

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III EXAMINATION – SUMMER 2025****Subject Code:3131904****Date:29-05-2025****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) Define following properties of materials: (a) Strength, (b) Elasticity and (c) Hardness **03**
 (b) Give classification of engineering materials **04**
 (c) Define atomic packing factor (APF). Calculate APF for FCC and BCC structures. **07**
- Q.2** (a) What is a solid solution? Explain with a neat sketch various types of solid solutions. **03**
 (b) Differentiate Macrostructure and Microstructure examination. **04**
 (c) Explain with neat sketch the steps involved in preparing specimen for microscopic examination. **07**
- OR**
- (c) What is Gibb's phase rule? Define system, phase and degree of freedom. Show that the degree of freedom at eutectic point in a binary phase diagram is zero. **07**
- Q.3** (a) Explain the process of solidification in metals. **03**
 (b) What is non-equilibrium cooling? Explain. **04**
 (c) Define allotropy. Explain it with reference to iron. **07**
- OR**
- Q.3** (a) State the composition, properties and applications of Hindalium and Invar. **03**
 (b) Explain the 'Lever Rule' with the help of a binary phase diagram. **04**
 (c) Draw Iron-Iron carbide equilibrium diagram. Name all important phases, temperatures and reactions. **07**
- Q.4** (a) Explain full annealing process **03**
 (b) Explain flame hardening process. **04**
 (c) Justify the requirement of Heat treatment processes for metals. Explain with neat sketch TTT diagram for heat treatment of steel. **07**
- OR**
- Q.4** (a) Explain any one method for production of metal powders. **03**
 (b) Explain the steps involved in Dye penetrant testing with neat sketch. **04**
 (c) Define Powder Metallurgy. State advantages, limitations and applications of Powder Metallurgy **07**
- Q.5** (a) Explain cathodic protection against corrosion. **03**
 (b) Compare destructive testing with non-destructive testing. **04**
 (c) Explain in detail Radiography testing method along with its advantages and limitations. **07**
- OR**
- Q.5** (a) Compare nodular cast iron and malleable cast iron. **03**
 (b) Classify different types of corrosion. **04**
 (c) Describe Ultrasonic Testing Method with its advantages and limitations. **07**
