

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2021**

Subject Code:3131904

Date:08/09/2021

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.

|           |  | Marks |
|-----------|--|-------|
| Q.1       | (a) Classify various types of engineering materials.   | 03    |
|           | (b) What is a solid solution? Explain with a neat sketch various types of solid solutions.   | 04    |
|           | (c) Draw neatly Iron-Iron carbide equilibrium diagram. Name all important phases, temperatures and reactions.                                | 07    |
| Q.2       | (a) Define following properties of metals: (a) Hardness, (b) Toughness (c) Fatigue   | 03    |
|           | (b) Explain the importance of microscopic and macroscopic examination of metallic materials.   | 04    |
|           | (c) Define atomic packing factor (APF). Calculate APF for Face centered cubic (FCC) structure with a neat sketch.                            | 07    |
| <b>OR</b> |  |       |
| Q.3       | (c) Explain Edge and screw dislocation with the help of a neat figure.   | 07    |
|           | (a) Briefly explain engineering requirements of materials.   | 03    |
|           | (b) List out the various methods used to combat corrosion.   | 04    |
|           | (c) Define allotropy. Explain it with reference to iron.   | 07    |
| <b>OR</b> |  |       |
| Q.3       | (a) What are the criteria for the selection of engineering materials?  | 03    |
|           | (b) Classify different types of corrosion.   | 04    |
|           | (c) Explain with a neat sketch Time-Temperature-Transformation (TTT) diagram for a eutectoid composition steel.                              | 07    |
| Q.4       | (a) List out various applications of powder metallurgy.  | 03    |
|           | (b) Discuss sintering process in powder metallurgy.  | 04    |
|           | (c) Name different types case hardening methods. Explain pack carburizing process with the help of a neat diagram.                           | 07    |
| <b>OR</b> |  |       |
| Q.4       | (a) Explain briefly Full Annealing process.  | 03    |
|           | (b) Explain Austempering process.  | 04    |
|           | (c) Explain with a neat sketch three common methods of powder production and discuss their influence on the properties of the final product. | 07    |
| Q.5       | (a) State and explain Gibb's Phase Rule.   | 03    |
|           | (b) Explain the 'Lever Rule' with the help of a binary phase diagram.  | 04    |
|           | (c) Describe Ultrasonic Testing Method and also mention its advantages and limitations.  | 07    |
| <b>OR</b> |  |       |
| Q.5       | (a) Explain the process of solidification in metals.   | 03    |
|           | (b) What is non-equilibrium cooling? Explain.  | 04    |
|           | (c) Explain in detail Radiography testing method along with its advantages, disadvantages.   | 07    |

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