

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**

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

**Subject Code:2131904**

**Date:11/09/2021**

**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.

- Q.1**
- |     |   |    |
|-----|---|----|
| (a) | Give the classification of engineering materials.                         | 03 |
| (b) | Define hardenability and toughness.                                       | 04 |
| (c) | Discuss the selection criteria and requirements of engineering materials. | 07 |

- Q.2**
- |     |   |    |
|-----|---|----|
| (a) | Define unit cell. Draw the neat sketch arrangement of atoms in B.C.C, F.C.C. and H.C.P. | 03 |
| (b) | State the difference between micro structure and macro structure.                       | 04 |
| (c) | Define atomic radius. Find atomic radius for BCC structure.                             | 07 |

**OR**

- |     |  |    |
|-----|--|----|
| (c) | Explain various mechanism by which diffusion take place. | 07 |
|-----|--|----|

- Q.3**
- |     |  |    |
|-----|--|----|
| (a) | Write the application of diffusion.                                      | 03 |
| (b) | Differentiate between elastic & plastic deformation.                     | 04 |
| (c) | Explain the effects of strain hardening on properties of metals briefly. | 07 |

**OR**

- Q.3**
- |     |  |    |
|-----|--|----|
| (a) | List the characteristics required for metal powder.                                | 03 |
| (b) | What is the difference between homogeneous and heterogeneous nucleation processes? | 04 |
| (c) | Explain four major methods to control grain structure during solidification.       | 07 |

- Q.4**
- |     |   |    |
|-----|---|----|
| (a) | Define system, phase and degree of freedom.                   | 03 |
| (b) | What is coring? Why it is observed?                           | 04 |
| (c) | Draw iron-carbon diagram and explain eutectic reaction in it. | 07 |

**OR**

- Q.4**
- |     |  |    |
|-----|--|----|
| (a) | List various heat treatment processes as applied to steel.   | 03 |
| (b) | Explain allotropy of iron.   | 04 |
| (c) | Explain the steps to obtain the TTT diagram for eutectoid steel and show on it the cooling curve representing annealing & hardening processes. | 07 |

- Q.5** (a) What are the characteristics of cast iron? 03  
(b) Differentiate between malleable cast iron and nodular cast iron. 04  
(c) State the principle of magnetic particle testing and enumerate the steps for it. 07

**OR**

- Q.5** (a) List application and properties of Tool steel. 03  
(b) State the advantages and disadvantages of powder metallurgy 04  
(c) Explain the principle of ultrasonic testing & state various inspection techniques used. 07

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