03

- (b)** Explain working principal of eddy current test. Mention various applications of eddy current test. **04**
- (c)** What is non-destructive test? list various non destructive tests. explain x-ray radiography. **07**
