

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-III EXAMINATION – WINTER 2025

Subject Code:3131904

Date:12-12-2025

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) | Give difference between Metals & Non-metals. | 03 |
| | (b) | What is Unit cell? Explain different types of unit cell with neat sketch. | 04 |
| | (c) | Draw and explain iron carbon diagram. | 07 |
| | | | |
| Q.2 | (a) | Enlist and Explain important properties of materials. | 03 |
| | (b) | Explain Recovery, recrystallization, and grain growth. | 04 |
| | (c) | Explain and differentiate Edge dislocation and Screw dislocation with neat sketch. | 07 |
| OR | | | |
| | (c) | Enlist and explain all point defects. | 07 |
| | | | |
| Q.3 | (a) | Difference between micro and macro examination. | 03 |
| | (b) | Briefly explain Gibb's Phase rule. | 04 |
| | (c) | What is a substitutional solid solution? Explain the Hume Rothery rule for the formation of a substitutional solid solution. | 07 |
| OR | | | |
| Q.3 | (a) | Discuss merits and de-merit of powder metallurgy process. | 03 |
| | (b) | Explain Jominy end quench test. | 04 |
| | (c) | What is Powder Metallurgy? Explain the process steps of Powder Metallurgy. | 07 |
| | | | |
| Q.4 | (a) | Draw and explain Pearlite. | 03 |
| | (b) | What is allotropic form ? explain different allotropic form of iron. | 04 |
| | (c) | Explain TTT diagram in detail with sketch. | 07 |
| OR | | | |
| Q.4 | (a) | What is eutectic point ? Explain in brief. | 03 |
| | (b) | Briefly explain Gibb's Phase rule. | 04 |
| | (c) | Draw and explain the phase diagram of binary system having complete soluble in liquid but total insoluble in solid phase with lever rule. | 07 |
| | | | |
| Q.5 | (a) | Explain Optical Metallurgical Microscope with neat sketch. | 03 |
| | (b) | Explain the steps of Dye Penetration Testing with neat sketch. | 04 |
| | (c) | Explain the principle of Radiography testing. With its use in metal testing. | 07 |
| OR | | | |
| Q.5 | (a) | What is heat treatment ? | 03 |
| | (b) | Differentiate Annealing Vs Normalising. | 04 |
| | (c) | Explain Flame Hardening Process with neat sketch. | 07 |

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-III (NEW) EXAMINATION – WINTER 2024

Subject Code:3131904

Date:26-11-2024

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.

		Marks
Q.1	(a) What are engineering materials, and how are they classified?	03
	(b) Calculate the atomic packing factor for a BCC and FCC crystal structure. How does the APF affect the density of the material?	04
	(c) Consider a situation where you need to select a material for a high-temperature furnace lining. Based on the properties of metals, ceramics, and composites, which material would you choose and why?	07
Q.2	(a) Define Macro examination & micro Examination and, State its uses in the field of Material Science.	03
	(b) Using the concept of solute strengthening, explain how the addition of elements like carbon in steel or aluminum in copper improves the strength and mechanical properties of the base metal.	04
	(c) Discuss the mechanism of crystallization, focusing on the nucleation and growth processes. What factors influence nucleation and growth in materials?	07
	OR	
	(c) Define the Dislocation and Differentiate Edge Dislocation and Screw Dislocation.	07
Q.3	(a) What are Hume-Rothery rules.	03
	(b) In Iron carbon diagram, which phases are presents at 0.4% carbon contain steel at 600 ⁰ C. and find out the % of Phases presents using lever rule.	04
	(c) Explain the eutectic and eutectoid reactions in detail. Discuss their differences and give examples of alloy systems where each reaction occurs.	07
	OR	
Q.3	(a) What is Gibbs' phase rule?	03
	(b) Differentiate between homogeneous nucleation and heterogeneous nucleation.	04
	(c) Draw Iron Carbon Diagram with all notations like Phases and Reactions Nomenclature.	07
Q.4	(a) Define Heat Treatments. States its purpose.	03
	(b) Explain the Grey cast iron.	04
	(c) Classify the Heat Treatments Process and Explain the Normalizing Heat Treatments.	07

OR

- Q.4** (a) Classify the Plain carbon Steel. **03**
(b) Explain the characteristics of Powder material used in Powder metallurgy. **04**
(c) Write full name of TTT Diagram. Draw TTT diagram for eutectoid steel with necessary notations. and Describe How Rate of Cooling is affect the Microstructure of Steel. **07**

- Q.5** (a) Define Powder metallurgy. State its Advantages and Limitation. **03**
(b) States the various Non Destructive methods. State the Advantages of RT over UT techniques. **04**
(c) Explain the various methods used to prevents the Corrosion. **07**

OR

- Q.5** (a) Define Corrosion. Classify the corrosion. **03**
(b) State the various metal powder production methods. Explain any one method among them. **04**
(c) Define Non Destructive Testing. Explain the Dye Penetrant Testing with principle, procedure, advantages and Limitations. **07**

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**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– III(NEW) EXAMINATION – WINTER 2022****Subject Code:3131904****Date:22-02-2023****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 the following material properties: i) Ductility ,ii) Creep and iii) Hardness **03**
(b) Classify the engineering materials. **04**
(c) Explain and differentiate Edge dislocation and Screw dislocation with neat sketch. **07**
- Q.2** (a) Describe applications of phase diagram. **03**
(b) Differentiate between deformation by slip and twinning. **04**
(c) Explain the detail procedure of polishing the specimen for micro examination. **07**
- OR**
- (c) Using Gibb's phase rule, explain unary phase diagram with the help of sketch. **07**
- Q.3** (a) Explain the phenomenon of "Allotropy" by giving a suitable example. **03**
(b) Explain Macro examination and Micro examination. **04**
(c) Explain Iron –Carbon diagram with neat sketch. **07**
- OR**
- Q.3** (a) State the composition, properties and applications of Hindalium and Invar. **03**
(b) Explain Point defect & Line defect. **04**
(c) Explain mechanical properties and applications of Gray Cast Iron. **07**
- Q.4** (a) State composition and specific applications of : **03**
Muntz metal ; German silver ; Naval brass
(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) Compare nodular cast iron and malleable cast iron. **03**
(b) Explain Pack Carburizing. **04**
(c) Explain the principle of Radiography testing. With its use in metal testing. **07**
- Q.5** (a) Explain Dye penetrant testing. **03**
(b) Explain Flame hardening. **04**
(c) Define Powder Metallurgy. State advantages, limitations and applications of Powder Metallurgy. **07**
- OR**
- Q.5** (a) Completely describe the "Sintering Process". **03**
(b) State the Qualities Required in Bearing Metals. **04**
(c) Explain the mechanism of corrosion. Also explain any one corrosion prevention technique in detail. **07**
