

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2023****Subject Code:3131904****Date:16-01-2024****Subject Name:Material Science and Metallurgy****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 the following material properties : **03**  
(1) Ductility (2) Creep (3) Fatigue
- (b) Give selection criteria of material for engineering applications. **04**
- (c) Explain a differentiate between edge dislocation and screw dislocation with neat sketch. **07**
- Q.2** (a) Explain a atomic packing factor. **03**
- (b) Draw : (1 1 2) , (-1 1 0), [1 0 0] and [-2 0 1] **04**
- (c) Write a Hume-Rothery rules for Substitutional Solid solution formation. **07**
- OR**
- (c) Derive an expression to calculate critical radius for homogeneous nucleation of a solid from liquid. **07**
- Q.3** (a) Describe applications of phase diagram. **03**
- (b) Differentiate between macro and micro examinations. **04**
- (c) Draw Iron Carbon Diagram with all necessary notations. Explain eutectic, eutectoid reaction. **07**
- OR**
- Q.3** (a) Outline major mechanical property requirements of bicycle wheel axle. **03**
- (b) The steel contains 0.4 % C contain steel is softer than the steel contain 1.2 % C. True or false? **04**  
Justify using Lever Rule.
- (c) Using Gibb's phase rule, explain unary phase diagram with the help of sketch. **07**
- Q.4** (a) Define Heat Treatment and classify heat treatment processes. **03**
- (b) Differentiate between annealing and normalizing. **04**
- (c) Justify the need of Heat treatment processes for metals. Explain with neat sketch TTT diagram for heat treatment of steel. **07**
- OR**
- Q.4** (a) State the composition, properties and applications of Hindalium and Invar **03**
- (b) Explain Point defect & Line defect **04**
- (c) List out the various characteristics of fine metal powder. Explain any four. **07**
- Q.5** (a) What is the main objectives of NDT method? **03**
- (b) Explain differentiate between LPT and MPT. **04**
- (c) Explain the principle of Radiography testing. With its use in metal testing. **07**
- OR**
- Q.5** (a) Draw Jominy hardenability set-up including labeling & important dimensions. **03**
- (b) Explain difference between dry type and Wet type corrosion. **04**
- (c) Explain the NDT method widely used for inspection of castings. **07**

\*\*\*\*\*