

Seat No./Enrollment No.: _____

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

Subject Code: BE03000221

Date: 22/06/2026

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.

- Q.1** (a) Discuss Gibbs Phase Rule. 03
(b) Give the classification of engineering materials. Give example of each. 04
(c) Using a suitable case discuss the criteria for selection of materials for engineering applications. 07
- Q.2** (a) Define following: Unit Cell and Coordination Number. 03
(b) Explain the allotropy of Iron. 04
(c) Define Miller Indices. Explain the procedure to find Miller indices for crystal planes with an example 07
- OR
- Q.2** (c) What do you mean by imperfections in crystals? Explain Point defects and Line defects in crystals. 07
- Q.3** (a) Give the constituents and properties of plain carbon steel. 03
(b) Discuss the Hume-Rothery rules for solid solutions. 04
(c) Describe the Cooling Curve for a pure metal and a solid solution alloy. 07
- OR
- Q.3** (a) Discuss the properties and applications of Brass. 03
(b) Discuss about microstructures and properties of hypoeutectoid steel. 04
(c) Draw a neat and labeled $Fe-Fe_3C$ equilibrium diagram. Explain Eutectic reaction. 07
- Q.4** (a) Differentiate between Annealing and Normalizing heat treatments. 03
(b) Discuss the properties and engineering applications of Titanium and its alloys. 04
(c) Draw and explain the TTT diagram for eutectoid steel. 07
- OR
- Q.4** (a) Define hardenability. List factors affecting it. 03
(b) Describe the induction hardening process. 04
(c) Give the advantages, disadvantages and applications of powder metallurgy. Discuss about sintering. 07
- Q.5** (a) Discuss about galvanic corrosion. 03
(b) Describe the principle of Ultrasonic Testing with its merits. 04
(c) Compare Magnetic Particle Testing and Dye Penetration Testing. 07
- OR
- Q.5** (a) List different steps of sample preparation for metallography. Explain the need of etching. 03

- (b)** Discuss the properties and engineering applications of Aluminum and its alloys. **04**
- (c)** List different methods to prevent metallic corrosion in industrial environments. **07**
Explain about use of coatings.
